The Effect of Human Capital on Inwards FDI: Evidence from European transition economies

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Abstract

A country's human capital has been neglected as a potential determinant of inwards foreign direct investment (FDI), both in theory and empirical research. When human capital has been included in models of the determinants of FDI, it appears simply as a control variable or one of the variables in a "kitchen sink" approach, usually without any theoretical rationale for its inclusion or critical discussion of the measures used. The mis-specification that may result from this is advanced as one of the potential explanations for the very diverse findings in previous literature and the failure of the meta-regression analysis (MRA) reported in this thesis to find an 'authentic' effect of human capital on inwards FDI. Accordingly, this research seeks to fill this gap, by identifying the mechanisms through which human capital is expected to attract FDI to European transition economies and drawing conclusions about the most appropriate measures of human capital given the characteristics of the former communist (education) system. The 'productivity-enhancing' skills and traits that (foreign) investors are likely to value in such economies are identified and the manner in which these skills are developed is analysed. In the light of this analysis the conventional human capital measures used in empirical analyses are critically assessed. These contributions are used to develop an empirical model for estimating the effect of human capital on inwards FDI at country-, sector- and industry-level in 12 European transition economies during the period 1995-2008. Consistent with the results of previous studies, as suggested by the MRA, no significant effect of traditional volume measures of human capital on FDI inflows/stocks is found. However, some evidence is presented in this thesis indicating that the quality dimension of human capital as measured by cognitive skills proxies may affect inwards FDI in the manufacturing sector. Accordingly, several potential explanations for the findings and some of their implications for future macro-level research focusing on the effects of human capital are explored.

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Abbreviations

ALL – Adult Literacy and Lifeskills Survey

BEEPS – Business Environment and Enterprise Survey

CEE – Central and Eastern Europe

CEEC – Central and Eastern European Country

EBRD – European Bank for Reconstruction and Development

EFI – Economic Freedom Index

EU – European Union

FDI – Foreign Direct Investment

FE – Fixed Effects

FEVD – Fixed Effects Vector Decomposition

FIMS – First International Mathematics Study

FISS – First International Science Study

GDP – Gross Domestic Product

GMM – Generalised Method of Moments

HAC – Heteroskedasticity and Autocorrelation Consistent

IALS – International Adult Literacy Survey

i.i.d – independent and identically distributed

ICT – Information and Communication Technology

ISCED – International Standard Classification of Education

IV – Instrumental Variable

LSDV – Least Squares Dummy Variable

LSDVC – Corrected Dynamic Least Squares Dummy Variable

NACE – Nomenclature Générale des Activités Économiques dans les Communautés Européennes

OECD – Organisation for Economic Co-operation and Development

OLI – Ownership-Location-Internalisation

OLS – Ordinary Least Squares

PIAAC – Programme for the International Assessment of Adult Competencies

PISA – Programme for International Student Assessment

R&D – Research and Development

RE – Random Effects

RESET – Regression Equation Specification Error Test

SBTC – Skill-Biased Technological Change

SE – Standard Error

SEE – South-Eastern Europe

SIMS – Second International Mathematics Study

SISS – Second International Science Study

TIMSS – Third International Mathematics and Science Study

UNCTAD – United Nations Conference on Trade and Development

UNESCO – United Nations Educational, Scientific and Cultural Organization

UNICEF – United Nations Children's Fund

VIF – Variance Inflation Factor

wiiw – Vienna Institute for International Economic Studies

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Preface

From having virtually no inwards foreign direct investment (FDI), over the two decades of transition the formerly centrally planned European economies have managed to attract a share of global foreign direct investment (FDI) stock nearly three times larger than their share of global output. This FDI has been an important source of external capital, but it also played a crucial role in modernising and restructuring these economies at firm- and economy- level, and facilitating their overall transformation to a market economy. However, the success of individual European transition economies in attracting inwards FDI has been far from equal, which has motivated extensive empirical research on the locational factors that drive inwards FDI in this group of countries. This research has, by and large, neglected the quality of the labour force as a factor that may affect foreign investors' choice of investment destinations, which is somewhat surprising as at the outset of transition this was considered one of European transition economies key advantages in the global competition for FDI. A few studies include human capital as a control variable, but the choice of measures often appears to be arbitrary and lacks a theoretical rationale based on an underlying relationship between human capital and FDI. This neglect reflects the lack of attention that human capital receives in FDI theory and empirical research in general.

Accordingly, this thesis seeks to address these gaps in the literature by: analysing the reasons why, theoretically, countries with relatively larger human capital endowments are expected to attract higher volumes of FDI; utilising the insights gained, as well as the results of a meta-regression analysis, to inform the choice of human capital measures to be used in empirical investigations in European transition economies, considering the specific characteristics of their (pre-transition) education systems; and empirically estimating the relationship between human capital and FDI in a sample of 12 European transition economies for which data is available: Albania, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia.

Following most empirical research on locational determinants of FDI, the hypotheses developed in this thesis are initially tested using country-level data. However, recognising that the relative weight attached by foreign investors to different host country characteristics is likely to vary according to their motivation for undertaking FDI, the relationship between human capital and FDI is further investigated using sector- and industry-level manufacturing FDI data. The industry-level analysis is considered of particular interest in this research because the size of the elasticity of FDI to human capital is likely to depend on the technological intensity of the activity they intend to undertake in the host economy. Accordingly, the sector/industry level analysis, which appears to be the first of this kind to investigate the effect of human capital on FDI, can be considered as one of the most important contributions of this thesis to the empirical literature on FDI determinants in European transition economies and beyond.

An empirical investigation at firm-level was also considered, but later dismissed due to lack of availability of, and access to, usable firm-level data. The severe limitations of firm-level FDI data availability across Europe appears to be the main reason why there has been limited micro-level research on (the determinants) FDI to date (CEPR, 2012). The availability (and accessibility) of data for the purpose of such research appears to be particularly limited for European transition economies. An initial research into firm-level data sources identified four databases which provide comparable data on firms from several European economies to European transition economies, none of which appear to be publicly available. The first two, EBRD's foreign investment survey used by Smarzynska-Javorcik (2002) and the PECODB database (Alessandrini, 2000, cited in Resmini, 2000, p. 666) used by Resmini (2000) and Altomonte and Resmini (2001), were dismissed because they cover investment decisions only in the first years of transition. This was considered a major limitation in the context of transition which is characterised by quick and major changes in the business environment, and in the economy/society overall. The other two databases, Amadeus and Zephyr by Bureau Van Dijk, appear to be suitable for this analysis because they provide up to date information regarding the investment decisions of a large number of European firms, but the high financial cost of accessing this data has prevented the inclusion of a firm-level investigation in this thesis.

This thesis is structured as follows. The first question addressed in **Chapter 1** of this thesis is *"Why should European transition economies seek to attract foreign direct investment (FDI)?"*. The list of benefits from inwards FDI conventionally cited in literature is initially assessed to establish the importance of FDI for host countries, followed by an examination of the characteristics of European transition economies which are argued to make FDI even more important in the context of transition from a centrally planned to a market economy. Subsequently, the analysis focuses on the characteristics of European transition economies' level and quality of human capital development that may affect the desirability of their workforce to foreign investors. Accordingly, the next two questions addressed in this chapter are: *"What is the (relative) volume and quality of European transition economies' human capital?"* and *"How do European transition economies differ from other economies in terms of their human capital formation and labour market structure?"*. To answer these, an overview of traditional measures of educational attainment and direct measures of cognitive skills is provided, as well as an assessment of some key characteristics of these economies' education systems and labour markets that directly affect the formation of their human capital. The final question addressed in Chapter 1 is *"How successful have European transition economies been at attracting FDI since the fall of communism"*. To address this question, a statistical overview of FDI patterns in the sample and in individual economies is provided.

The initial question addressed in **Chapter 2** of this thesis is *"How are FDI flows explained in economic theory?"*. A review of different approaches to explaining the determinants of FDI is used to examine the conditions that must be satisfied for a firm to decide to undertake FDI, in the first place, and the factors that are expected to affect its location decision. To inform the empirical investigations of this thesis, a question that is of particular interest in this review was *"Does availability/quality of human capital in potential investment destinations affect a firm's choice of location?"*. Having found very few references to human capital in FDI theory, an underlying theoretical rationale for a relationship between human capital and inwards FDI is sought in macroeconomic growth theory, where human capital has gained a central role in recent decades. Accordingly, the question *"How does human capital affect labour- and total factor-productivity (growth) at macroeconomic level?"* is next addressed in this chapter in an attempt to draw conclusions on the mechanisms through which it may affect the profitability, and hence location decisions of, foreign investors. Finally, having established in Chapter 1 that foreign investors may affect the skills of the host country workforce, the final question addressed in this chapter *"Is there likely to be an endogeneity problem in the empirical analyses in this thesis due to reverse causation in the relationship between human capital and FDI?"*.

Having previously provided a theoretical rationale for a relationship between human capital and inwards FDI, the next question addressed in **Chapter 3** is *"Does the current empirical evidence support the hypothesis that inwards FDI is attracted by higher levels of human capital?"*. A critical review of previous studies shows no apparent consensus: positive, insignificant, and even negative effects of human capital on FDI have been reported. Therefore, a meta-regression analysis (MRA) is estimated as a means of quantitatively analysing the results of previous literature. The first question addressed by the MRA is *"Is an 'authentic' effect of human capital on inwards FDI evident in previous research?"*. MRA estimates provide an "average" of the estimated empirical effects which synthesises the results of previous research. In this context, a second important question to be addressed by the MRA is *"Can the contradictory results be explained by different characteristics of the original studies?"*. The conclusions drawn from the MRA warrant a deeper analysis of how human capital is likely to affect labour productivity (and FDI) and whether the conventionally used measures are appropriate.

The analysis in **Chapter 4** builds on the discussion in Chapter 2 on the channels through which human capital is expected to affect inwards FDI by addressing the question *"What are the specific productivity-enhancing characteristics of human capital that (foreign) investors value and where/how are these developed?"*. To address this question, some key assumptions of human capital theory and growth theory are critically appraised and implications for the measurement of human capital in empirical research are developed. A list of cognitive and non-cognitive skills that are expected to be valued in a market economy is identified and the manner in which these are formed is researched as a matter of importance both from a policy perspective and for informing the choice of appropriate human capital measures in applied research. This generic discussion is further contextualised to European transition economies, utilising the specific characteristics of their human capital identified in Chapter 1. Accordingly, the next research question to be addressed in Chapter 4 is *"What are the appropriate measures of human capital when estimating its effect on inwards FDI in European transition?"*. It is argued in this research that there are transition-specific factors beyond those related to human capital that need to be accounted for and the theoretical framework provided in Chapter 2 needs to be extended accordingly. Hence, the final question addressed in Chapter 4 is *"Which are the transition-specific factors that can affect inwards FDI in European transition economies and how should they be controlled for in empirical investigations?"*.

Drawing upon the analyses in Chapter 2 and 4, a baseline model was specified in order to address the key question of **Chapter 5**: *"Do European transition economies with higher levels of human capital manage to attract more inwards FDI?"*. Initially, the effect of different human capital measures on *FDI inflows* is estimated using a panel-robust Fixed Effect (FE) estimator, Driscoll-Kraay estimator and two-way cluster robust estimator. However, since the human capital variables used here change slowly over time, the Fixed Effect Vector Decomposition (FEVD) estimator which also utilises cross-country variation is favoured on the grounds of higher efficiency. Accordingly, the estimations are also carried out using a FEVD estimator. Finally, considering arguments in favour of using *FDI stocks* as the dependent variable, the effect of human capital on FDI is estimated in a stock-adjustment framework using the Corrected Dynamic Least Squares Dummy Variable (LSDVC) estimator. The other question addressed in this chapter is *"Do the transition-specific characteristics of human capital affect the level of inwards FDI received by European transition economies?"*. To answer this the baseline model is augmented with proxies to account for the extent to which the workforce of these economies has been affected by the characteristics of human capital formation during communism analysed in Chapters 1 and 4.

Chapter 6 extends the empirical investigation of the previous chapter to a sector- and industry-level. The first question addressed in Chapter 6 is "*In which economic activities is any relationship between inwards FDI and human capital expected to be stronger?*". To answer this, a classification of economic sectors is first provided based on their association with different types of FDI and the manufacturing sector is identified as the sector where inwards FDI is likely to be more sensitive to the measures of human capital. Accordingly, the next question addressed in this chapter is *"Do European transition economies with higher levels of human capital manage to attract more inwards FDI to their manufacturing sector?"*. To answer this question, the effect of different human capital variables on manufacturing FDI is estimated in a stock-adjustment framework using the LSDVC and System GMM (Generalised Method of Moments) estimators using, respectively, aggregate manufacturing FDI stocks and country-industry pairs of FDI stocks as an independent variable. Next, drawing from the skill-biased technical change hypothesis, it is hypothesised that the effect of human capital on FDI is likely to be stronger in more technology-intensive manufacturing industries. Accordingly, the last question to be addressed in this chapter is *"Is there a (stronger) effect of human capital on FDI in medium- and high-technology manufacturing industries compared to that in low-technology industries in European transition economies"*. Similar to the approach above, a System GMM estimator is used on country-industry pairs of FDI stocks to address this question.

Chapter 7 synthesises the main findings of this thesis and lists its main contributions to knowledge and identifies its main limitations. The first question addressed in this chapter is *"How can the (largely insignificant) findings of this thesis be explained?"*. After having examined alternative potential explanations, the final question to be addressed is *"(How) do the findings of the empirical investigation challenge the conventional view on the relationship between human capital and FDI at theoretical level and the way in which this is investigated empirically?"*. This chapter concludes with suggestions for further research and explores some wider implications of this thesis' findings for future macro-level research involving measures of human capital.

Chapter 1

FOREIGN DIRECT INVESTMENT AND THE WORKFORCE IN EUROPEAN TRANSITION ECONOMIES: AN INTRODUCTION

Contents

1.1 Introduction

This chapter seeks to provide the context for the research conducted in this thesis by answering three questions. First, this chapter will provide arguments as to why inwards foreign direct investment (FDI) is expected to be beneficial from a host country's perspective, with special reference to European transition economies. Second, this chapter will present the trends of inwards FDI in European transition economies since the beginning of transition and its distribution among individual economies. The importance of FDI for these economies is then discussed in terms of its contribution to capital accumulation and beyond and it is argued that the positive effects of FDI in the context of transition can exceed those in other economies. After arguing that inwards FDI can be highly beneficial for European transition economies, the chapter will assess human capital formation in these economies as one of the factors that may attract FDI. In particular, this chapter will investigate how the (legacy of) communist education systems and labour markets have affected the workforce of these economies, seeking to answer the third question: why and how this workforce is likely to differ from that of developed economies?

Although the aim of this chapter is to provide a context for the analyses in the rest of this thesis, the analysis is kept narrow and tightly based on the research questions to be investigated. Namely, this chapter does not seek to provide inclusive discussions on the process of transition from a centrally-planned to a market- economy, their education systems and labour markets in European transition economies, or general patterns of FDI and its effects in these economies, topics which have been analysed extensively in previous literature on transition economies. Rather, this chapter seeks to identify and analyse the key aspects of these topics that are argued to be directly related to the potential relationship between human capital and FDI and in this specific context and, as such, will inform the investigations that are undertaken in the rest of this research.

The rest of this chapter is organised as follows. Section 1.2 explains why European transition economies should seek to attract FDI and assesses how successful they have been at this over the last two decades. More specifically, Sub-section 1.2.1 examines the nature of FDI and its potential benefits for the host economy, whilst Sub-section 1.2.2 extends and contextualises this discussion for European transition economies and provides a statistical overview of inwards FDI in these economies.

Sections 1.3 analyses measures of the quantity and quality of human capital formation in European transition economies. In particular, it discussed the type of skills that their (pre-transition) education systems tended to emphasise. Section 1.4 continues to analyse the dimensions of labour markets in these economies that may determine their attractiveness to foreign investors. In particular, it examines the level of labour costs in these economies and emphasises the importance of considering how the (legacy of) specific characteristics of pre-transition labour markets have shaped the skills and attitudes of the workforce. Section 1.5 summarises the findings and explains how these motivate the key research questions that will be addressed in the rest of this research.

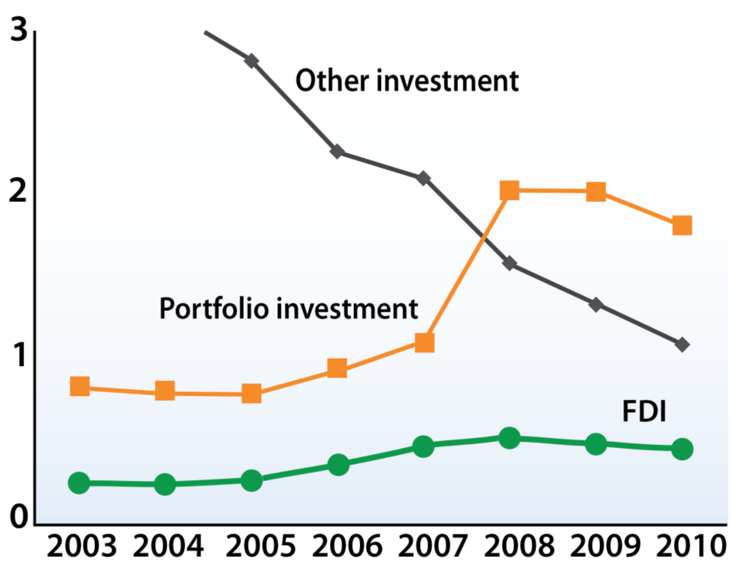
1.2 Why should European transition economies seek to attract FDI?

This section seeks to establish the importance of inwards FDI for European transition economies and to illustrate the extent to which these countries have managed to attract FDI over the last two decades since the fall of communism. Sub-section 1.2.1 starts with a more generic discussion focusing on the nature of FDI and the ways in which host economies can benefit from it, whilst Sub-section 1.2.2 identifies and analyses key dimensions of the transition process that are argued to make FDI even more important in this context. In presenting this analysis the focus of this sub-section is on dimensions of European transition economies that are considered to be closely related to the focus of this research programme. More general discussions on various aspects of the transition process and these countries' overall economic development during transition can be found, among others, in Lipton et al. (1990), World Bank (1996), Blanchard (1997), Roland (2000), Blejer and Skreb (2001), Filer et al. (2001), Campos and Coricelli (2002), Jeffries (2002), World Bank (2002) Winiecki and Kondratowicz (2005), Bandelj (2007), Lieberman and Kopf (2008), EBRD (various years) and UNECE (various years). General patterns of FDI inflows into European transition economies and their effects have also been extensively documented and analysed by previous studies, among which are: Lankes and Stern (1998), Kaminski and Riboud (2000), Hunya (2000a,b; 2004), UNECE (2001), Sohinger, 2005, Kalotay (2001; 2010), FIAS (2007), UNCTAD (various years) and EBRD (various years).

1.2.1 The (potential) benefits of FDI for the host economy

Foreign direct investment (FDI) accounts for the largest share of external capital flows into developing and transition economies (UNCTAD, 2011). From a host country's perspective, FDI is considered to be more attractive compared to other forms of international capital flows, i.e. portfolio investment and other investments such as commercial loans or trade credits, partly because it is (largely) non-debt creating and relatively more stable (UNECE, 2001; Albuquerque, 2003). UNCTAD (2011) shows that the volatility of FDI inflows as measured for each year by the relative standard deviation (i.e. coefficient of variation) for the preceding ten years has been considerably lower compared to that of portfolio and other investment during the period 2001-2010 (Figure 1.1 below). The Figure below further suggests that, despite experiencing higher volatility compared to previous years, global FDI has remained considerably more resilient compared to other types of investment during the latest financial crisis.

Figure 1.1: Volatility of global FDI inflows, 2003-2010



Source: World Investment Report 2011 (UNCTAD, 2011)

One of the reasons why FDI is less volatile compared to financial investment lies in the nature of 'direct' investment and the duration of the commitment it involves. The commitment of the investment when undertaking foreign *direct* investment is, by definition, considered to be of a long-term nature. According to IMF and OECD definitions (IMF, 1993, 2009; OECD, 1996, 2008), direct investment is an investment made by a resident entity of one economy (the ‘direct investor’) aimed at establishing a *lasting interest* in an enterprise that is resident in another economy (the ‘direct investment enterprise’), including the reinvestment of any profits made by the direct investment enterprise. According to this definition, the ‘lasting interest’ involves the acquisition of at least 10% of the shares or voting power of the direct investment enterprise by the foreign investor. The ‘lasting interest’ is considered to imply a strategic long-term relationship between the entities and a significant degree of influence by the direct investor in the management of the direct investment enterprise. This distinguishes FDI from portfolio investment which typically involves a lower share of ownership/voting power held by the foreign investor and generally no influence in the management of the direct investment enterprise.

The long-term nature of FDI and the involvement of the foreign investors in the management of the enterprise are argued to make the investors more prone to transfer both technology in the form of capital goods, and technological and managerial know-how to the direct investment enterprise. De Mello (1997, p. 9), for instance, argue that this is because direct investment allows the foreign investor to retain “formal control of the technology and knowledge transferred”. The association of FDI with the purchase or in kind transfer of capital goods is argued to make it less reversible because fixed assets are more difficult to liquidate (UNECE, 2001). Moreover, together with the transfer of know-how, this appears to represent the single most important reason why FDI is argued to benefit the host economies more than any other type of foreign investment or domestic fixed capital formation, a proposition examined in the rest of this sub-section. Considering that, as Blomström and Kokko (2003, p. 3) point out, multinational enterprises (MNE) “undertake a major part of the world’s private R&D efforts and produce, own, and control most of the world’s advanced technology”, the scope for transfer of advanced capital goods and technological know-how to the host country through the foreign investment they undertake appears to be large. Consistent with the arguments above, FDI is widely recognised as one of the most powerful channels for the transmission of technology and know-how across countries, especially from developed to developing and transition economies (e.g. Blomström et al., 1996; World Bank, 2008a). The association of FDI with such transmission in turn is the starting point for most arguments that link FDI to numerous benefits for the host economy, discussed below, and ultimately faster economic growth (de Mello, 1997; Blomström and Kokko, 2003; Ozturk, 2007; Deng et al., 2009; Weber, 2010).

According to orthodox FDI theory which is reviewed in Section 2.2, foreign investment will occur only under the condition that an MNE (believes it) has, or will gain, a firm-specific advantage by locating production in a foreign country. The possession of this firm-specific advantage, usually in the form of superior technology and/or knowledge, is what is expected to more than offset the inherent difficulties of operating on foreign soil, allowing MNE's to compete successfully with domestic firms and those in the countries they may wish to export to from the investment destination (Blomström and Kokko, 2003; Ford et al., 2008). With this argument as a starting point, foreign investment enterprises are inherently expected to have higher (labour and) total factor productivity compared to their domestic counterparts in the same sector. Thus, the mere operation of MNE affiliates in the host economy is expected to be associated with technological progress and increased productivity (UNECE, 2001; Uzagalieva et al., 2010). By increasing the competitiveness of the industries in which they enter, MNE's will influence the structure of production and employment in the host economy. If inwards FDI is predominantly directed towards high-technology and high-skill intensive sectors and/or stages of production, it can drive the host economy towards greater specialisation in high value-added activities (Resmini, 2000; UNECE, 2001; UNCTAD, 2002). Similarly, FDI can increase competitiveness, and by implication, the size, of exports, improving the host country's external financial position. In addition, FDI can affect the composition of the host country's exports, potentially towards goods and services with a higher R&D content, thereby helping the host economy to move up the global value chain (UNCTAD, 2002; Sohinger, 2005). The development of higher value added (stages of) production in the host country, i.e. the production of more valuable products, in turn, generate more income (and profits for the companies) and create higher-skill and higher paying jobs which are relatively more sustainable because they are less wage-elastic.

In the process of production, MNE's can also affect the skills of the host countries' workforce and enhance their R&D capabilities. In order to be able to successfully perform their jobs in the foreign affiliate enterprises, local employees and managers are expected to learn from the parent firms or expatriate staff based in the host country. Regardless of the form of this transfer of knowledge, i.e. whether this is done through formal training or just learning by doing, the MNE will this way augment the knowledge and skills of the host country's workforce (de Mello, 1997; Blomström and Kokko, 2003). Furthermore, FDI can enhance the technological capacity of the host country by financing and undertaking R&D there. The World Bank (2008a) argues that although this is not a common in the case of developing and transition economies, there is an increasing trend of MNE's undertaking R&D in these countries. Finally, in addition to the direct effect of MNE's through the transfer of knowledge to their local employees, they may also affect the skills of the host country's workforce indirectly. Namely, to the extent that MNE's seek skilled labour, their presence in the host market may encourage individuals to upgrade their skills, e.g. through education and training, in order to secure a job in these firms which, evidence suggests, tend to pay higher wages compared to their domestic counterparts (Onaran and Stockhammer, 2008; Andrews et al., 2009; Eriksson and Pytlikova, 2011).

The potential effects of FDI discussed above refer to the transfer or development of technological and managerial know-how by the foreign investors, directly, i.e. under the control of the parent company, or through the provision of appropriate incentives for this to occur. However, know-how can also leak, or 'spill over', to the host economy through multiple channels, with or without the foreign affiliates' will or intention. These 'spillovers' of technological and organisational know-how from the foreign investment enterprise can affect the whole industry where the enterprise operates, as well as to other related industries through forward and backward linkages.

First, firms in the MNE's own industrial sector may be affected by positive spillovers in several ways. Just by observing the operation of the MNE, domestic firms can learn about new products, production techniques, inputs, and management and marketing practices, which they can replicate or modify in order to improve their productivity (UNECE, 2001; World Bank, 2008a; Vahter, 2010 Fu, 2012). Managers and employees who have gained direct knowledge and experience in the foreign investment enterprises can subsequently quit, transferring their new skills to other employers or using them to establish their own firms (Blomström and Kokko, 2003; World Bank, 2008a; Fu, 2012). Moreover, even the mere increase in competition from the MNE's can be beneficial for the host market. Namely, the entry of MNE's can reduce the market power of existing firms and introduce new and/or better products or services in the market and, by doing so, it may 'force' its competitors to introduce new products and production techniques and to increase their investment in human capital (Blomström et al., 2000). Finally, FDI may encourage the formation of industrial clusters in the host economy, creating a self-reinforcing effect by attracting further FDI, i.e. the 'agglomeration economies' effect to be discussed in Section 2.3.

Second, MNE's may affect the firms in upstream and downstream industries in the recipient country. The upstream industries may benefit simply because MNEs may increase the demand for intermediate products. In addition, local suppliers to the foreign investment enterprise may be trained and advised by the MNE in order to improve their production standards and/or design to the level required by the MNE (World Bank, 2008a). The MNE's supplier can then deploy this new know-how more broadly, i.e. in the production of other products and/or products for other clients. Similarly, positive spillovers can occur in downstream industries. Namely, the buyers of the MNE's products may receive technical assistance or training from the MNE; and they can benefit from the higher competition between the suppliers in terms of lower prices and/or introduction of new varieties of intermediate goods by the MNE.

The potential effects of FDI discussed above have direct implications for the way FDI is expected to ultimately affect economic growth in the host country, as explained later in this section. However, first it is important to note that the positive spillovers from FDI do not occur automatically and the size of spillovers depends on the type of activities that are undertaken in the host economy by the MNE's as well as the "absorption" capacities of the domestic firms and other business environment and institutional factors, as explained later in this section.

The positive spillovers are going to be limited if MNE's intentionally limit the affiliates' access to the technology adopted and the R&D they undertake, for instance if they fear that intellectual property rights are not protected (Dunning, 1994;

UNECE, 2001). In this case the scope for technical advancement and technological learning in the host country would be limited, regardless of the absorptive capacities of the host economy. By the same token, the spillovers to downstream industries will be limited if the foreign affiliate only buys low value-added intermediate products from local suppliers (and importing higher value-added products or producing them in-house). Moreover, FDI may also have negative effects on the host country's economy, although these appear to taken into consideration relatively rarely in academic research and in policy-making. This can occur if MNE's deploy too few, or the "wrong" kind of technological capabilities (Dunning, 1994; UNECE, 2001), for instance if the host country is relatively well endowed with cheap low-skilled labour. If the level of technology deployed is low and the production of foreign affiliates in the host country is restricted to low value-added activities, even the direct positive effects (i.e. within the control of the foreign affiliate), such as increased productivity, export competitiveness and improvement of a country's position in the global value chain, may not occur or may even be negative. Further, the 'competition effect' of an MNE's entry does not necessarily improve competition and encourage incumbent firms to innovate and/or increase their productivity. On the contrary, its entry can reduce competition in the domestic market by 'crowding out' incumbent firms, i.e. forcing them out of the market because they may not be able to invest in upgrading their technology and know-how in order to compete with the MNE (UNECE, 2001). Finally, concerns have also been raised about potential negative effects of inwards FDI related to host countries' national security (e.g. if foreign investors have excessive control over strategic industries that are important defence capabilities) and excessive influence of foreign investors in host countries' policy-making (Golub, 2003).

The potential effects of FDI on the host economy discussed above, both direct and through spillovers, have implications for the way FDI is treated in growth theory. In a neoclassical growth framework (e.g. Solow, 1956) long-term economic growth is determined by technological change which is assumed to grow exogenously at a constant rate. In this setting, there is no scope for FDI to influence the rate of technological change through the channels discussed earlier; therefore FDI can be treated as merely a means of funding capital accumulation in the host economy. Foreign capital is essentially equivalent to domestic capital and, as such, it can only have a short-term impact on the host country's output growth. In an endogenous growth framework, on the other hand, knowledge and technological advancement are endogenously determined and they are of crucial importance in explaining long-term growth (Section 2.3 provides a more detailed discussion). In this framework, the growth-enhancing potential of FDI is much greater than that predicted by neoclassical models (e.g., Balasubramanyam et al., 1996). As explained earlier, FDI is likely to be associated with the introduction/development of new technology and know-how, both directly and through spillovers. In endogenous growth models, to the extent that FDI causes or encourages human capital development and technical change in the host economy, it can be treated as an "engine of growth", affecting not only short-term output movements, but also long-term economic growth.

Accordingly, with endogenous growth models (Romer, 1990; Grossman and Helpman, 1991) as a starting point, Borenzstein et al. (1998) develop a theoretical model in which FDI as a channel of technology advancement is the main determinant of economic growth in developing economies. In this model, MNEs due to their superior 'knowledge', i.e. what is referred to as the 'ownership advantage' in FDI theory reviewed in the next chapter, can introduce new capital goods at a lower cost compared to domestic firms. Therefore, FDI can increase the rate at which advanced technology is introduced, therefore increasing economic growth in the long run. However, Borenzstein et al. argue that the effect of FDI on growth depends on the level of human capital in the host economy. According to these authors, the level of human capital (measured by the average years of secondary schooling for males in their model) determines the size of the effect of FDI on growth because it affects the ability of a country's workforce to understand, adopt, and adapt, the new technologies embodied in FDI. This argument is consistent with the Nelson-Phelps hypothesis (discussed further in Section 2.3) according to which human capital facilitates technology diffusion.

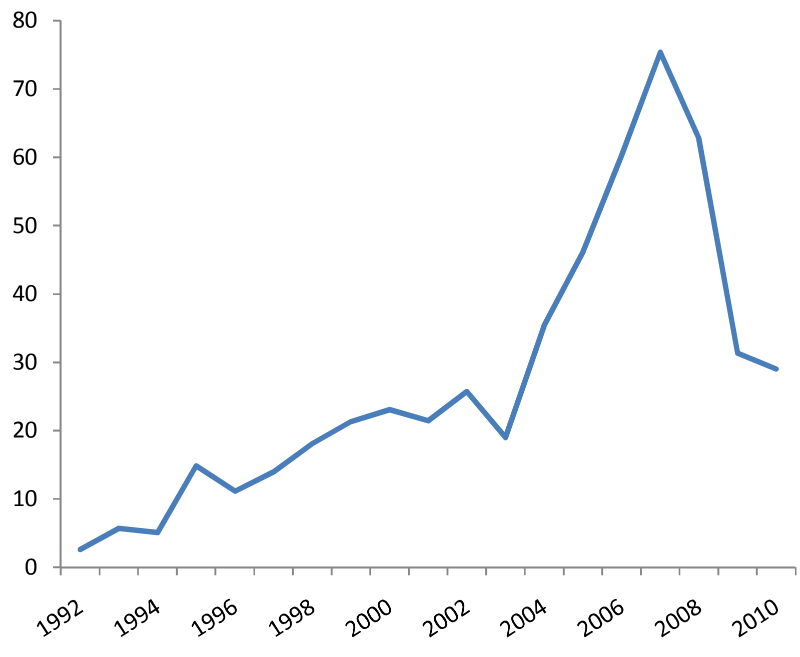
Consistent with the theoretical arguments that suggest the effects of FDI can be diverse and depend on host country characteristics, empirical evidence on the benefits of FDI has been mixed (De Mello, 1997; Blomström and Kokko, 2003; Lipsey and Sjöholm, 2004; Ozturk, 2007; Smarzynska-Javorcik, 2008; Smeets, 2008). There appears to be some evidence of positive spillovers, from foreign affiliates to domestic firms, regardless of domestic firm characteristics (Jensen, 2009; Havranek and Irsova, 2010; Vahter, 2010); and of a positive effect of FDI on growth at a macro level, unconditional of host country characteristics (Campos and Kinoshita, 2002; Nath, 2009; Ekanayake and Ledgerwood, 2010). However, the literature at large does not appear to come to clear conclusions. Rather, as Lipsey and Sjöholm (2004, p. 25) conclude in their review of studies addressing FDI and economic growth, "the main lesson might be that the search for a universal relationship is futile". Accordingly, the consensus view that seems to emerge currently from the empirical literature, consistent with the theoretical arguments discussed earlier in this section, is that a positive impact of FDI is not automatic and it depends crucially on the absorptive capacity of the host economy and/or its firms. Different authors have identified different determinants of the absorptive capacity of the host economy. The most widely cited appears to be the level of human capital, as hypothesised by Borenzstein et al. (1998) above and empirically supported by the same study as well many others (e.g. Xu, 2000; Ford et al., 2008; Wang and Wong, 2009). Other factors determining the (size of) FDI effects in terms of positive spillovers and economic growth at country level have been found to be: well-functioning markets (Balasubramanyam, et al. 1996), a higher technological level of the host economy's firms (Pessoa, 2008; Havranek and Irsova, 2010), strong safeguarding of intellectual property rights (Smarzynska-Javorcik, 1999), benevolent financial systems and financial market regulations (Hermes and Lensink, 2003; Alfaro et al., 2004; Durham, 2004; Wang and Wong, 2009) and high level of host country openness (Basu et al., 2003; Havranek and Irsova, 2010; Weber, 2010).

1.2.2 Inwards FDI and its effects on European transition economies

1.2.2.1 A statistical overview of inwards FDI and its contribution to financing investment

Until the beginning of the 1990s, European transition economies had negligible stocks of FDI due to previous restrictive policies that had been implemented primarily for doctrinal reasons (UNCTAD, 2008a). However, beginning in the 1990s these countries implemented extensive reforms: they liberalised trade, implemented privatisations of state-owned enterprises and made efforts to improve their macroeconomic performance. In hand with these, European transition economies created regulatory frameworks that were favourable to FDI. They have removed most barriers to foreign investment, provided them 'national treatment' (i.e. the same treatment as domestically-owned firms) and protection of their investment, including protection from expropriation, the right to transfer profits abroad and to repatriate any invested capital (Witkowska, 2007; UNCTAD, 2008b). In addition, most of these countries provided various incentive packages for foreign investors in the form of tax exemptions for varying periods (up to ten years), duty-free imports of (high-tech) equipment, job creation benefits, training grants, etc. (UNCTAD, 2008b). Partly reflecting these policy changes, European transition economies managed to attract increasingly larger FDI inflows until the beginning of global financial crisis, reaching a record of USD 75 billion in 2007. Figure 1.2 shows the aggregate FDI inflows into European transition economies which, as explained in the Preface, refer to the sixteen Central and Eastern European (CEE) and Baltic economies: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, the Former Yugoslav Republic (FYR) of Macedonia, Montenegro, Poland, Romania, Serbia, Slovak Republic and Slovenia.

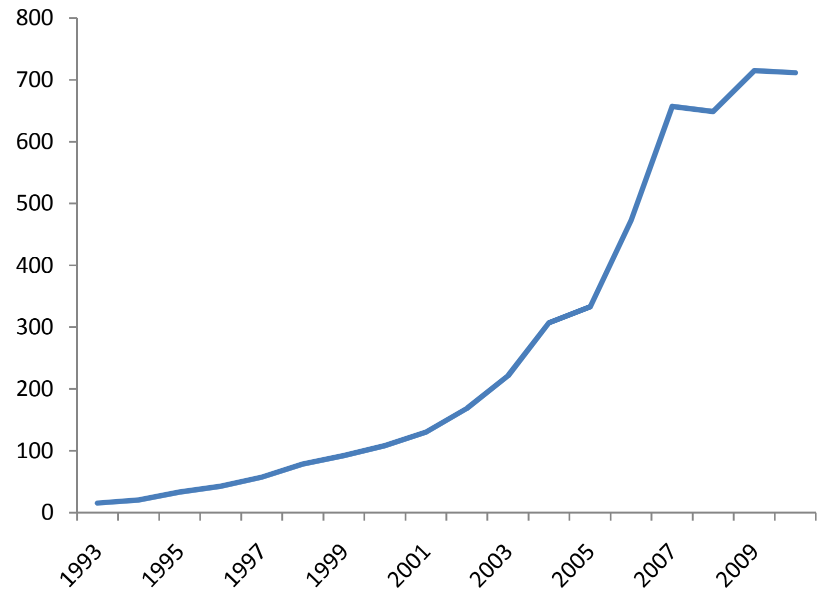
Figure 1.2: FDI inflows into European transition economies, 1992-2010 (Billion USD)*



Source: Own calculations based on UNCTADStat (UNCTAD, 2012)
*FDI inflows were aggregated for the whole sample of European transition economies. They are measured in US Dollars at current prices and current exchange rates.

Despite the large drop in FDI inflows in 2008-2010, FDI stocks in European transition economies have seen a generally rising trend since the beginning of transition (Figure 1.3 below). Similarly, during the transition period these economies managed to attract an increasing share of global FDI stock from 0.7 in 1994 to a peak of 4.3 percent in 2008 which is high relative to their share of global population (1.8 percent) and output (1.5 percent), calculated based on data from WDI (2010). The European transition economies' share of global FDI, however, experienced a slight decline in the following years, which corresponds with the global financial crisis.

Figure 1.3: FDI stocks in European transition economies, 1993-2010 (Billion USD)*



Source: Own calculations based on UNCTADStat (2012)
*FDI inflows were aggregated for the whole sample of European transition economies. They are measured in US Dollars at current prices and current exchange rates.

The volume of FDI into European transition economies has been highly concentrated (Table 1.1 below), with the four top destinations, Poland, Czech Republic, Hungary and Romania, accounting for around three quarters of their FDI stock in 2010.

Table 1.1: Distribution of FDI stocks, 2010

Country	Share of FDI (%)
Poland	27.0
Czech Republic	18.1
Hungary	12.8
Romania	9.8
Slovak Republic	7.1
Bulgaria	6.7
Croatia	4.8
Serbia	2.9
Estonia	2.3
Slovenia	2.1
Lithuania	1.9
Latvia	1.5
Bosnia and Herzegovina	1.0
Montenegro	0.8
Macedonia, FYR	0.6
Albania	0.6
Total	**100.0**

Source: Own calculations based on UNCTADStat (UNCTAD, 2012)

However, once the size of their economies is accounted for, a different picture appears (see Figure 1.4 below). From the Central and Eastern European countries (CEECs) above, only the Czech Republic, Slovak Republic and Hungary seem to stand out in terms of their success in attracting FDI stocks, suggesting that Poland and Romania are top destinations mainly due to the size of their market. Other top performers, having accounted for the size of their economy, are Montenegro, Estonia and Bulgaria, followed by Croatia, Macedonia and Serbia. An initial glance at the characteristics of the top performers suggests that some of other factors driving the FDI distribution within European transition economies, in addition to the size of the economy, could be the speed of reform and transformation to a market economy, privatisation opportunities, (prospects of) EU accession and availability of natural resources. For instance:

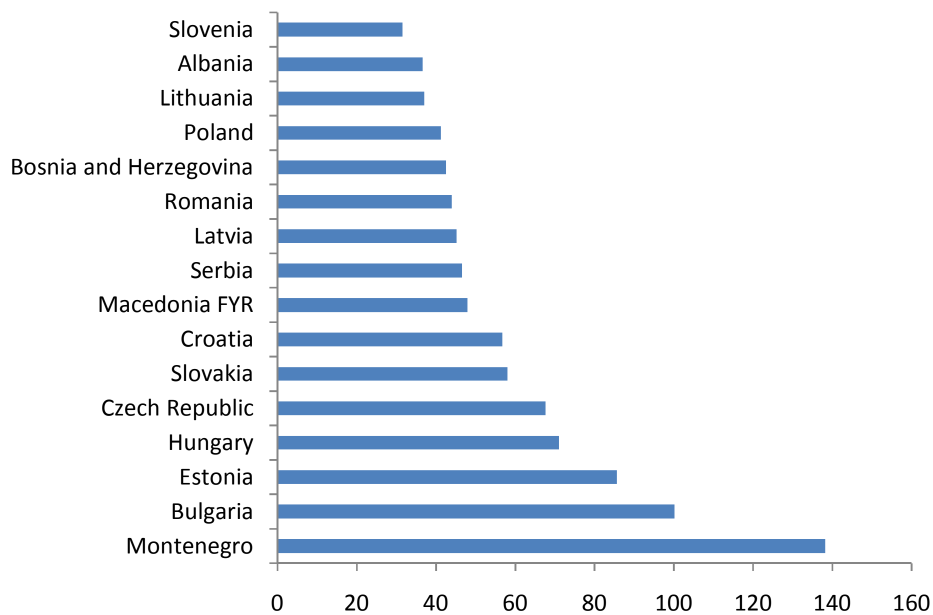
Czech Republic, Slovak Republic, Hungary and Estonia are renowned for being fast reformers among European transition economies (OECD, 2001; Sohinger, 2005)

The major share of Bulgaria's inward FDI has been accumulated in the wake of its accession to the EU and in years after that (Kalotay, 2008; UNCTAD, 2011)

Both Bulgaria and Croatia have undergone large-scale privatisations in the recent years (EBRD, various years; UNCTAD, various years). The domination of privatisation-related FDI appears to be indicated by the unusually high FDI inflows in these countries in the years when these privatisations took place (UNCTAD, 2012).

Montenegro has experienced considerable FDI inflows in the tourism sector and, related to this, its coastal real estate sector (e.g. ESI, 2012).

Figure 1.4: FDI stocks as a share of GDP, 2010 (%)



Source: UNCTADStat (UNCTAD, 2012)
*FDI stocks measured in US Dollars at current prices and current exchange rates.

The importance of FDI is perhaps most clearly indicated by its contribution to gross fixed capital formation (GFCF) in the host economy. A review of the (unweighted) average shares of FDI in European transition economies in their GFCF indicates that FDI has played a significant role in supplementing domestic investment since the beginning of the transition period. Table 1.2 below shows that all European transition economies with the exception of Slovenia have had average shares of FDI in GFCF in excess of 13 percent in the period 1992-2009. Slovenia also appears to be an exception in that it has managed to achieve very high investment rates in this period (its average being ranked fourth in the sample), despite the limited contribution of FDI. On the other hand, those relying more heavily on FDI are Bulgaria with an FDI/GFCF ratio of almost 40 percent, Estonia and Hungary at ratios of over 25 percent, and Macedonia and Slovak Republic at a ratio exceeding 20 percent. Overall, the shares of FDI in GFCF in European transition economies, with the exception of Slovenia, appear to be high by international standards: almost all the countries' averages (by far) exceed the average shares of around 9 and 11 percent for the group of developed and developing economies, respectively, in the same period (UNCTAD, 2012).

Table 1.2: Average* FDI/GFCF and GFCF/GDP ratios, 1992-2009

Country	FDI/GFCF (%)	GFCF/GDP (%)
Bulgaria	38.9	18.9
Estonia	27.5	28.0
Hungary	25.6	21.7
Slovak Republic	21.0	28.3
Macedonia, FYR	20.8	17.7
Czech Republic	19.4	27.3
Latvia	19.3	22.7
Croatia	18.2	20.8
Serbia and Montenegro***	17.3	15.0
Bosnia and Herzegovina**	16.5	22.6
Poland	16.3	20.1
Romania	16.1	22.2
Albania	13.9	21.5
Lithuania	13.9	22.5
Slovenia	6.6	24.0

Source: Own calculations based on UNCTADStat (UNCTAD, 2012); WDI (2010)
*The reported figures refer to unweighted averages
**Data covers the period up to the break up of Serbia and Montenegro (until 2007)
***Data for Bosnia and Herzegovina covers only the period after the war (from 1996)

A note of caution seems to be is in order when interpreting the shares of FDI in domestic investment. This ratio implicitly assumes that FDI contributes to gross capital formation, i.e. either in kind transfers physical capital or the provision of the funding necessary for its purchase. However, the definition of FDI does not specify the use of the funding: FDI may involve investment in physical capital, but also mergers and acquisitions, i.e. a change in ownership which does not necessary contribute to fixed capital formation. This concern has been previously raised by

Lipsey (2000) who fails to find empirical support for the hypothesis that FDI has a positive effect on capital formation in developing economies. Accordingly, various studies have argued that this could especially be a cause for concern in transition economies where, as discussed later, a considerable share of FDI has involved enterprise acquisitions in the form of privatisations (Krkosa, 2001; UNECE, 2001). However, despite these concerns, Krkosa's (2001) empirical investigation suggests a positive relationship between FDI and GFCF in Central and Eastern European (CEE) economies. The results of this study further suggest that the impact of FDI on capital formation in these economies is substantially higher than other sources of finance such as domestic credit and capital market financing. One reason why a significant relationship is found between FDI and domestic investment in these CEE economies, despite the high share of FDI related to privatisation, may be that the old vintage of the capital in the formerly state-owned companies made it necessary for foreign investors to invest in physical capital upon acquisition. Kalotay (2001) and Meyer and Estrin (2001), for instance, note a tendency of privatisations made by foreign investors in these economies to be followed by new investment in physical capital, often exceeding the size of the initial investment. However, the importance of FDI for transition economies may be best illustrated by the effects it has had on the real economy, discussed next.

1.2.2.2 The effects of inwards FDI in the context of European transition economies

At the outset of transition high levels of inward FDI were considered as essential for the successful and speedy transformation of the formerly centrally-planned economies (Lipton et al., 1990; Donges and Wieners, 1994; Sachs, 1997). Therefore, it is no surprise that virtually all European transition economies appear to have put the attraction of FDI high in their policy agendas during the transition period. In terms of "financial flow effects", revenues from privatisation-related FDI have served as a means for some of the European transition to finance their budget deficits, reduce their external debt and/or boost their foreign reserves (UNECE, 2001). However, as explained above, the potential for FDI to (positively) affect the economy by far exceeds any improvement in the external financial positions, and it is argued here to be greater in these economies compared to that in other economies due to the specific nature of the transition.

At the outset of transition, European transition economies were left with deep structural distortions inherited from the previous system. In communist economies the structure of the economy did not necessarily correspond to the demands of the market or the comparative advantages of regions and countries (Filer et al., 2001). The structure of production and employment reflected the priorities of the central planners: industrialisation of the production structures formerly focused mainly on agriculture and development of military power (e.g. Brunello et al., 2011). Accordingly, their resources were mainly channelled towards heavy industry, while the production of consumptions goods and the service sector was not considered as important (e.g. Lipton et al., 1990; Filer et al., 2001; Campos and Coricelli, 2002). Moreover, their manufacturing sectors were extremely biased toward heavy industry and once the communist system collapsed they faced chronic excess demand because "they produced goods...without benefits...for consumption" (Lipton et al., 1990, p.79). On the other hand, these economies had price distortions and shortages of consumption goods inherited from the previous system which contributed to macroeconomic imbalances such as hyperinflation and high current account deficits (Kalotay, 2001). In this respect, foreign enterprises through their day-to-day operations, i.e. their production and pricing practices, contributed to the amelioration of the price distortions inherited from the previous system; the elimination of shortages of goods and services that were demanded in the market and the reduction in host countries' trade deficits (Kalotay, 2001).

In addition to these structural problems, the ex-communist economies were also characterised by inefficient technologies and obsolete physical assets in their existing industries (Filer et al., 2001; Orts et al., 2005). Under these conditions, considerable resources were needed to fund required fixed investment for restructuring at the level of the enterprise and the economy overall. However, the European transition economies had limited domestic resources to finance this investment and, given their low domestic savings rates (Demekas et al., 2005; Sohinger, 2005), it was very important for these economies to be able to rely on foreign capital for this purpose. Given that developed economies represent the largest source of greenfield project in transition economies (UNCTAD, 2011) and most research and development (R&D) takes place in MNEs located in the developed economies, it is reasonable to expected that FDI can provide the advanced technology and know-how needed. Accordingly, FDI has recognised as an important source of technological progress in transition economies (Campos and Coricelli, 2002; Campos and Kinoshita, 2002; Uzagalieva and Kocenda, 2010). Foreign investment companies have also been documented to introduce new products, and management, marketing and organisational practices not previously used in these economies (Kalotay, 2001; Pavlínek, 2002); promote a new work ethic (Filer et al., 2001); improve (labour) productivity, value added of their products and export competitiveness (Smith et al., 1997; UNECE, 2001; Hunya, 2000a, 2002; UNCTAD, 2003); and, consistent with knowledge spillover, to FDI has been found to positively affect process innovation in incumbent firms in the industry it enters (Vahter, 2010).

In the previous sub-section it was argued that FDI can affect the industrial specialisation of the host country and its position in the global value chain. Resmini (2000) argues that these effects can be especially large in the context of transition where major changes are occurring in the structure of the economy and export patterns. However, these effects have not been uniform across European transition economies. Significant structural changes due to FDI have been argued to have taken place in those European transition economies which accessed into the European Union (EU) in 2004 and 2007 (Kalotay, 2010). The most successful countries in materialising these effects are those countries of the CEE which are considered as early reformers, e.g. Hungary, the Czech Republic and Estonia (Hunya, 2000a; UNCTAD, 2003). On the other hand, Kalotay (2010) points out that the economies of South-East Europe (SEE) (except Bulgaria and Romania which accessed into the EU in 2007) benefited from FDI-induced structural changes to a much smaller extent.

Finally, the effects of FDI in the context of transition are argued to extend beyond those that would be expected in a context of a mature market economy. Transition economies, with the partial exception of ex-Yugoslavia, Hungary and Poland, had no recent experience with private business or markets, which made them poorly equipped to (successfully) operate private enterprises and integrate them into the world market (Kalotay, 2001; Mihalyi, 2000). In these circumstances, FDI has been argued to have a crucial role in strengthening the emerging private sector and establishing the institutions necessary for the efficient operation of the market

(Kalotay, 2001; Sohinger, 2005). This appears to be particularly the case when it comes to privatisation-related FDI, as discussed next.

FDI has played a major role in the privatisation of formerly state-owned industries in European transition economies (Kalotay and Hunya, 2001; UNCTAD, various years; EBRD, various years). Privatisation to foreign investors has been shown to be associated with superior post-privatisation performance relative to other types of privatisation (Smith et al., 1997; Kocenda and Svejnar, 2002; Lizal et al., 2002; Kocenda and Svejnar, 2003). Some of the likely reasons for their superior performance can be related to: the relatively poor skills of domestic owners to operate in a market economy (Harvylyshyn and McGettigan, 1999); the dispersed ownership structure created by other methods such as mass privatisation and insider privatisation (Claessens et al., 1997; Kocenda and Svejnar, 2002); and, in the case of the latter, the likely resistance to restructuring by the managers/employees (Carlin and Landesmann, 1997). Perhaps the most important role of privatisation-related FDI can be attributed to the privatisation of services such as fixed and mobile telecommunications, utilities, banking and insurance, all of which, according to Kalotay (2001), have been rapidly upgraded as a result. Here it is argued that FDI in these services is particularly important in a transition context. The reliable supply of (innovative) services in the telecommunications and utilities industries can directly encourage the development of the emerging private sector by decreasing the operating costs of private enterprises. Involvement of foreign investors in banking and insurance, on the other hand, in addition to helping stimulate an improvement in the quality of the services (Kalotay, 2001) and facilitation of financial deepening (Schwaiger and Liebeg, 2007), is likely to have a positive effect in terms of increasing trust in the financial sector and improving businesses' perception of the business environment.

In a similar manner, Kalotay (2001) argues that all privatisation-related FDI, regardless of the industry, has played a role in increasing the transparency of economic transactions, a key feature distinguishing a market economy from the previous system. He finds a positive correlation between the share of sales to foreign-owned companies and the level of perception of transparency, as measured by Transparency International. On the other hand, the correlation between insider privatisation and state ownership and the degree of transparency is found to be negative, which, Kalotay argues, is indicative of this type of privatisation leading to a similar way of enterprise management with that practiced under the previous system. However, privatisations to foreign investors can also be argued to send a signal that the host country's government is genuinely committed to establishing a market economy. Consistent with this argument, Sohinger (2005) argue that the (speed of) market-based and growth-inducing reforms in transition economies have been partly driven by the desire of their governments to attract FDI.

Further, considering the limited domestic resources in European transition economies, it is not clear that some of the larger privatisations could have been carried out without the involvement of strategic foreign investors. If these privatisations could have been undertaken by domestic private investors, it is unclear that they could have successfully restructured and managed, considering the lack of knowledge and experience in operating enterprises in a market economy.

Considering the theoretical arguments and empirical evidence discussed above, arguments that FDI has contributed greatly to the amelioration of structural and macroeconomic distortions in European transition economies, as well as the speed and success of their transformation (Bevan and Estrin, 2004) appear to be warranted. In fact, these arguments may explain why FDI has been found to be a significant determinant of economic growth in European transition economies (Campos and Kinoshita, 2002; Nath, 2009), unconditional of the level of human capital or other factors in the host economy, a finding not common for other samples of countries, as explained in the previous sub-section.

1.3 Human capital formation in European transition economies

The previous section has documented very large disparities in inward FDI within European transition economies, even after accounting for the size of their economies/population. The different degrees of success in attracting FDI have motivated numerous empirical investigations on the factors that drive FDI into (European) transition economies (Lansbury et al. 1996; Smarzynska-Javorcik, 2002; Kinoshita and Campos, 2003; Serbu, 2005; Bellak et al., 2009; Riedl, 2010; Kudriavceva, 2011). These studies have identified various generic- and transition specific- determinants of FDI, but, by-and-large, they tend not to investigate the effect that stocks of human capital in these countries may have played in attracting FDI. This is somewhat surprising considering that, at the outset of transition, the high level of human capital in these economies was expected to represent one of their key advantages in competing for FDI (e.g. UNECE, 2001; Kinoshita and Campos, 2003; Bevan and Estrin 2004), especially in combination with the relatively lower wages compare to Western Europe (Magda et al., 2011), as discussed in the next section. The rest of this section will analyse some key dimensions of human capital formation in European transition economies that may be relevant to foreign investors when choosing their investment location. Namely, the level of educational attainment of their workforce is discussed in Sub-section 1.3.1, followed by an examination of the mix of occupations and type of skills emphasised in Sub-section 1.3.2. Finally, Sub-section 1.3.3 provides an assessment of the quality of European transition economies' education systems and the extent to which they develop skills that are considered relevant in a dynamic market economy. More general discussions of the characteristics of these economies pre-transition education systems and the skills they developed have been provided, among others, by World Bank (1996), EBRD (1997), Micklewright (1999), Berryman (2000), Pe'teri (2000), Mertaugh and Hanushek (2005), Marks and Tesar (2005) and Lamo et al. (2010).

1.3.1 Educational attainment of the workforce

Conventionally in the economic literature a country's human capital endowment is measured by rates of educational participation and levels of attainment. Based on such quantitative educational outcomes, the formerly planned economies were believed to be well-endowed with human capital. In the first decade after transition, literacy rates in European transition economies ranged between 96.7 and 99.7 percent, with a calculated (unweighted) average of 98.1 percent (WDI, 2010). With an average of approximately 8.9 years of schooling in the population aged 15-65 in 1990, they were ranked much closer to advanced economies than to developing economies in this respect (Table 1.3 below).

Table 1.3: Average years of education in the working age population, 1990

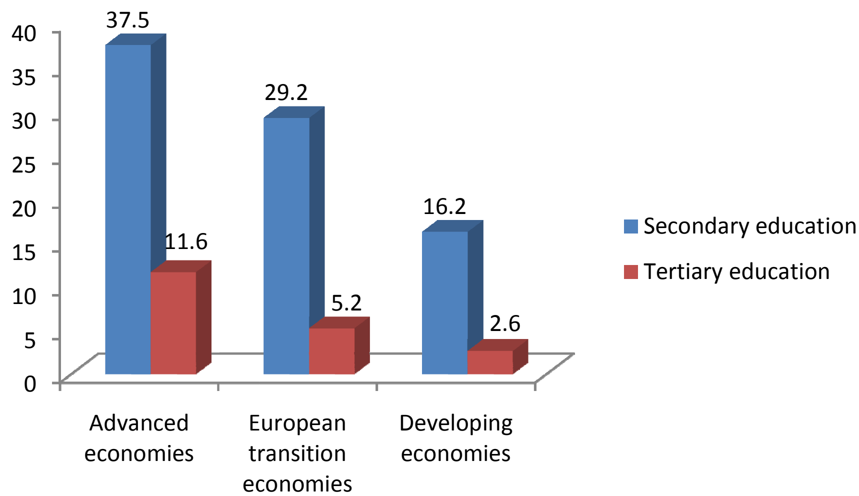
Country	Average years of schooling
Czech Republic	10.8
Slovak Republic	10.5
Advanced economies	**9.6**
Romania	9.3
Estonia	9.2
Albania	9.0
Lithuania	8.9
Hungary	8.8
Bulgaria	8.8
Poland	8.5
Slovenia	8.0
Latvia	8.0
Serbia	7.9
Croatia	7.8
Developing economies	**5.2**

Source: Extracted from Barro and Lee (2010)

However, a breakdown of educational attainment figures according to the level of education completed shows that the gap between European transition economies and developed economies increases significantly at tertiary education level (Figure 1.4 below). Namely, whilst the percentage of the working age population who had completed secondary education was 28% higher in 1990 in the developed economies than in the European transition economies, the percentage of those who had completed tertiary education was 123% higher[1].

[1] The figures for the percentage of population who have completed secondary education were calculated based on Barro and Lee (2010) by adding the share of population who have completed tertiary education to the original figures. This was because the original Barro and Lee (2010) data refer to the share of population who have completed secondary education as the *highest* level of education, so it automatically excludes the share of the population who have completed secondary education and *have continued* to complete tertiary education.

Figure 1.5: Educational attainment of the workforce, 1990 (%)



Source: Own calculations based on Barro and Lee (2010)

However, the most important differences with regard to human capital between transition economies and developed economies appear to be related not to the quantity, but to the quality of education. Despite the apparently relatively high levels of educational attainment of transition economies, serious concerns have been raised with regard to the quality and relevance of the mix of skills developed under the previous system in a market economy, as discussed below.

1.3.2 The mix of occupations and types of skills provided

In the previous system, the centrally planned production meant that the mix of occupations needed in the economy could be planned and developed accordingly. These economies were focused on the manufacturing sector and largely neglected the service sector (Filer et al., 2001; Campos and Coricelli, 2002; Rutkowski et al., 2005) and their education systems were geared towards producing the mix of occupations appropriate for this structure. They tended to develop highly specialised, occupation- or even firm-specific skills to be used in production, often through vocational education (World Bank, 1996; Filer et al., 2001). Table 1.4 below illustrates the emphasis of these education systems on vocational/technical upper-secondary education at the outset of transition. Estonia and Lithuania appear to be exceptions in having, respectively, around a fifth and a third of students enrolled in this type of education in 1990. In the other economies for which data is available the unweighted average share of vocational/technical enrolments is 60 percent, ranging from 47.2 in Bulgaria to 78.4 percent in Romania. By 2008, however, the emphasis on vocational/technical education has declined considerably in most of these countries, whilst remaining the same or increasing to a lesser extent in other ones[2]. This appears to indicate that the centrally planned economies over-valued and over-emphasised this type of education.

Table 1.4: Emphasis of vocational/technical education, 1990 and 2008*

	Share of vocational/technical enrolments (%)	
Country	**1990**	**2008**
Romania	78.4	60.0
Poland	68.4	24.7
Czech Republic	63.9	69.1
Slovak Republic	63.2	15.0
Slovenia	61.0	59.7
Croatia	58.0	63.1
Hungary	55.7	63.7
Albania	55.3	8.9
Latvia	48.1	36.8
Bulgaria	47.2	47.1
Lithuania	34.5	28.4
Estonia	20.5	33.0

Source: Own calculations based on TransMONEE (UNICEF, 2010)
*Figures for Croatia and Slovenia refer to 1991 and 1993 instead of 1990, respectively, whilst those for the Slovak Republic refer to 2007 instead of 2008.

Moreover Marks and Tesar (2005, pp. 26-27) argue that even the universities of centrally planned economies had "an explicit orientation towards enhancing production", being focused on vocational education and the advancement of technical and scientific knowledge. Subjects such as business and social sciences, on the other hand, were largely neglected in the centrally planned economies (World Bank, 1996; Mertaugh and Hanushek, 2005). Such a composition of human capital in terms of the types of skill and the occupational mix raises serious questions of its adequacy in a market economy for two reasons. First, there was a lack of qualified individuals in subjects such as economics, management, marketing and law, each of these areas being crucial to the efficient functioning of a market economy. Second,

[2] In some of the countries the share of vocational enrolments remains surprisingly large, however the composition and content of these courses are likely to have changed to reflect the demands of the new market economy, e.g. expansion of the business education at the expense of technical education (Jeong et al., 2008)

vocational training which was emphasised in these systems tended to develop specific skills which were relatively more valuable for operating specific technology (Krueger and Kumar, 2004). This approach may have been appropriate for a centrally planned economy where technological change was slow and it was customary for individuals to be prepared for a specific occupation and to remain in the same job throughout their lives. On the other hand, general, conceptual-based, education is superior in developing more general skills (Krueger and Kumar, 2004; Filer et al., 2001) which are transferable across jobs and occupations. In particular, Bowles and Gintis (1976) argue, academic education enhances creativity and problem-solving skills, compared to vocational training which promotes specific skills. However, the education systems of the centrally planned economies appear to have been generally less successful, or even less interested, in developing these skills and traits conventionally attributed to general education.

Reflecting the desire to keep the established social order, education systems in the centrally planned economies were prone to promoting conformity, whilst largely discouraging individual initiative and critical thinking (Mertaugh and Hanushek, 2005). This approach was reflected throughout the education system, e.g. in the lack of autonomy for educational institutions (Marks and Tesar, 2005) and their detailed, centrally-prescribed, curricula, textbooks and teaching methods (Micklewright, 1999). However, perhaps most importantly, this approach was reflected in the instruction and evaluation methods adopted in the classroom, as they directly contributed to the mix of skills and behavioural traits that were developed/promoted under this system. Marks and Tesar (2005), for instance, argue that the instruction and evaluation methods adopted by universities under central planning "stressed familiarity with lecture materials and facts rather than independent studies and a capacity for analytical thinking which could lead to innovative thought" (p. 27). This is line with the arguments of other studies which hold that the education systems of these economies emphasised mastery, or memorisation, of knowledge and facts rather than critical thinking and problem-solving skills (World Bank, 1996; EBRD, 1997; Berryman, 2000). Indeed, rather than not promoting critical thinking and creativity, the previous educational systems actively discouraged these due to their potential to undermine the established order. By virtue of enforcing conformity to rules and authority, these education systems promoted docility, discouraged self-initiative and suppressed individuals' sense of self-efficacy. These latter personal traits represent additional characteristics of human capital which are especially relevant in dynamic market economy, as discussed in Chapter 4 of this thesis.

1.3.3 The quality of education provision

In addition to the distinctive features of the human capital formation process discussed above, more general concerns have been raised about the quality of education provided. There was no national system of quality assurance (World Bank, 1996; Micklewright, 1999). The guaranteed employment provided for all graduates in the centrally planned economy meant that there was no evaluation feedback from the market, either in terms of the needed skills, or in terms of the quality and relevance of the skills provided to graduates (World Bank, 1996; Filer et al., 2001; Marks and Tesar, 2005). Marks and Tesar (2005) also argue that universities under central planning were in essence focused on certification rather than knowledge creation and transfer. On the other hand, educational institutions, like other (state-owned) enterprises, were led by a central plan and had to meet their targets of "production". In the absence of mechanisms of quality control, this meant that they could adjust their academic standards in order to achieve the required numbers of professionals in specific fields (Pe'teri, 2000). This argument is in line with the relatively low repetition rates found in many transition countries and evidence of human capital stock overvaluation compared to countries with comparable levels of development and efficiency of their education systems (Beirne and Campos, 2007).

The deficiencies of the centrally-planned education systems described above appear to be consistent with quality measures of their human capital derived from standard international test scores. Although these measures are not available for all European transition economies and for long time-spans, these results are indicative of the types and quality of skills their education systems develop. An observation that is immediately visible when reviewing the results of different cross-country tests is the diversity in the (relative) performance levels, both across European transition economies, and of the same economies in different tests and/or different points in time. The following paragraphs briefly summarise these results and identify some stylised facts from an assessment of three relevant international studies of cognitive skills in which different European transition economies participated in one or more rounds. The first two tests discussed here cover students in compulsory education (usually at the 8th grade), whilst the last one covers the countries' working age population.

The first two tests, the Third International Mathematics and Science Study (TIMSS; IEA, 2000a,b; 2008), and the Programme for International Student Assessment (PISA; OECD, 2004, 2007, 2010a) differ in two ways. TIMSS measures students' academic competence in mathematics and science and it was administered in four rounds (1995, 1999, 2003, 2007). PISA, on the other hand, focuses on three themes, alternating between in each round: reading, mathematics and science; therefore, its results may not necessarily be comparable across years or with TIMSS. Second, whilst TIMSS tests academic competence and can be regarded as a measure of success of education systems at imparting knowledge, PISA seeks to measure functional competence, i.e. ability to use knowledge to solve real-life problems rather than mastering curriculum. As such, PISA can be considered to measure competences that are more general in nature and, as argued above, can be viewed to be more relevant in a dynamic modern economy and in the process of transition

A review of TIMSS results (IEA, 2000a,b; 2008) shows that some of the European transition economies achieved satisfactory scores, especially in the earlier rounds (e.g., the Czech Republic, the Slovak Republic, Hungary, Slovenia and Bulgaria have scores that were significantly above the average of the participating countries in the 1999 round). A few of the European transition economies tend to have average scores (e.g. Lithuania and Latvia), and the rest have scores significantly below the average (e.g. Romania and Macedonia in 1999, and the new participating countries in 2007, Bosnia and Herzegovina and Serbia). The performance of these countries, however, does not always remain similar across years, as discussed later in this section.

Although the TIMSS and PISA results are not strictly comparable because they refer to different points in time and the same countries are not always covered in different tests, the overall performance of European transition economies in PISA again cannot be considered as satisfactory. In the second and/or third rounds of PISA in 2003 and 2006 (OECD, 2004, 2007) which focused on mathematics and science respectively, Estonia, Slovenia and the Czech Republic and Slovak Republic achieve scores that are significantly above the OECD average. Similar to its performance in

TIMSS, Hungary stands in the middle, with a score that is not significantly different from the OECD average, and almost all other countries consistently have significantly lower scores (Croatia, Poland, Latvia, Lithuania, Montenegro, Romania and Serbia). Two striking difference are noted when comparing differences between their TIMSS and PISA performance: Bulgaria which was a top performer in TIMSS 1999 has a score significantly lower than the OECD average in PISA 2006, whilst Poland which was a bottom performer in the former test manages to achieve a score that is not significantly different from the OECD average in the latter test. These differences may be partially explained by the fact that the tests were conducted at different points in time, meanwhile the education systems in these economies appears to have been changing. The improved performance of Poland appears to be as a result of successful reforms that this country has undertaken starting from 1999 (OECD, 2010a) and it is consistent with the major improvement of this country's performance in PISA reading tests between 2000 and 2009, discussed below. The fall in Bulgaria's performance also seems to reflect a general deterioration of its education system. This country's results are consistent with TIMSS 2007 (IEA, 2008) that reports this country experienced the largest deterioration in TIMSS performance since 1995.

The performance of European transition economies in the PISA tests focused on readings appear to be even weaker than that in mathematics and science. In PISA 2000, all participating economies from this group (the Czech Republic, Hungary, Poland and Latvia) scored significantly lower than the OECD average. In PISA 2009 (OECD, 2010a), only Poland from this group managed to reach a score that is significantly higher than the OECD average, joined by Estonia which is a new participant and also performs above average. Hungary reaches the OECD average score, similar to other tests, leaving all the other European transition economies (except for Bosnia and Herzegovina that does not participate) with significantly lower scores.

However, transition economies also appear to differ from other economies in terms of the types of skills they develop. PISA measures and analyses the student performance in terms of different types of skills. PISA 2009, for instance, analyses three different aspects of reading: accessing and retrieving information, integrating and interpreting it, and reflection and evaluation. The results of this analysis appear to support the arguments above, according to which educations systems in European transition economies focused on imparting knowledge rather than developing the ability to critically evaluate information. Here, all the countries which PISA 2009 (OECD, 2010a, p. 71) lists as being significantly lower on the 'reflect and evaluate' subscale compared to one or two of the other subscales are European transition economies (Azerbaijan, Bulgaria, Czech Republic, Kazakhstan, Kyrgyzstan, Montenegro, the Russian Federation, Serbia, Slovak Republic, and Slovenia), suggesting that this is a specific characteristic of these particular education systems[3].

PISA also provides information on the distribution of student scores within countries and disaggregates student performance according to six proficiency levels. The students reaching the highest proficiency level in reading, according to OECD (2010a), are those that are able to comprehend, thoroughly analyse and evaluate, both explicit information and unstated implications provided in the text. The share of students performing at this level is argued by OECD (2010a, p. 49) to be particularly important because these skills are "...greatly valued in knowledge economies, which depend on innovation and nuanced decision making that draw on all the available evidence". Like in the case of previous indicators, most European transition economies perform poorly in this respect (see Table 1.5 below). The percentage of students reaching level 6 proficiency is lower that the OECD average of 0.8 percent in all European transition economies. Poland and Estonia are, again, the best performers among these economies, approaching the OECD shares of 0.7 and 0.6 percent, respectively, followed by Hungary, Slovak Republic and Slovenia with shares of 0.3 percent. Albania, Montenegro, Romania and Serbia, on the other hand, have no students performing at the highest level of proficiency. The mean scores of the top 5 percent of the students appear to follow the same pattern as the number of students reaching proficiency level 6: Poland and Estonia leading, followed by the more advanced CEE and Baltic countries, Croatia and Bulgaria, leaving the other four SEE countries behind with significantly lower scores. The only exception in these patterns appears to be Bulgaria, with an unusually high share of students who

[3] On the other hand, countries performing significantly better on the 'reflect and evaluate' subscale compared to one of two of the others are Hong Kong-China and all the English-speaking countries, with the exception of Ireland (Australia, Canada, New Zealand, the United Kingdom and the United States).

reach the highest proficiency in comparison to its relative performance of in terms of top students' mean score.

Table 1.5: Performance of top students in reading, PISA 2009

Country	Top 5% of students (average score)	Students with proficiency level 6 (%)
Poland	640	0.7
OECD average	**637**	**0.8**
Estonia	633	0.6
Czech Republic	627	0.4
Hungary	623	0.3
Slovenia	623	0.3
Slovak Republic	621	0.3
Croatia	611	0.1
Latvia	610	0.1
Lithuania	608	0.1
Bulgaria	603	0.2
Serbia	572	0.0
Romania	564	0.0
Montenegro	558	0.0
Albania	538	0.0

Source: Extracted from PISA 2009 (OECD, 2010a)

Finally, the relatively poor performance of European transition economies also extends to the International Adult Literacy Survey (IALS; OECD, 2000) which, in contrast to the previous tests, measures the cognitive skills of the working age population. The IALS seeks to measure individuals' ability to understand concepts and apply them effectively in practice. Although few transition economies participated in this test, the results indicate a similar pattern with PISA and TIMSS whereby Czech Republic stands out as the top performer of this group and is ranked relatively well, whereas the other countries, Hungary, Slovenia and Poland are ranked at the bottom.

Overall, the performance of European transition economies in international tests of cognitive skills can be summarised as follows.

European transition economies, on average, perform worse than developed economies, consistent with concerns regarding educational quality that have been raised by various authors, discussed at the beginning of this sub-section.

These economies perform relatively better in tests of mathematics and science compared to those in reading. This is may be partially explained by the structure of their economies and employment, discussed in the previous section.

The education systems of European transition economies appear to be significantly better at imparting knowledge (i.e. developing skills of retrieving and interpreting) information, than at developing the ability of students to reflect on and evaluate this new information.

The top performers in this group appear to be from Central and Eastern Europe: Estonia, the Czech Republic, and, to a lesser extent, the Slovak Republic, Slovenia, and Hungary. These are also some of the countries that have been most successful at attracting FDI, as explained in the previous section.

Like overall performance, top students' performance and the share of the most able students varies significantly within European transition economies. The ranking of the countries in terms of best-performing students tends to follow their mean performance.

The economies of South-Eastern Europe appear to be among the weakest performers in all the tests in which they participate (with the exception of Bulgaria in earlier years). Similarly, these countries tend to be, on average, less successful at attracting FDI.

The performance trends of countries such as Bulgaria and Poland suggest that, despite expectations that education systems are likely to be prone to inertia, educational performance is not "written in stone". The experience of Poland, in particular, suggests that, if appropriately designed and implemented successfully, educational reforms can have significant effects within a relatively short period of time.

The level of educational attainment, and especially the quality and mix of skills provided by (pre-transition) education systems, in turn, is likely to have implications for the quality of the labour force in European transition economies and their attractiveness to foreign investors. These and other characteristics of these economies' labour markets which can affect foreign investors' decisions are discussed in the next section.

1.4 Labour markets in European transition economies

The development of the European transition economies labour markets after the fall of communism has been documented and analysed extensively, among others, by Svejnar (1999), Boeri, (2000), Filer et al. (2001), Campos and Coricelli (2002), Havlik (2005), Barr (2005), Rutkowski et al. (2005), Commander and Kollo (2008), Flabbi et al. (2008) and Brunello et al. (2011). The focus of this section is narrower: it seeks to identify and examine some key dimensions of the labour markets that may affect the desirability of these countries' workforce to foreign investors. The first sub-section examines the levels, and trends, of labour costs in European transition economies. The second sub-section focuses on other characteristics of these labour markets inherited from the communist system: the mix of occupations and labour (im)mobility, skill shortages in the labour market, and a low level of labour productivity and prevailing work ethics.

1.4.1 Labour costs

At the outset of transition, low labour costs compared to the rest of Europe (combined with high educational attainment, discussed earlier) were considered to be a key factor that could attract foreign investors (e.g. Kinoshita and Campos, 2003; Serbu, 2005; UNCTAD, 2008a). The first part of this sub-section provides a statistical overview of wage levels and trends in European transition economies, and then continues to assess other aspects of labour markets which are argued to challenge and/or augment this conventional view.

Table 1.6 below presents the average level of gross monthly wages in European transition economies in 1995, a few years into the transition period. The definition of gross wages varies in different data sources, but Bellak et al. (2008, p. 22) explain that in the database by the Vienna Institute for International Studies (WIIW, 2010) used here, gross wages refer to "net wages plus personal income tax and social security contributions of employees, fringe benefits, bonuses, vouchers, etc.". Bellak et al. argue that this measure is imperfect for FDI studies because, among other problems, it does not include non-wage labour costs, and therefore does not represent the total cost of labour (i.e. including employers' contributions to social security and benefit plans) which would be a more relevant measure to be taken into consideration by the foreign investors. However, the gross wage is used here as it appears to be the only one for which data is available for the sample of European transition economies under consideration here (excluding Serbia and Montenegro). Table 1.6 reveals diversity in the level of average wages in the sample in the early years of transition which does not appear to be necessarily related to the level of advancement in transition. Two ex-Yugoslav republics, Croatia and Slovenia appear to stand out with average wages that are around twice as high as the (unweighted) average of the sample, followed by the more advanced transition economies of CEE, Czech Republic, Hungary, Poland, Slovak Republic, with notably lower figures. The Baltic economies which were also considered more advanced in the process of transition, Estonia, Latvia, Lithuania, have lower wages that the average, together with the less-advanced economies of SEE, Romania, Bulgaria and Albania.

Table 1.6: Labour costs in European transition economies, 1995

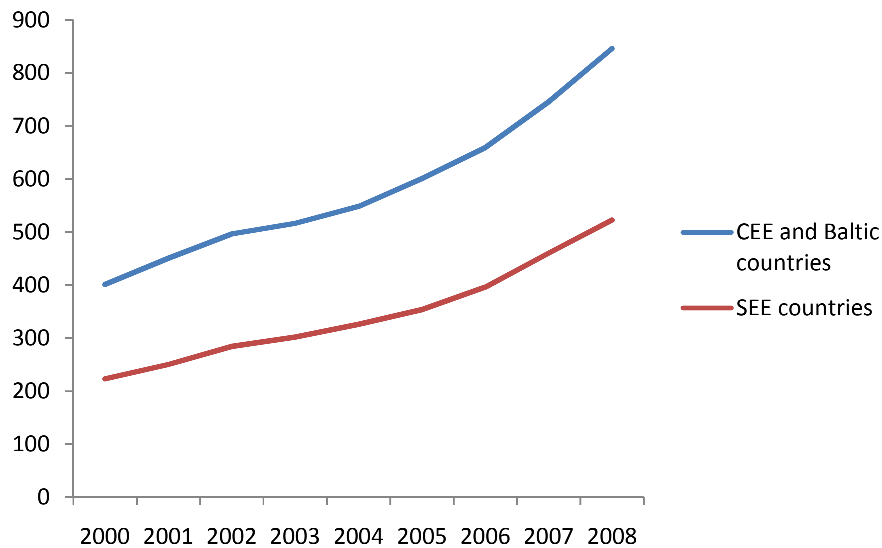
Country	Average gross monthly wage (EUR)*
Croatia	518
Slovenia	467
Czech Republic	294
Hungary	291
Poland	267
Slovak Republic	239
Estonia	194
Latvia	159
Romania	127
Lithuania	113
Bulgaria	106
Albania	75

Source: Own calculations using WIIW (2010) data

*EUR conversion using exchange rate data from Penn World Tables (PWT, 2009)

The level of wages in European transition economies has increased rapidly during the years since 1995. Figure 1.6 presents the trends of (unweighted) average gross wages for two groups of transition economies: the CEE and Baltic economies that have accessed into the EU in 2004 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia) and the rest, i.e. the SEE economies (Albania, Bulgaria, Croatia and Romania). The data presented in Figure 1.6 below shows an increase in wages during 2000-2008 which appears to follow a similar trend in the two groups of economies, regardless of their level of development and EU accession. In both groups, the average level of wages has more than doubled during these nine years, this change being slightly more pronounced in the SEE group. However, there are significant differences in the average level of wages in these groups throughout the period. In 2000, the level of monthly wages in the economies that have accessed into the EU is around EUR 400, which is 80% higher than that in the SEE, EUR 220. As wages in the SEE have since increased at faster rate, the difference between the two had declined by 2008, by which time wages in the more advanced group of transition economies were 63% higher compared to the SEE.

Figure 1.6: Monthly wages in European transition economies (EUR), 2000-2008



Source: Extracted from WIIW (2010)

Despite the rapid increases in labour costs illustrated above, on average, absolute labour costs have remained considerably lower in European transition economies compared to other European countries. Table 1.7 below presents the average gross monthly wage in European transition economies and in selected European economies for comparison. In 2008, the (unweighted) mean value of monthly wage in the selected European economies[4] is approximately four times as high as that in European transition economies. The country with the highest average wage among these economies is Slovenia, with a wage that is equal that in Portugal, the country which, according to Eurostat (2012), has the lowest average wage among these selected Western European economies. The pattern of wages within the transition

[4] The selected Western European countries include those with the highest and the lowest wages in Europe.

economies in 2008 remains similar to that in 1995, with Slovenia, Croatia and the CEE and Baltic economies being ranked the highest and the SEE economies at the bottom.

Table 1.7: Comparison of wages with selected Western European economies, 2008

Country	Average gross monthly wage (EUR)
Switzerland	3924
Germany	3450
Finland	3162
Sweden	3132
France	2798
Austria	2732
Spain	2101
Portugal	1391
Selected Western European economies (average)	**2836**
Slovenia	1391
Croatia	1044
Czech Republic	903
Poland	834
Estonia	824
Hungary	788
Slovak Republic	723
Latvia	680
Lithuania	623
Montenegro	609
Bosnia and Herzegovina	569
Serbia	560
Romania	477
Macedonia, FYR	428
Bulgaria	268
Albania	227
European transition economies (average)	**684**

Source: Own calculations using data from WIIW (2010) for European transition economies and Eurostat (2012) for the Western European economies

Finally, it should be noted that a comparison of absolute labour costs, both in terms of the gross wage measure used here and in terms of total labour costs, is still insufficient for providing full information on the attractiveness of a country's workforce in FDI studies. The assessment of an investment location according to this type of measure would have to assume that the quality, and productivity, of the workforce that can be attained in different locations is homogeneous. Therefore, (real) unit labour costs which measure labour costs accounting for differences in labour productivity have been argued to convey much more relevant information to foreign investors (Holland and Pain, 1998; Bellak et al., 2008). Accounting for productivity differences has been argued to be of particular importance in the context of transition economies where, empirical evidence suggests, labour productivity attained is likely to be significantly lower compared to developed economies (Bellak et al., 2008, p. 23). Unfortunately, as there appear to be no (publicly) available data for unit labour costs for the European transition economies, the analysis in this section has to be restricted to absolute wage costs and, as such, it should be interpreted with caution. The rest of this section continues to examine other specific characteristics of labour markets in European transition economies which may partly explain why labour productivity here tends to be lower compared to developed economies, and hence may affect the attractiveness of these economies to foreign investors. As these characteristics are inherited from, or mainly arise as a result of, the previous system, a contextual discussion of the relevant characteristics of the communist labour markets and the major developments during the transition period are provided first.

1.4.2 The legacy of communism and labour productivity: structural change, workforce skills, labour (im)mobility and cultural factors

In the former communist economies of Europe and the Soviet Union education, employment and wages were centrally planned and regulated, just like the structure of economy. As explained in the previous section, these economies were overly-focused on manufacturing, and largely ignored services. The priorities of the state were reflected beyond the relative size of the sectors in terms employment. Wages were set based on a centrally determined administrative grid which favoured the manufacturing sector. The level of wages in this sector was higher than that in the services, regardless of employees in services being, on average, more educated (Flanagan, 1998; Brunello et al., 2011). More generally, the wage grids were argued to have favoured physical work to intellectual work because they kept narrow differences between the wages of skilled and unskilled workers (e.g. Newell, 2001). This was supported by empirical studies that find low wage returns to education during the communist system compared to those found in developed economies coupled with significant increases in the education premium once the wages were market-determined during the transition period (Flanagan, 1998; Newell and Reilly, 1999; Orazem and Vodopivec, 1997; Campos and Jollife, 2003; Andren et al., 2005; Fleisher et al, 2005; Munich et al., 2005; Flabbi et al., 2008; Hung, 2008).

After the fall of communism the situation in the (labour) market changed drastically and rapidly. The liberalisation of the market combined with changes in external trade patterns, previously focused (exclusively) on the Soviet Union and other communist economies meant that a major reallocation of resources, including labour, was required. The size of sectors such as mining, manufacturing and utilities decreased, both in terms of their contribution to GDP and to employment, whilst that of the service sector increased significantly (Newell, 2001; UNECE, 2001; World Bank, 2002; Boeri and Terrell, 2002; Rutkowski et al., 2005; Brunello et al., 2011). There were also changes within the manufacturing sector, the share of consumer goods increasing at the expense of heavy industry (e.g. UNECE, 2001). The share of agriculture, another major sector during communism, either remained the same, or increased (e.g. in Poland and Romania) as individuals turned to agriculture in response to the loss of jobs in industrial jobs (Rashid et al., 2005; Rutkowski et al., 2005).

The reallocation of resources throughout the economy meant that the demand for workers of different occupations changed during transition. Traditional industries declined or disappeared altogether, whereas previously small industries and completely new ones were flourishing, thus requiring a large share of the workforce to change occupations if they were to find a job. In Estonia, for instance, it is estimated that between 35 and 50 percent of the employed individuals changed their occupations in the first five years of the transition period (Campos and Dabušinkas, 2003). In accordance with the structural changes described above, it was occupational groups such as plant and machine operators, clerks, professionals and craft and related trade workers that contracted in Estonia, whereas that those in service industries increased. Also consistent with the expansion of the service sector, Newell (2001) shows that in European transition economies there was an increase in the employment of non-manual workers, especially in managerial, professional and technical occupations.

The reallocation of employment between industries in European transition economies was coupled, and partially driven, by the contraction and/or privatisation of (formerly) state-owned enterprises and the creation of new jobs mainly in the emerging private sector (e.g. Boeri and Terrell, 2002). The reallocation of employment to the private sector and the abolition of the wage grids meant that the price of labour would be allowed to reflect labour market conditions and worker productivity. Accordingly, the market valuation of different types of skills replaced the distortions of wages and incentives enforced by the previous system (Magda et al., 2011), namely the undervaluation of highly-skilled labour and the overvaluation employees working in the manufacturing sector. Consistent with a decompression of wages, empirical evidence documents a rise in the returns to education throughout ex-communist European economies during the process of transition, as explained earlier in this section. The increase in returns to education have been argued to be at least partly driven by the expansion of skill-intensive services such as finance, insurance, real estate, tourism, consulting and information services (Orazam and Vodopivec, 1997). Consistent with this view, there was a rise of relative wages in the service sector and a fall of those in agriculture and production sectors (Newell, 2001).

However, studies of individual earnings appear to provide valuable information on more than merely changes in the labour market due to wage decompression and rising demand for skilled labour. Many of these studies tend to find that returns to education during the transition period depend on the type of education: whilst rates of return to general education, both tertiary and secondary, are found to have increased, those to vocational/technical secondary education were found to have either decreased or remained the same compared to the communist period (Flanagan, 1998; Chase, 1998; Campos and Jollife, 2007). Whilst previous wage decompression and the rising demand for skilled labour can explain the rising education premium for tertiary- and general secondary- education, it does not explain the apparent differences between the labour market outcomes of vocational and general secondary education graduates during transition. These differences appear to be consistent with the differences in the type of skills imparted by general vs. vocational education, discussed in the previous section. Namely, it appears that the skills imparted by general education equipped workers to respond (more easily) to changes in the labour market, whereas the occupation- and/or technology-specific skills imparted by vocational education frequently became obsolete with the technological and/or structural changes in these economies. Accordingly, many studies have argued that the specificity of skills of the labour force played a significant role in the manifestation of skill-shortages, low worker adaptability and high levels of (long-term) unemployment in European transition economies (Flanagan, 1998; Boeri, 2000; Rutkowski et al., 2005; Rutkowski, 2007; Commander and Kollo, 2008).

With the above arguments as a starting point, Lamo et al. (2010) investigate the effect of skill specificity on labour mobility in two European transition economies, Estonia and Poland. These economies went through major reallocation shocks at the same time, but Poland's education system was characterised by a much greater emphasis on vocational secondary education during the communist period. The empirical investigation in Lamo et al. suggests that, in both countries, holding a general degree is associated with better labour market outcomes during the transition period: individuals with vocational degrees suffered from longer unemployment spells. Similarly, older individuals holding such degrees were more likely to leave the labour force through early retirement schemes, indicating that the labour market offered relatively more/better opportunities for general secondary education graduates. Further, Lamo et al. develop a theoretical model to analyse the effect of initial education skill-specificity on labour market adjustments when sectoral demand shifts require the reallocation of workers across firms and industries. According to their model, over-specialisation has led to much higher and persistent unemployment in Poland compared to Estonia. Furthermore, the effect of skill-specificity on unemployment is higher compared to labour market institutions such as wage rigidity and employment protection. The conclusion of this analysis, thus, appears to strongly support the hypothesis that the emphasis on specific skills developed through vocational education represented an obstacle to labour mobility in early transition where labour market flexibility was especially important due to the rapid technical and structural changes in the economy.

A potential problem with the empirical evidence above could be that individuals might self-select into different types of education, in which case the labour market outcomes would reflect their personal characteristics (e.g. innate intelligence or social status) and not necessarily their educational experience. However, considering that in the communist system the structure of incentives was such that students were encouraged to select vocational curricula and employees with vocational education were overvalued in the labour market, Lamo et al. (2010) argue that self-selection is unlikely to significantly affect the results of these labour market studies. On the contrary, they argue, if there would be any self-selection, it would be that more rather than less-able individuals would choose vocational education. Based on this it is argued that the relatively lower returns to vocational education are due to the specificity of skills this type of education imparts which in turn limits the mobility of workers across occupations.

However, the problem of labour (im)mobility in European transition economies cannot be attributed exclusively to skill-specificity. Other characteristics of their labour markets and education system characteristics as well as cultural factors inherited from the communist system, discussed in the previous section, are also likely to have inhibited mobility of labour during the transition period. The certification received from formal education essentially secured an individual a job in the occupation he/she was qualified for. Then individuals typically stayed in the occupations they were qualified for through this initial education, often without even changing their workplace, and thus they were not accustomed to changing jobs or occupations. Similarly, having worked in the same jobs throughout their careers, moreover in an environment where technical change was slow, workers did not have to, and were not used to, learning new skills after having completed initial education. These factors, along with a high incidence of skill-specificity, have also been argued to have to have slowed down the process of labour market adjustment in European transition economies (e.g. Filer et al., 2001).

Another factor restricting labour mobility has been argued to be lack of training which would provide individuals new skills and prepare them to perform the new jobs being created (in the newly emerging industries). During the previous system lifelong learning virtually did not exist, largely because it was unnecessary since workers did not change jobs and technical change was not frequent. The legacy appears to continue as even the most advanced European transition economies which are now EU members, with the exception of Slovenia, lag far behind the rest of EU in this respect. Rutkowski (2007), for instance, point out that the percentage of adults participating in some form of education and training in the best-performing countries in the EU is 25 percent, which is five times higher than that in the transition economies which have joined the EU in 2004 and 2007.

Finally, there are other characteristics of communist labour markets in addition to the level of skills and occupational mobility which may affect the attractiveness of their workforce to foreign investors. In the communist system employment was considered a guaranteed right and accordingly a zero unemployment rate was sought. Seeking to guarantee the right to have a job, it was common for enterprises which were state-owned to employ more employees than needed (Boeri and Garonna, 1993); indefinite contracts were normally offered, regardless of employee- or firm-performance (Rashid et al., 2005; Munich et al., 2005). The almost complete job security provided by the state meant that workers did not have incentives to provide effort at work in order to keep their jobs. Similarly, there were no performance-related wage- or other- incentives which would motivate workers to work harder or to further develop their skills after initial schooling. These employment arrangements are exactly the opposite of those expected to increase labour productivity. In addition, the desire to keep wage differentials between individuals low despite differences in their qualification has been argued to be another factor which kept employee productivity low (e.g. Commander and Kollo, 2008). The (lack of) work ethics and culture promoted in this system is unlikely to have changed instantaneously once labour markets were liberalised, especially if workers on average had already spent a large part of their career under the communist system.

Considering the apparent deficiencies of the workforce in transition economies, in terms of both (mix of) skills and cultural factors, it is not surprising to see that firms operating in these economies tend to report skill shortages and increasingly saw inadequate workforce skills as a key obstacle to doing business. The Business Environment and Enterprise Survey (BEEPS, 2005) conducted in the economies covered in this research suggests that filling vacancies for skilled workers is time consuming. Table 1.8 below summarises the number of weeks it took the surveyed firms in BEEPS (2005) to fill a vacancy for skilled worker, averaged across the economy. As in every other indicator analysed in this chapter, the data reveals disparities across European transition economies. The countries with the highest skill shortages, where it took a firm over a month to hire a skilled worker, are Slovakia, Croatia and the three Baltic economies, Latvia, Estonia and Lithuania.

Table 1.8: Time required to fill a vacancy for a skilled worker, 2005

Country	Number of weeks*
Slovakia	6.1
Latvia	5.6
Estonia	5.4
Croatia	4.7
Lithuania	4.4
Slovenia	3.5
Hungary	3.4
Czech R	3.2
Albania	3.0
Serbia and Montenegro	2.8
Macedonia	2.5
Poland	2.4
Bulgaria	2.4
Romania	2.4
Bosnia and Herzegovina	1.9

Source: Own calculations based on BEEPS (2005)

*Averages of the figures reported by firms across the country

However, it should be noted that these figures are not strictly comparable across countries because they may reflect different labour market conditions. These figures are expected to depend on the number of available skilled workers in the economy, especially those that are not currently employed. On the other hand, they also reflect the demand for skilled workers, which, in turn, depends (partly) on the structure of the economy, and particularly on the technological level and the added value in activities/stage of production carried out. Therefore, it may not be surprising that counter-intuitive positive (though low) correlations were found between the length of time it takes to fill a vacancy and the percentage of population who have completed secondary/tertiary education in a country.

Rutkowski et al. (2007, pp. 20-26) summarise further evidence suggesting labour and skill shortages in European transition economies during the previous decade in terms of growing vacancy rates, particularly in construction and manufacturing and increasing dissatisfaction with the level of workforce skills. Rutkowski et al. argue that these difficulties arise largely as a result of skill mismatches, rather than mere labour shortages. They show that in virtually all transition economies that have joined the EU there are high levels of "excess supply" of unskilled workers who cannot fill the emerging vacancies because they do not possess the required skills.

Further, Rutkowski et al. document increases in unit labour costs, i.e. increases in labour costs exceeding the increases in labour productivity in some of these economies, which they argue are a result of pressures on wages caused by skill shortages.

Taken together, the evidence presented in this section challenges the conventional argument that European transition economies should expect to attract FDI primarily through lower of labour costs. This argument seems over-simplistic for two main reasons. Firstly, any advantages that these economies may have with regard to labour costs are expected to wither, especially if the skill shortages they face are not overcome. Secondly, this section and the previous one have shown that most of these economies are not doing enough to overcome the skill shortages/mismatches by providing high-quality initial education and further training. Moreover, whereas skill formation can be affected by public policy or private sector investment, the cultural factors which cause the workforce in these economies to have lower productivity compared to other economies with longer market economy experience are likely to be highly prone to inertia and may take more time to change. Namely, it could be argued that the behavioural traits and/or (lack of) work culture and labour mobility promoted in the communist education systems and labour markets can only be significantly diluted as new cohorts who have been raised/educated after the fall of this system enter the labour market. Therefore, it is argued here that the age structure of the workforce may be another relevant labour-related factor affecting foreign investment in European transition economies.

Table 1.9 below presents data on the share of working age population that has been educated in a post-communist system from age 14 or younger, the share of the labour force aged 30 years or younger in 2008. In this respect, Albania appears to stand out with half of its working age population younger than 30, which is considerable higher than the rest of the sample where it ranges from 28 to 37 percent, with an (unweighted) average of 33 percent.

Table 1.9: Working age population educated after the fall of communism (%), 2008

Country	Working age population aged 16-30 (%)
Albania	51
Estonia	37
Latvia	36
Lithuania	36
Bosnia and Herzegovina	35
Macedonia, FYR	35
Poland	34
Romania	34
Slovak Republic	33
Bulgaria	31
Croatia	30
Hungary	29
Czech Republic	28
Slovenia	28

Source: Own calculations based on World Development Indicators (WDI, 2001)
*Figures refer to the share of population aged 0-14 at the outset of transition (year 1992) in the total working age population in 2008

In conclusion, this section has argued that in addition to conventional measures of the level of educational attainment of the workforce and labour costs, there are additional dimensions of post-communist economies which can significantly affect the level of (labour) productivity that foreign investors can achieve in these economies and which should be taken into account in empirical investigations of FDI determinants.

1.5 Conclusion

The first part of this chapter has provided arguments in favour of the importance of attracting inwards FDI from the perspective of the host economies, in general, and European transition economies, in particular. First, it was argued that its contribution is likely to extend far beyond the improvement of host countries' external financial positions and capital accumulation. ***Primarily due to its association with the transfer of technology and know-how, FDI was argued to potentially affect productivity growth in the host country in many ways, directly and through spillover effects***. For instance, inwards FDI was argued to be able to increase firm productivity and export competitiveness, develop labour force skills, and improve a country's position in the global value chain. Further, ***it was argued that in the ex-***

communist European economies, in particular, the potential for the benefits of FDI is even greater due to the specific context of transition with, among others, inherited structural distortions, obsolete human and physical capital, insufficient domestic savings to fund investment and lack of "market behaviour" experience. This chapter has also provided a statistical overview of FDI flows and stocks during the transition period. This appears to suggest that, ***overall, European transition economies have been relatively successful at attracting FDI over the last two decades. However, the distribution FDI stocks within in this group of countries is far from even***, even after accounting for the size of their economies/population.

The second part of this chapter has discussed some key aspects of human capital formation and labour markets in European transition economies which may be relevant in foreign investors' decision-making. An initial statistical overview has shown that these economies had similar levels of primary and secondary education attainment to those of developed economies, but they lagged behind at the level of tertiary education. C***ompared to developed economies, human capital formation in these economies was argued to be different in terms of the type of skills it developed***, e.g. through over-emphasising vocational education, but also in terms of the lower quality of education provided, as measured by international tests of cognitive skills. ***However, these economies are not homogeneous in terms of human capital endowments: there appear to be significant differences across European transition economies in both the quantity, and the quality, of human capital.*** The differences in human capital, in turn, are likely to affect the attractiveness of host countries' labour markets to foreign investors. This motivates the ***key research question of this thesis: "To what extent can the differences between the volumes of inward FDI across European transition economies be explained by the differences in their human capital quantity and quality of human capital?"***

Further (specific) characteristics of labour markets in European transition economies were argued to affect their attractiveness to foreign investors. In particular, ***it was argued that excessive job security, wage compression and lack of performance-related incentives kept employee motivation and productivity low during communism, and this (lack of) work culture could be difficult to change quickly. As a result,*** indicators of labour costs are likely to be particularly imperfect for conveying information on the relative attractiveness of a country's labour market in the context of transition, whilst other indicators related to ***the age structure of the population may become especially relevant***. Finally, it was argued that these context-specific characteristics of European transition economies' labour force should be taken into consideration when investigating the relationship between human capital and FDI in these countries. The potential relationship between these characteristics and foreign investment, as well as their implications for the measuring human capital are discussed further in Chapter 4, after providing a theoretical framework to link human capital to inwards FDI and a meta-regression of studies that empirically investigate this relationship in Chapters 2 and 3, respectively.

Chapter 2

DETERMINANTS OF FDI AND HUMAN CAPITAL: THEORY

Contents

2.1 Introduction

Having provided in Chapter 1 an introduction to the nature of FDI and its potential benefits for the host country, this chapter aims to provide a critical appraisal of the theoretical literature on FDI and the underlying theory of the FDI-human capital relationship. There is a vast and diverse literature which comprehensively analyses FDI from different perspectives; however, there appear to be very few studies that recognise the different conceptual and theoretical approaches or try to reconcile these with the approach they take. Similarly, there appear to be no inclusive reviews which present, classify, discuss and appraise the merits of different approaches or attempt to bring them together[5]. Whilst it is beyond the scope of this thesis to provide an exhaustive and comprehensive review of all the different approaches, this chapter aims to partly fill this gap in the literature by providing a brief, but concise, critical review of the main arguments and models associated with the major approaches to FDI in economic theory. This review of theory will be used to identify the potential determinants of inwards FDI and thus inform the specification of the models for the empirical analyses of this thesis.

Another major gap in FDI theory is the relatively rare inclusion of the host country's human capital as a relevant factor in the decisions of foreign investors. Even when human capital is present in an FDI study, it is not accompanied by an explicit theoretical framework within which its relationship with FDI is addressed. This chapter aims to fill this gap by explicitly discussing mechanisms through which a host country's human capital can affect inward FDI based on human capital theory and contemporary growth theories. Inferences from this theoretical framework, together with the results of a meta-regression analysis which is presented in the next chapter, will inform the choice of human capital measures for the later empirical analysis. Finally, this chapter will discuss the possibility of reverse causation: the effect that FDI can have on human capital development in the host economy.

The rest of this chapter is organised as follows. Section 2.2 reviews the different approaches to FDI in economic theory and identifies and discusses the instances

[5] Faeth (2009) represents a partial exception because it classifies and examines a large number of theories, though not all approaches are included (e.g. game theoretic approach and agglomeration economies). Dunning's OLI paradigm and review of literature (Dunning, 1988; Dunning and Lundan, 2008) also represents another partial exception because it brings together a number of different theories, but again not all of the major approaches are included.

where human capital is, implicitly or explicitly, referred to. Early FDI theories, both neo-classical and market failure-based, are discussed in sub-section 2.2.1; the OLI paradigm and new trade theory models are discussed in sub-sections 2.2.2 and 2.2.3, respectively, while other recent approaches such as that of game theory, policy competition and agglomeration economies are discussed in sub-section 2.2.4. Section 2.3 discusses the relationship between a host country's human capital and inward FDI. Sub-section 2.3.1 draws on a comprehensive analysis of the growth-effects of human capital in economic growth theory to provide arguments as to why human capital should be expected to attract inward FDI. The potential reverse causation in this relationship, i.e. the effects of foreign investors on the development of human capital in the host country, is discussed in Section 2.3.2 and the findings of the chapter are summarised in Section 2.4.

2.2 Theories of foreign direct investment

2.2.1 Early FDI theories

2.2.1.1 The neoclassical approach

Prior to the 1960s, capital transfers between countries were explained using the theory of portfolio capital movements, according to which international capital flows are driven by differences in interest rates across countries (Nurkse, 1933; Ohlin, 1933; Iversen, 1935). Similar neoclassical models which share the limitations of portfolio capital movement theory were developed in the 1960's by Heckscher-Ohlin, MacDougall-Kemp and Aliber. The Heckscher-Ohlin (H-O) model of trade theory explains FDI in a comparative advantage framework. At it is simplest form, this general equilibrium model involves two countries, two factors of production (labour and capital) and two goods. The model is based on some key underlying assumptions: perfect competition, absence of transaction costs, homogeneity and differing factor intensities of the two goods and factor endowments of the two countries, leading to differing factor prices. According to this model, under an assumption of factor immobility, countries will specialise in the production of commodities which are intensive in factors they are comparatively well endowed with and export them in return for commodities which are intensive in factors they are comparatively poorly endowed with, hence leading to price equalisation. Thus, under factor immobility, this model predicts that comparatively capital-abundant countries will export capital-intensive commodities. If, on the other hand, this assumption is replaced by that of capital mobility, then capital will move to capital-scarce countries where returns to capital are higher until the price of capital is equalised across countries. Hence, the H-O model, like portfolio capital movement theory predicts that capital will respond to interest rate differentials. This outcome is, in essence, shared by the MacDougall-Kemp model (MacDougall, 1960; Kemp, 1964) and Aliber's (1970) exchange rate theory, which represent extensions of the neoclassical approach to FDI. The first model introduces the possibility of host countries manipulating returns to capital, and hence cross-border capital movements, by introducing taxes. The second model introduces failures in exchange rate markets which allows firms from countries with strong currencies to raise capital more cheaply than their counterparts from countries with weak currencies, hence enabling them to finance foreign activities more cheaply.

Trying to explain the failure of the neoclassical approach to explain the small FDI flows to labour-abundant developing countries, Lucas (1990) provides another extension of this approach which includes human capital and political risk as further determinants of FDI. In this model, Lucas replaces labour with 'effective labour', i.e., labour adjusted for human capital differences across countries, to show that rate of return differentials across countries almost disappear once these differences are accounted for. Although Lucas does not model FDI flows directly, it represents one of the few examples in theoretical discussions of FDI that points out the importance of human capital and explicitly identifies labour productivity as the mechanism for its influence on FDI. The other determinant of capital flows into developing countries that Lucas introduces, 'political risk', is presented as a form of capital market imperfection which may cause the absence of capital flows predicted by neoclassical theory. If capital flows are viewed as borrowings (FDI), with capital flowing from the developed (capital-abundant) to the developing (capital-scarce) countries in the first period, and then interest payment (repatriated profits) flowing in the reverse direction in the next period, then developing countries can gain by terminating the contract when the repayment period begins. Lucas argues that developed countries will foresee the possibility that developing countries will choose to act in this manner and this will cause them not lend capital (i.e., invest) in the first place.

In summary, the theories discussed above have some common features. They all approach capital flows from a macroeconomic perspective, ignoring the individual firm, and they explain international capital flows in terms of relative factor prices. However, as explained in the previous chapter, FDI differs from portfolio capital flows in two important aspects. When making a foreign investment, multinational enterprises (MNE) are typically expected to retain control of the resources or rights transferred to the subsidiary. Further, unlike mere financial capital flows, FDI typically involves a transfer of a bundle of resources, including technology and managerial know-how. This implies that firms invest in a foreign country expecting to earn an economic rent on this combination of resources, including their organising ability (Hymer, 1976). Moreover, the neoclassical models above are based on strong assumptions which limit their ability to explain FDI in the real world. Assumptions of perfect competition, free and instantaneously transferable technology, constant returns to scale, homogeneity of inputs and absence of transaction costs have been heavily criticised and modified in subsequent theories which are discussed in the rest of this section.

2.2.1.2. Theories of market failure

In contrast to the macro-level neoclassical models discussed above, various theories were developed that put the firm, rather than a country's capital availability, at the centre of the FDI analysis. These theories recognise that markets are not perfect and assert that it is the very existence of market imperfections that induces a firm to engage in multinational production. Hymer (1976) and Kindleberger (1969) argue that in order for firms to engage in FDI, they must possess some kind of advantage specific to their ownership which is sufficient to compensate for the inherent disadvantages they face in competing with domestic firms. Such disadvantages, Faeth (2009) explains, arise due to foreign investors having less information, higher uncertainty and the physical distance from their affiliates and differences in culture, business ethics, the legal system and regulations. Such ownership-specific, non-financial, advantages imply the presence of structural market imperfections such as product differentiation (an imperfection of commodity markets), managerial expertise, new technology or patents (an imperfection of factor markets) or government intervention.

Linking the ownership advantages with factor endowment distribution, Vernon (1966) develops a theory of product cycles which explains FDI as a decision between exporting and investing in foreign production. According to him, the ability of firms to innovate depends on the structure of their country's factor endowments, institutions and markets, giving firms of certain countries advantages relative to others. According to this theory, the innovatory product is initially produced in the home country for both the domestic and foreign markets. However, as the product becomes 'standardised' and consumers' demand becomes more price-elastic, the innovating firms turn to foreign production seeking cost-efficiency by reducing their labour costs.

While the above theories explain what enables a firm to become an MNE, internalisation theory focuses on another key dimension of FDI. Namely, it aims to address the question of why should cross-country value-added activities be organised by hierarchies instead of being left to market forces, i.e., why should a firm own production facilities in a foreign country instead of trading intermediate products through the market. According to Buckley and Casson (1976), there is high risk and uncertainty in intermediate product markets which causes high transaction costs and it is the balance between these and the cost of ownership that determine whether a firm will engage in FDI. The choice ultimately depends on firm-, industry- and country-specific factors. Other reasons for internalising transactions are the appropriability problem that arises as a result of the public good nature of technology (Magee, 1977) and reputation concerns (Hennart 1982, 1991). However, the internalisation approach is limited in its ability to explain the pattern of FDI because it does not take into account locational factors, i.e. why a firm chooses a certain location for its foreign production activities.

In summary, the theories discussed in this sub-section do recognise FDI as a distinct form of capital flows beyond that of mere financial capital. They put the firm at the centre of the analysis and rely on market imperfections that arise in the real world to explain the existence of FDI. Separately, they address different aspects of MNE activity: why some firms become MNEs (the ownership advantages), why they choose to organise cross-country transactions within the firm (internalisation theory) and, to a limited extent, why firms turn to foreign production (product cycle theory).

However, individually, they do not provide a complete framework for analysing all FDI or an agreed basis for estimating equations of its determinants. That is what Dunning (1988) with his OLI paradigm aimed at providing a holistic and general explanation which could more fully address the extent and pattern of FDI.

2.2.2 The OLI paradigm

Dunning's (1980) eclectic paradigm of international production 'envelopes' the explanations of different macroeconomic and industrial organisation theories which are complementary and context specific (Dunning, 2000a). As such, it (at least partially) accepts, and builds on, the different theories of FDI discussed in the previous section. For instance, it accepts that traditional trade theory can explain the production of some types of products (where production and trade can be explained solely by the spatial distribution of factors of production), but that this theory fails to address the ownership of governance of their production activities (Dunning and Lundan, 2008). Production of other products requires resources or capabilities with which not all firms are equally endowed, in which case the factor endowments theory with perfect markets is not applicable. In such cases, Dunning and Lundan (2008) argue, in order for firms to engage in FDI, two types of market failure must be present: a structural market failure which enables firms of a foreign country to have, or gain, an advantage over domestic firms in their home market (termed above as the ownership-specific advantage), and the inherent failure of markets to trade intermediate products at a lower transaction cost compared to a hierarchical organisation (as the internalisation theory asserts). According to Dunning's paradigm, the nature of MNE activities can only be explained if all three elements are brought together. The cross-border characteristic of international production is explained by the ownership (O) advantages of a country's firms and the spatial distribution of resources of the home and host countries (locational advantages - L). However, the ownership of these activities is explained only when the internalisation advantage (I) is brought in, i.e. the firms' (own perception of) superiority in governing the combination of O and L assets compared to market forces and/or the ability to exercise monopoly power over the assets by governing them. Hence the OLI paradigm's main hypothesis is that the level and structure of firm's foreign value-added activities depend on the following conditions being satisfied simultaneously: the extent of the presence of an ownership-specific (O) advantage

(1); the extent to which the firm believes it is in its best interest to internalise (I) the use of its O advantages rather that to sell them or their rights of use to other firms (2); the extent to which the firm believes it is in its best interest to utilise its O advantages in foreign locations, the choice of which, in turn, depends on each country's competitive advantage (3). Finally, provided that the above conditions are satisfied, foreign value-added activities depend on the extent to which the firm believes foreign production is consistent with its stakeholders' long-term objectives (4) (Dunning and Lundan, 2008, pp. 99-100).

In the OLI framework (Dunning and Lundan, 2008), the **ownership advantage** may be asset-specific (Oa) – the ownership of intangible assets such as technology, managerial, marketing and entrepreneurial skills – or (formal or informal) institutional assets (Oi) such as the firms' organisational systems, norms and incentive structures. Alternatively, it may refer to transaction-cost minimising (Ot) advantages which lower transaction costs due to the common governance of asset-specific and complementary assets. These may include advantages such as exclusive or more favourable access to inputs or product markets which arise in established firms (as opposed to their *de novo* counterparts), or in terms of the ability of MNEs (as opposed to other firms) to diversify risk and make use of the international distribution of resources. Ownership advantages are affected by the cultural, legal and institutional environment in the firms' home country.

Location-specific advantages within the OLI framework (Dunning and Lundan, 2008) are very diverse and affect both home and host countries. They are related to the spatial distribution of natural and created resources and the cost, quality and productivity of inputs (including labour).[6] Further, they are related to the size of markets, communication and trade costs related to transportation, and artificial barriers to trade. The legal and regulatory framework, economic system, government policies, and investment incentives and disincentives can also affect the country of both source and destination of FDI, as can the cross-country differences with regard to language, culture, business ethics and politics. Finally, the destination of FDI may

[6] The quality and productivity of labour appears to implicitly refer also to a high level of human capital. However, it may also refer simply to quality and productivity of labour in economic activities that do not necessarily require highly-skilled labour. Namely, it may refer to lower levels or skill or simply a sort of "physical productive capacity" which is in line with some of the empirical literature on FDI (discussed in Chapter 4) which uses health indicators as measures of human capital.

be affected by agglomeration economies and spillovers, as well as by the infrastructural provisions in the host country (including that of education).

Internalisation advantages in the OLI paradigm arise either as a means of avoiding transaction costs that arise due to market failure or for exploiting market failure. Through internalisation, firms are able to avoid search, negotiation and contract enforcement costs; they are more easily able to control the quality of intermediate and final products and supplies of inputs. Alternatively, they can engage in (anti)competitive activities such as transfer pricing, cross-subsidisation and tax liability minimisation.

In conclusion, the value that the OLI paradigm adds to FDI theories is the argument that it is not the presence of an advantage *per se*, but *combination(s)* with other advantages that determine FDI flows. For instance, it argues that it is not the just the possession of managerial experience or technology, but the also the gains from internalising their use which gives a firm an advantage over its domestic competitors (in the foreign country). Hence, the unique argument of the OLI paradigm is that the value of the combination of the OLI variables as a whole exceeds that of the sum of its parts (Dunning, 2001).

Building on previous work by Behrman (1972), Dunning and Lundan (2008) distinguish between four types of FDI according to the investors' motives: market seeking, efficiency seeking, natural resource seeking, and strategic asset or capability seeking. [7] Market-seeking FDI refers to investments that are made for the purpose of supplying the market of the destination country or those of countries adjacent to it. Efficiency-seeking FDI refers to rationalisation of FDI in a way that allows firms to benefit from geographically dispersed activities due to factor-endowment differences or economies of scale and scope. Interestingly, Dunning and Lundan includes the availability and, by implication, cost of highly-motivated unskilled and semi-skilled labour in their third category of 'natural resource-seeking'. Like most FDI literature, they make no reference here to the importance of labour skills or productivity related

[7] Even though Dunning and Lundan (2008) term this category as *natural resource* seeking originally this is not restricted to natural (or 'physical') resources and therefore it is referred to in this discussion as resource seeking.

to skills[8], implicitly assuming these to be irrelevant and restricting the focus only to labour costs. Labour skills are only identified in the next category, strategic asset-seeking FDI. This type of FDI refers to investment that is undertaken for the purpose of protecting or advancing the firm's long-term competitiveness, e.g. through mergers to gain strength over competitors or acquiring its suppliers. The motivation for this type of FDI, according to Dunning and Lundan (2008, p. 69) is "...to acquire technological capability, management or marketing expertise and organisational skills" (Dunning and Lundan, 2008, p.69). This is the only instance where skilled labour appears as a determinant of FDI in Dunning's paradigm; however, this argument is too limited because it appears to apply exclusively to inwards FDI in technologically-advanced, countries and exclusively to the facilitation of innovation. However, in this thesis it is argued that, theoretically, human capital is also likely to be a relevant factor in foreign investors' decisions through other mechanisms and this should apply across countries, types of FDI and sectors of economic activity (even though the level of relevance may vary).

2.2.3 New trade theory

New trade theory provides an alternative framework for analysing FDI, integrating OLI's firm-based approach into general equilibrium models. This industrial organisation approach to trade theory introduces features of product differentiation, imperfect competition and economies of scale. Within the new trade theory, two strands of models have been developed: models of vertical firms, which combine the OLI approach with the factor endowments theory, and models of horizontal firms, which combine this approach with proximity and concentration advantages. These two strands of previously mutually exclusive models have been recently integrated into the knowledge-capital (KK) model. The following sub-sections discuss the vertical, horizontal and KK model, respectively.

2.2.3.1 Vertical models

Helpman (1984) attempts to explain international trade using a general equilibrium model where firms' decisions to become multinational play a central role. Helpman's model integrates features such as economies of scale, product differentiation and monopolistic competition into traditional factor endowment theory to examine the

[8] Note that the characterisation of labour force as 'highly-motivated' implicitly relates to its productivity, but not to its level of skills.

location choices of MNEs' production. Firms are assumed to have an ownership advantage in terms of management, marketing and/or R&D, a firm-specific input which Helpman terms as 'general purpose input' (H), the use of which is assumed to be internalised by the firm. Differentiated products are produced using labour and the H factor, both of which are immobile across countries, but the latter is assumed to be able to serve production activities without being located in the production plant. The optimal factor-proportions (and prices) differ between countries and, provided that the differences are so high that prices cannot be equalised by trade of goods, firms producing differentiated products will wish to geographically fragment their production. The country with relatively higher endowments of H will be the firms' choice for the parent country, hosting headquarters and their activities, while the other one will host the production plant. The presence of economies of scale in production, an assumption of this model, induces firms to have a single production plant. In addition, trade costs and tariffs are assumed to be zero in this model, leaving no further motivation to have plants in other countries, therefore excluding the possibility of horizontal MNEs which are discussed in the next sub-section. This type of model implies that skilled-labour intensive headquarter activities will be carried out in the parent country, while production activities will be located in unskilled-labour intensive countries. However, as Zhang and Markusen (1999) point out, this prediction does not match FDI patterns in practice as the most (unskilled) labour abundant countries receive very little FDI. Like Lucas (1990), Zhang and Markusen turn to the (un)skilled workforce to explain the failure of theory to predict FDI flows. They posit that, notwithstanding that unskilled-labour intensive activities are undertaken abroad, foreign investors still have direct requirements for skilled workers in the host country in terms of engineers, technicians and managers, as well as indirect requirements in terms of infrastructure and legal institutions. Focusing on the direct requirements, Zhang and Markusen's model predicts that as the differences in skilled-labour endowments between the parent and host country increase, i.e. the latter become sufficiently skilled-labour scarce, inward FDI will fall to zero. While this model, unlike the majority of FDI theories, does point out the requirements of foreign investors for human capital explicitly, it does not go further to address the rationale as to why human capital is relevant; it appears implicitly. It appears that Zhang and Markusen are referring to human capital's productivity-enhancing effects and possibly to adoption and/or adaption of technology (discussed in the next section), since they point out the importance of engineers in particular.

2.2.3.2 Horizontal models

The horizontal models strand is relatively more developed, perhaps because this type of FDI, which seeks to supply foreign markets, is more prevalent in practice (Markusen, 1995, 2002). Unlike the vertical models of FDI discussed above, horizontal models are typically based on one of the following assumptions: the use of only one factor of production, symmetric factor endowments across countries, therefore excluding the motivation for splitting different stages of production activity. On the other hand, they recognise the existence of trade costs and tariffs, hence the motivation for foreign production as a means of avoiding these costs or gaining access to markets which can only be served locally. Similar to vertical models, Markusen's (1984) horizontal model incorporates knowledge-based ownership advantages due to R&D, marketing, scientific and technical workers, product differentiation and product newness and complexity. These knowledge-based assets have two features which facilitate FDI: they can be transferred more easily between production plants and they often are of a joint-input nature because they can be used in multiple production plants without diminishing in value. The joint-input nature of knowledge capital gives rise to firm-level economies of scale because, like a public good, it can be supplied to additional plants at a very low cost. Under these circumstances, MNEs arise because they are more cost-efficient, i.e. a multi-plant firm, compared to individual single-plant firms, has to make only one investment in knowledge capital.

Extensions of Markusen (1984) include Horstmann and Markusen (1987) and Markusen and Venables (1998, 2000). Horstmann and Markusen (1987) further develop a model where, as in the original one, there are assumed to be trade costs and tariffs and firm-level economies of scale (due to knowledge capital) which provide motivation to have multiple production plants. On the other hand, there are also assumed to be plant-level economies of scale which provide motivation for producing only domestically and exporting goods to foreign markets. The existence of MNEs then depends on the trade-off between the advantages of directly accessing foreign markets and those of scale economies in production, hence the term proximity-concentration hypothesis. The model predicts that, in equilibrium, MNEs will arise in industries where transportation costs, tariffs and firm-specific fixed costs representing knowledge capital are high relative to plant-level fixed costs. Markusen and Venables (1998, 2000) extend the general equilibrium models to explicitly consider the lack of symmetry in country size and factor endowments. Their models predict that that the importance of MNEs relative to trade increases as countries become more similar in size and relative factor endowments.

2.2.3.3 Knowledge-capital (KK) models

Integrating the horizontal and vertical models above, Markusen et al. (1997) develop the knowledge-capital (KK) model which simultaneously incorporates features of both models, therefore permitting both types of MNEs to arise endogenously. In particular, the assumptions of trade costs and differences in factor intensities are combined, providing motivation for both horizontal and vertical FDI. The KK model, like the vertical model, assumes that knowledge-based activities can contribute to production activities without being at the same location. Like the horizontal model, it assumes that these activities can be applied simultaneously in multiple production plants (at low marginal cost). In the KK model with two countries, two factors (skilled and unskilled labour) and two goods (one homogeneous with constant returns to scale and one with firm- and plant-level economies of scale), predictions about MNE activity vary with parameter values. Horizontal MNEs dominate when transportation costs are high and the host and destination countries are similar in size and relative endowments. Intuitively, if market size differs, the bigger market is favoured and, if factor endowments differ, vertical fragmentation is favoured unless transportation costs are high.

2.2.4 Other approaches

2.2.4.1 Policy competition models

This approach to FDI addresses the incentives that governments provide to attract FDI. The location choice of MNEs in these models depends on various factors that can be affected by government policy such as wages, taxes, subsidies and labour market flexibility. These models suggest that firms choose a location based on a combination of wages and level of taxes (Black and Hoyt, 1989; Haaparanta, 1996). However, Haufler and Wooton's (1999) model predicts that fiscal incentives are typically relatively less important than market size and therefore small countries find it hard to attract FDI even with lower taxes. According to Haaland and Wooton

(1999), firms gain from agglomeration effects and hence government subsidies should have the role of attracting the first investor which is needed in order to create a modern sector, i.e. to introduce a new, more technologically advanced, sector in the domestic economy. In Haaland and Wooton (2001a) there is a trade-off between initial subsidies and labour market flexibility, but, according to their model, only the latter has long-term effects on inward FDI. Another variable which is predicted to be relevant in this approach is the unemployment level; locations with flexible labour markets and high unemployment (and therefore low opportunity cost of employment) attract FDI (Haaland and Wooton, 2001b). It appears that the term 'labour' in this model refers to unskilled labour because high unemployment in a country does not necessarily lower the price of skilled labour: the latter is more likely to depend on the unemployment rate of skilled labour, a distinction which this model, like most FDI literature, does not consider.

2.2.4.2 Game theory

The game theoretic approach (Jacquemin, 1989; Veugelers, 1995; Graham, 1998) explains the decision to engage, or not, in FDI as a firm's (perceived) optimal move based on the action, or likely response, of other 'players'. Like Hymer (1976) and other market-failure theories, this approach argues that MNEs arise in markets with concentrated power. In such markets, the actions of one firm affect the market price and the actions of other firms. Graham (1998) develops a model which addresses FDI decisions in a world with two countries and two firms, each of them a monopolist in their home market, to show that the presence of a cost-advantage (or O-advantage in Dunning's paradigm) is neither a necessary nor a sufficient condition to explain FDI. When each of these firms enters the other's market, it causes the incumbent firm to lose a share of its monopoly profits. In this setting, a firm may enter the foreign market even though it may not have the cost-advantage: this becomes the best response to the entrance of the foreign firm in its own market, causing a reduction of its monopoly profits. The foreign firm, on the other hand, takes this likely response into account when making the decision to enter the market initially, and may decide not to enter the foreign market despite its cost-advantage, weighting the profits gained in that market against the profits lost in their domestic market due to the other firms 'punishment'. This approach, however, appears to deal with horizontal FDI which aims to supply the foreign market, and it is not clear to what extent it applies to vertical FDI which does not necessarily involve entrance into a market as a seller.

2.2.4.3 Agglomeration economies

Based on the 'new economic geography' approach (Krugman, 1991) FDI is argued to be prone to 'agglomeration forces', as a result of which FDI in a host country can increase even without any changes in other locational determinants. This self-reinforcing effect can arise if foreign investors cluster in specific locations because they benefit from positive externalities arising from the presence of previous foreign investors, e.g. due to the possibility of technological and knowledge spillover, the presence of a specialised workforce, or linkages to suppliers/customers of specialised intermediate products. Evidence consistent with the presence of agglomeration effects as a locational determinant of FDI has been found, among others, by: Cheng and Kwan (2000), Blattner (2006), Bobonis and Shatz (2006) and Riedl (2010).

In conclusion, the review of FDI theory in this section suggests that human capital is largely ignored in FDI analyses. The theories that do consider human capital do not directly model the relationship between human capital and FDI or explicitly address its theoretical foundation(s) which implicitly mostly appears to stem from the effect of human capital on productivity and/or its ability to affect the incidence and speed of the adoption of new technology. Further, this literature does not elaborate the relevant skills that foreign investors seek in terms of the level and type of human capital and, by implication, the relevant measures of human capital in relation to FDI. As will be seen in Chapter 3, a similar gap in literature is also manifested in the empirical studies which address the role of human capital as a determinant of FDI; in most of the empirical literature the choice of the human capital measure is not even discussed and often appears to be a result of data availability rather than a specific theoretical rationale. This thesis aims to fill these gaps in the current literature by explicitly considering the theoretical rationale for human capital as a determinant of FDI and, based on this and recent developments in growth theory, to derive a model with appropriate measures for empirically testing this relationship in the subsequent chapters.

2.3 Human capital and the attraction of FDI

Although generally insufficiently recognised and inappropriately addressed in FDI theory, human capital has gained a central focus in economic growth literature in the last two decades (Temple, 2001; Sianesi and Van Reenen, 2003; Goldin and Katz, 2008; Jones and Romer, 2010; Breton, 2012; Hanushek and Woessmann, 2011a). The relationship between human capital and economic growth, discussed in the first sub-section below, can inform the analysis of human capital in relation to FDI. However, in the previous chapter it was argued that causation in the human capital-inward FDI relationship can also work in the opposite direction: foreign enterprises can develop the skills of the workforce in the host country. Such feedback effects from FDI to human capital pose a potential problem in the empirical estimations to be undertaken in the subsequent chapters because they may cause the key regressor(s), i.e., human capital variable(s), to be endogenously determined. The second sub-section below explores the possibility of reverse causation by assessing the theoretical arguments and, where available, empirical evidence, linking FDI to human capital development in the host economy.

2.3.1 The role of human capital in economic growth theory

From a theoretical viewpoint, the rationale for human capital being a factor that determines the location of firms' value-added activities can be derived from human capital theory and theories of economic growth. In the former (neoclassical) theory (Schultz, 1961; Becker 1964; Mincer, 1974) human capital is considered a means of production; investment in human capital through schooling, training or work experience enhances the skill level of individuals and hence their productive capacity. Their productive capacity in turn determines their wage level, i.e. returns to schooling. Hence, according to this view, human capital obtained through education translates into productivity and productivity translates into the wage level; in the simplest neoclassical labour market, the observed wages perfectly reflect productivity.

The human capital theory approach was incorporated in theories of growth after the 1980s (e.g. Lucas, 1988; Mankiw et al, 1992). Mankiw et al. (1992), for instance, incorporate human capital into the standard neoclassical growth model developed by

Solow (1956).[9] Instead of assuming a homogeneous labour input, Mankiw et al. distinguish between uneducated and educated labour, the latter being proxied by the share of labour force that has completed secondary education. In line with human capital theory, an increase in educational attainment (assumed to be highly correlated with human capital investment) enhances the productivity of the workforce and hence the level of output produced in the economy. In this augmented Solow model, the *accumulation* of human capital is one of the determinants of the steady-state growth paths of economies. However, despite the impact of human capital on the steady-state level of output, i.e. the height of the steady-state path, its impact on growth rates is only transitional. Once the *growth* of human capital ceases (i.e. the increase in the proportion of the population with secondary education in Mankiw et al., 1992 ceases, which is inevitable), its effect on the growth *rate* of output will cease. Steady-state growth rates in this model, as in the traditional neoclassical ones, are determined by the rate of technological advancement which may take the form of new products, markets and processes. However, despite the crucial role of technological change recognised by neoclassical models, this component is not modelled but rather assumed to be growing constantly at an exogenous rate. New growth theories discussed next go further and attempt to endogenise growth, either by modelling the economic forces underlying technological change, as in Romer (1990), or by allowing long-run growth to be determined by human capital accumulation, as in Lucas (1988).

Lucas's (1988) contribution in endogenous growth theory, like the human capital augmented Solow model above, treats human capital as one of the inputs in the process of production. However unlike Mankiw et al. (1992) who define human capital simply as the proportion of population who have attained a certain level of education, in Lucas' model (part of) human capital is not necessarily tied to individuals. Human capital in this model is acquired by schooling as well as by experience (i.e. 'learning-by-doing') and it does not display diminishing returns to scale, which allows it to become an 'engine of growth'. This feature of the model is obtained by the presence of "inheritance of human capital within families of goods as

[9] In a simple neoclassical growth accounting framework, output is a function of factor inputs: capital and labour which is assumed to be homogeneous (hence human capital is not a relevant factor). The part of growth that cannot be explained by factor accumulation, referred to in the literature as the 'Solow residual', represents the total factor productivity in the economy which in the neoclassical growth theory is assumed to grow exogenously at a constant rate.

well as within families of people" (p. 28). The first is obtained when the skills previously acquired for producing goods is, at least to some extent, useful in learning to produce new ones which are continuously being introduced (even though diminishing returns to acquiring skills for existing goods apply); the second is achieved by applying the technology of acquiring human capital to families rather than individuals, allowing for the initial human capital of new family member to be dependent on that attained by older members of the family, i.e. by allowing for a inter-generational transfer of human capital. An implication of Lucas's model is that human capital accumulation, and thus growth of output, can continue even after that of educational attainment of the current population in the economy ceases. In this model (implicitly at least) the mechanism through which education affects growth is by increasing the productivity of the workforce and it is the change in, rather than. or in addition to, the stock of, human capital that affects growth.

Also with Solow's model as a starting point, Romer (1990) develops an alternative approach to endogenising growth by addressing the economic factors underlying technological progress. In Romer's model technological change arises largely as a result of an intentional search for new 'ideas' on the part of profit-maximising firms or inventors. 'Ideas' refer to the advancement of the technology of production, allowing "...a given bundle of inputs to produce more or better output" (Jones, 1998, p.72); they range from the instructions for designing an engine and the formula for creating a drug to new approaches to retailing (e.g. e-commerce) or human resource management (e.g. paying an efficiency wage). The difference between 'ideas' and 'objects' is central to Romer's model and to the mechanism through which human capital affects growth. Ideas are inherently different from other economic goods because they are non-rivalrous but in this setting they must be only partly excludable, i.e. their use by one firm or person does not preclude or in any way limit their use by others, though the inventor/firm can prevent their use by other firms for the purpose of production.[10] Ideas are intertwined with human capital because they

[10] Because of their non-rivalrous nature, ideas need to be produced only once and thus their producers incur only a fixed cost and no (or trivial) marginal cost. In this case, marginal cost pricing which is a feature of perfect markets would result in negative profits. Hence, ideas must be at least to some extent excludable in order for market incentive to exist for inventors/ inventing firms to develop ideas and for technologic to progress in this model. Partial excludability in Romer (1990) is defined as the inventor/inventing firm having a property right over its use in production but not in future research for the purpose of designing new ideas. In this way, the creators of new ideas can benefit from the stock of the existing ideas in the economy.

are largely developed as a result of research and development (R&D) activities which are human capital intensive in nature. The difference between human capital and ideas is that the former is inherently tied to a physical individual (i.e. 'an object') which makes it rivalrous, while the latter is not[11], and thus can be used by anyone with knowledge of it once it has been created. The non-rivalrous nature of ideas in Romer's model has the implication that they can be accumulated infinitely, regardless of the individuals who invented them. The non-excludability of ideas, on the other hand, has the implication that the stock of ideas is an input in the production of new ideas and in Romer's model it increases the productivity of human capital in their production. These two features allow ideas, and thus human capital, to have a lasting effect on growth rates in the long-run. In this model, like in Lucas's, human capital has a central role in explaining long-term growth rates but the (main) mechanism of its influence is less direct. The crucial role of human capital in this model stems from its intensive use in the creation of knowledge (ideas) which is added to its traditionally recognised role as an enhancer of productivity in the production of the final output. The new mechanism through which growth is affected by human capital also implies that, unlike Lucas's and Mankiw et al.'s models above, Romer's model relates a country's long-term growth rate to the *stock* of human capital rather than *changes* in the stock.

Though the idea of human capital having a central role in the process of economic growth became influential only in the late 1980s, its distinctive nature beyond a simple factor of production was recognised much earlier by Nelson and Phelps (1966). Their approach to human capital is in some respects very similar, and can be considered as complementary, to that of Romer (1990). Both models link human capital, technology and economic growth: Romer focuses on innovations, while Nelson and Phelps focus on the diffusion of frontier technology, both recognising the respective processes to be conditional on the level of human capital and having a crucial role on economic growth. Nelson and Phelps argue that the main role of the human capital[12] is not to provide individuals with the ability to perform current tasks

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[11] In reality ideas are usually tied to physical objects (e.g. a formula is tied to a piece of paper and software is tied to a CD-Rom), but the cost of replicating them is negligible compared to the cost of producing the original so it is reasonable to assume these costs away.

[12] In their original paper, Nelson and Phelps use the term education which is implicitly assumed to be synonymous with human capital. In this research, however, it is recognised that equating educational

more effectively, but to enable them to adapt to change, i.e. to perform, or learn to perform, different tasks. According to them, because education enhances individuals' ability to receive, understand and process information, it prepares workers to adapt to the new technology more quickly, but it also enables managers to better follow, understand, assess and discriminate between new technologies, thus reducing the risk (and increasing likelihood) of introducing new technology earlier rather than waiting to inform their decision on the experience of other firms. For these two reasons, the quantity and quality of human capital is argued to determine the gap between frontier technology and actual technology used in practice at the economy level. Technology, thus, is not transferred instantaneously in this model and it is actual technology, made of both new and old technologies, that determines total factor productivity and thus economic growth. The Nelson-Phelps approach has been subsequently extended to incorporate "domestic" innovation (Benhabib and Spiegel, 2005; Vandenbussche et al., 2006), a threshold level of human capital as a condition for technological catch-up (Benhabib and Spiegel, 2005) and concern with the composition of human capital in terms of skill level and type of education (Vandenbussche et al., 2006 and Krueger and Kumar, 2004, respectively). This approach has also been embedded into a general equilibrium model (Cosar, 2011) in which skilled workers enhance productivity at firm level by adopting new techniques from a growing stock of world knowledge. In the Nelson-Phelps approach, like in Romer (1990), it is the levels of human capital rather than changes in it that are important. Hence, to some extent the approaches of Romer and Nelson and Phelps to human capital can be thought of as variations of the same idea in essence, complementing each other in explaining innovation and technology diffusion within the setting of developed economies, and the diffusion of technology from these to developing economies. Another feature which these two models and that of Lucas share is the presence of externalities which give rise to increasing returns to scale with respect to human capital either because skills are (partly) transferrable to the production of new goods and to the next generation (as in Lucas, 1988), or because innovators and imitators benefit from the existing stock of knowledge (as in Romer, 1990 and Nelson and Phelps, 1966, respectively).

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attainment to human capital attainment is an over-simplification of the relationship between the two, an issue which is to be discussed in Chapter 4.

The consensus which persists in economic growth theory regarding the positive role of human capital in the growth process appears to be largely, though not universally[13], shared by the empirical literature. Despite the difficulties of measuring human capital which are discussed in detail in Chapter 4, the relationship between human capital (typically proxied by quantity of educational attainment) and economic growth has been supported by various empirical analysis, including Barro (1991, 1997), Mankiw et al. (1992), Sala-i-Martin et al. (2004) and Hanushek and Woessmann (2008). As far as the specific approaches discussed above are concerned, attempts have been made to empirically discriminate between the effects of human capital stocks and its accumulation on growth but, as Hanushek and Woessman (2008, p.632) conclude in their review, "it is beyond the scope of current data to draw strong conclusions about the relative importance of different mechanisms". Both hypotheses have received empirical support by various studies. Benhabib and Spiegel (1994, 2005), Hojo (2003), Di Liberto et al. (2011) find support for the effect of stocks of human capital, while Mankiw et al. (1992), Temple and Woessmann (2006), de la Fuente and Domènech (2006), Cohen and Soto (2007) find support for the effect of human capital accumulation on economic growth. However, here it should be noted that, theoretically, there is no reason for these models to be considered as mutually exclusive, which would explain the lack of conclusiveness in their empirical results. Empirically, evidence consistent with the coexistence of both these mechanisms is found by Ciccone and Papaioannou (2005), Sunde and Vischer (2011) and, indirectly, by Hanushek and Woessmann (2009a, 2011a). In accordance with this line of thought, the endogenous growth model of Vandenbussche et al. (2006) which is discussed later in this section recognises the importance of human capital as a determinant of both productivity enhancement and innovation/technology adoption.

Consistent with the original idea of Nelson and Phelps (1966) regarding the importance of human capital to the adoption of new technologies is the skill-biased

[13] The relationship between human capital and growth is not considered as proven by some studies. For instance, Bils and Klenow (2000) argue that the relationship between education and growth could be caused by reverse causation or by omitted factors that are related to both human capital and growth, while Pritchett (2006) argues that cross-country differences that are found in the growth effects of human capital may be due to differences in the institutional environment which induce different types of activities, some of which are productive and some counterproductive from a social perspective.

technical change (SBTC) hypothesis (Machin, 2004). The starting point of this hypothesis is the empirical observation of improvement in employment outcomes for tertiary education graduates since the 1980s in developed economies, despite their increasing numbers. The rising relative wages and employment of skilled workers that have accompanied the continuous increase in their supply appear to be contrary to predictions of a simple supply-demand model. These simultaneous changes in the composition of human capital and labour market outcomes may be explained by a model in which these outcomes are determined by a 'race' between the demand and supply of skilled and unskilled labour (Manning and Manacorda, 1998), in which the relative demand for skilled workers increases more than their relative supply. According to the skill-biased technical change hypothesis, the persistent shift in the demand for skilled workers can be attributed to the new productivity-enhancing technologies that are being introduced into workplaces, which can be operated only by individuals who have the necessary skills (which are implicitly assumed to stem from their education).

Consistent with the skill-complementary nature of technology maintained by this hypothesis, Caselli and Coleman (2006) maintain that countries may choose the technology which is best suited to their relative factor endowments; thus, unskilled-labour abundant countries may choose technologies to take advantage of this factor. Similarly, Acemoglu and Zilibotti (2001) develop a model where, due to the deficiencies in skilled labour, technologically less-advanced countries may choose local technologies rather than the more advanced skill-complementary ones developed in the advanced countries, even when the latter are available. When these arguments are applied to FDI, it follows that host country skills affect not only foreign investors' decisions to invest in a country, but also the level and type of technology that is transferred. Similar arguments have been made previously by de Mello (1997, p. 30) who argues that foreign investors may select technologies to transfer to the recipient countries depending on their specific productive and institutional characteristics. The importance of human capital in determining the choice of technology has also been confirmed by case studies presented in UNCTAD (1999) and Ritchie (2002). Another relevant implication of the skill-biased technical change hypothesis is the increasing importance of skills over time to firms, which has found support in literature (Murnane et al., 1995; Katz and Autor, 1999; Goldin and Katz, 1998, 2008) and may also apply to the influence of human capital on FDI. Accordingly, Miyamoto (2003) argues that global shifts in labour demand towards more highly skilled labour due to the skilled-biased technical change explain, at least partially, the increasing importance of human capital as a FDI determinant indicated by some empirical studies discussed in Chapter 3 of this thesis (e.g. Noorbakhsh et al., 2001).

A final implication of this approach is the importance of the composition of human capital, and tertiary education graduates in particular, for technology adoption which, as previously discussed, is maintained to be directly linked with economic growth. In this respect, the skill-biased technological change hypothesis is consistent with the arguments of (mostly) recent growth models, discussed next, which emphasise the importance of the composition of human capital in terms of levels of education, types of skills and mix of occupations.

Vandenbussche et al. (2006) develop an endogenous growth model in which technological progress depends on both innovation and imitation. Under the (reasonable) assumption that innovation is a relatively more skill-intensive activity compared to technology adoption, this model predicts that returns to high-skilled human capital rise as economies approach the technological frontier and rely more on innovation. In this model, (the share of) high-skilled human capital contributes to total factor productivity growth (TFP) through innovation in advanced countries. In countries farther away from the technological frontier, however, it is (the share of) low-skilled human capital that mainly contributes to TFP growth through the adoption of technologies developed in the advanced countries[14]. The different growth-enhancing effects of different levels of human capital predicted by this model have been empirically supported by Vandenbussche et al. (2006) and Di Liberto et al. (2011) who use tertiary and lower level educational attainment as proxies for high and low skill levels, respectively, and by Soukiazis and Cravo (2008) who use patent ratios and average years of schooling as such proxies. However, Hanushek and Woessmann (2009a, 2011b), investigating the growth-enhancement effects of the

[14] This model is, to some extent, consistent with the argument of Aghion and Howitt (1998) who posit that secondary and tertiary education attainment best reflects the number of potential researchers/developers in the economy and should be expected to be associated with an increase in innovation.

quality of schooling on growth (as measured by international test scores) find evidence that is inconsistent with this view. The effect of the share of students who have achieved basic literacy on economic growth does not vary with the level of development, but the effect of the share of top performers is significantly larger in countries with initial lower levels of output. Hanushek and Woessmann (2009a) argue that basic literacy captures the effect of human capital as predicted by neoclassical theory, while top performance in these tests captures the effect of human capital as predicted by the Nelson-Phelps approach. The findings of Hanushek and Woessmann imply that, contrary to one of the predictions of Vandenbussche et al. (2006), it is high-skilled human capital that is required for technology adoption in less developed economies and accelerates convergence with the advanced economies.

Another view on the composition of human capital and growth points out the relevance of the specific type of skills, both in terms of general vs. specific skills and the mix of occupational skills. Krueger and Kumar (2004), for instance, posit that general skills provided by general education are more suitable for operating new technologies, while specific skills provided by vocational education are more suitable for operating old technologies. They develop a model with endogenous technology adoption by firms which shows that when the rate of technological progress increases, countries with initially similar growth rates can diverge. Countries with conceptual-based education experience higher growth rates compared to those that focus of skill-specific education. Similarly, Goldin and Katz (2008) argue that the focus of the American education system on general skills based on formal education (as opposed to specific on-the-job training) may be a key dimension in explaining the 'exceptionalism' of this education system which they see as a driver of the country's economic success in the twentieth century.

Cosar (2011) points out that it is not appropriate to aggregate human capital when analysing technology adoption. Because not all graduates are equally suitable for this activity, he posits that the share of tertiary graduates in sciences and engineering in the workforce is a more appropriate measure when measuring the capacity for technology adoption in a country. In this line of thought, but focusing on technological improvement instead of adoption, Murphy et al. (1991) argue that the allocation of talent across occupations can influence economic growth. Here it is argued that when able (or 'talented') individuals engage in productive activities, they improve the technology and create positive spillovers as others learn from them, increasing productivity and ultimately output. However, when the able engage in rent-seeking activities[15] which merely redistribute wealth, they improve and expand these activities. As a result, the returns to productive activities decreases, further discouraging talent from entering the latter and ultimately depressing growth. To test these hypotheses, Murphy et al. investigate the growth effects of the share of college enrolments in engineering and law as proxies for productive and rent-seeking activities, respectively, and find evidence consistent with their theory: the share of engineering in total enrolments has a positive effect on growth while that of law enrolments has a negative effect. Finally, recent economic growth research emphasises the quality, rather than just the quantity, of education as a determinant of economic growth. Schoellman (2009), Soto (2010) and Hanushek and Woessmann (2009a,b; 2011) find evidence of a positive relationship between the quality of education and economic growth. Consistent with this, Lavy (2010) finds that the effect of instructional time on the level of cognitive skills (as measured by PISA scores) in much larger in developed economies than in developing economies.

In contrast to the theories discussed above, Acemoglu and Autor (2012) propose a novel approach to explaining 'what human capital does' and how it affects a country's economic growth. In a critique and extension of Goldin and Katz's skill-biased technical change hypothesis, Acemoglu and Autor (2012) argue that the orthodox human capital view underlying this hypothesis, i.e. that human capital increases productivity by augmenting effective units of labour, is an over-simplification. Instead, they propose a task-based approach where it is not the skills of the workers *per se* that produces the higher output, but the application of these to the tasks needed in production. Accordingly, the effect of human capital varies depending on the complexity of tasks that are undertaken. Acemoglu and Autor test the complementarity of skill complexity and human capital using a state-level panel model for the USA in which economic growth is explained by the changes in human capital, as well as the initial level of task complexity (as measured by the share of

[15] Rent-seeking activities, according to Murphy et al. refer to employment in government bureaucracy, army, organised religion and law and financial services.

employees in professional, managerial and technical occupations), and the interaction term between the two. The most notable finding of this investigation is that the effect of the level of human capital, as measured by average years of education, is conditional on the level of complexity of the tasks on use. Perhaps most relevant for this thesis is the finding that the gains from higher levels of schooling, as measured by the growth of average years *tertiary* education attained by the population, are higher in states with a higher level of initial task complexity. The growth of average years of *lower-than-tertiary* education attained, on the other hand, is a positive and significant predictor of economic growth, but its effect is not conditional on the complexity of tasks performed.

A conclusion that follows from the discussion in this section is that there is a strong theoretical framework linking human capital to economic growth through three potential mechanisms, namely: enhancement of workforce productivity, facilitation of innovative activities, and adoption of new technologies in the production process. Returning to the initial focus of this thesis which motivated this discussion, the relationship between human capital and FDI, it is argued here that all these three mechanisms are potentially relevant to foreign investors. The first mechanism, labour productivity, may appear more obvious and has been relatively more recognised by the FDI literature (though more often implicitly than explicitly, as argued in Section 2.2). As discussed in Section 2.2, Hanushek and Woessmann (2009a) find that the share of students achieving basic literacy, which they argue to represent the 'labour productivity' effect, is a significant determinant of growth regardless of a country's level of development. Similarly, Acemoglu and Autor (2012) find that levels of lower-than-secondary educational attainment have a positive effect on growth regardless of the level of skill complexity. Based on these findings of growth studies, it can be argued here that the 'productivity effect' is likely to be important for inwards FDI regardless of the destination country. The second mechanism, facilitation of innovations, is referred to by Dunning and Lundan (2008) in a particular type of resource-seeking FDI which relates to highly skilled-labour in technologically advanced countries, but appears largely irrelevant elsewhere. Indeed, since foreign value-added activities in transition economies are likely to involve later stages in the product life cycle and not be geared towards product innovation, this mechanism becomes relevant only once the idea of formal

R&D activities is replaced with a more inclusive one, e.g. when considering innovations of an organisational and/or marketing nature (Jones, 1998), or process innovations on the factory floor or the introduction of new inputs to production (Cosar, 2011).[16] The third mechanism through which human capital can affect inward FDI is through facilitating adoption of technology developed by the parent firm in the production process of a subsidiary. This mechanism can be argued to be the most important one from the perspective of the host economy because it may affect not only the volume of FDI, but also the level of technology employed by foreign investors (UNCTAD, 1999; Ritchie, 2002).

2.3.2 Potential endogeneity in the relationship between human capital and inward FDI

In Section 1.2 it was argued that one of the potential benefits that it conventionally associated with inward FDI is the development of the workforce skills. The rest of this section provides a critical review of the theoretical arguments and empirical evidence on this issue, seeking to establish whether there is likely to be an endogeneity problem in the empirical analyses of the relationship between human capital and inward FDI which will be presented in the next chapters.

FDI has been argued to develop the skills of the workforce in numerous ways. In the short-term, foreign affiliates tend to provide training for their employees. The evidence available, although scarce, suggests that MNEs perform significant training, and they are more likely to provide training than their domestic counterparts (Ritchie, 2002). The effects on workforce skills can extend beyond the firm's domain, as explained in the previous section, if the MNE trains their suppliers or buyers, or if the staff of the MNE leave the firm and start another business or work for another firm. However, the scope for workforce development by the MNE has been argued to be overestimated considering the share and profile and of workers that are trained and the type and level of skills that they receive in training. Reviewing evidence of MNE training activities in South-East Asia, Ritchie (2002) points out that not all employees receive training and those that are more educated, younger and in management positions tend to receive more training. Moreover, Kapstein (2002) and Ritchie (2002) argue that foreign investors provide higher-level

[16] Though, in the case of FDI, the latter may refer to adaption of technology by a subsidiary.

training only to the relatively more skilled and/or educated employees, whereas less skilled employees are only provided with the skills necessary to carry out the specific processes and operate the specific equipment necessary to perform their jobs. In a similar manner, Slaughter (2002) argues that, like any other private firm, MNEs are more likely to develop skills that are firm-specific rather than general skills such as numeracy, literacy and problem-solving. Taken together, the arguments above seem to suggest that MNEs' training activities do supplement the skills of the workforce in the host country, but they should not be expected to substitute for domestically-provided education and training.

In the short-term foreign investors can affect skill formation indirectly through (voluntarily) supporting local educational institutions (te Velde, 2002), or influencing their curriculum choices and the quality and quantity of the vocational training they provide (Slaughter, 2002). An example of the latter would be the agreement of Costa Rica to expand secondary education in electronics and English in order to secure a large investment on an assembly and testing facility by Intel. However, in cases such as this one it can be argued that FDI has merely served as an incentive to develop (a certain type of) skills and the direction of the relationship is not clear-cut. In this spirit, Michie (2002, p. 369) concludes that "human resources have more often been developed not so much by the MNEs...but rather by the domestic governments themselves as a way of attracting that inward investment. Thus...the causal process has been the enhancement of human capital to attract inward investment".

Over a longer time span, FDI has been argued to increase human capital in the host country by providing more employment opportunities and higher wages for skilled workers, thus providing greater incentives for individuals to acquire skills through education and/or training (Blomström and Kokko, 2003; Eriksson and Pytlikova, 2011; Wang, 2011). Here, te Velde (2002) distinguishes between the 'composition' effect and 'skill-bias' effect that foreign investors can have on the local labour market. The first, according to te Velde, happens if the operations and/or industries that foreign investors engage in are relatively more skill-intensive than those in which domestically-owned firms do. The second effect refers to 'skill-bias' within the firm or the sector, i.e. due to foreign investors possessing relatively more advanced technology (and physical capital) than their domestic competitors, and therefore requiring more skilled workers to adopt these technologies (and operate more advanced equipment).

These arguments are implicitly based on a key underlying assumption of complementarity between skills and (foreign) capital, an assumption which is stated explicitly in what appears to be the only theoretical model linking inward FDI to human capital formation in the host country, developed by Egger et al. (2005). In Egger et al.'s model, FDI inflows represents a key link through which capital market integration affects economic growth in the host country. Similar to the studies above, these authors argue that capital inflows provide individuals with an incentive to acquire higher education by raising the relative marginal productivity, and thus relative wage, of high-skilled to low-skilled labour. Consistent with this, their model predicts that capital market integration leads to higher participation in higher education in the country receiving foreign capital, which in turn promotes economic growth.

The other key assumption for the arguments above is that foreign investors pay employees higher wages than domestic firms, a proposition which appears to be widely documented and accepted in economic research, as discussed in Section 1.2. The reason(s) why relatively higher wages are observed in foreign-owned firms is less clear. This differential may represent a 'foreign premium' *per se* or be due to foreign investors achieving higher labour productivity and/or specific employee-, firm- and industry- characteristics (Fosfuri et al., 2001; Budd et al., 2006; Heyman et al., 2006). However, this appears to be of little importance for the purpose of this analysis because as long as foreign investors provide more employment opportunities for relatively skilled employees and they pay them relatively higher wages, they will provide more incentive for individuals in the host country to invest in human capital.

Empirical evidence on the effect of FDI on human capital development in the host country is scarce. In a panel study of 87 countries in the period 1960-2000, controlling for endogeneity, Egger et al. (2005) find a positive and robust effect of FDI inflows on the educational attainment of the host countries' population as measured by average years of tertiary schooling attained or by the share of population who have completed tertiary education. Similarly, Wang (2011) investigates the effect of inward FDI in different industries on the educational attainment of the population in the USA. The results of this study suggest that there are significant differences in the effects of FDI depending on the industry where investment is undertaken. Namely, Wang finds that FDI in the information industry increases the average years of tertiary education attained, whilst FDI in manufacturing industries has the opposite effect, and that other industries do not have any effect.

The theoretical arguments and empirical evidence above appear to suggest that there is potential for endogeneity due to reverse causation in the relationship between a host country's human capital and the volume of FDI it receives. However, the ways in which FDI may affect human capital development and the time span for these effects to take place is less clear, and the presence of endogeneity is likely to depend on the choice of measures that are ultimately used in the empirical analysis. Therefore, this issue is further discussed in the empirical chapters of this thesis.

2.4 Conclusion

This chapter has provided a critical review of different theories which have been developed to explain FDI. The review has identified a considerable number of potential determinants of inward FDI and it has shown that human capital is not taken into account by most of these theories. Further, the few studies that do recognise human capital do not to provide arguments as to why it may attract FDI. Having found no clear and explicit rationale(s) for a relationship between human capital and inward FDI in FDI theory, the chapter sought to explore these through an analysis of the role of human capital in economic growth theory. Accordingly, three mechanisms through which human capital could affect inward FDI were identified: productivity enhancement, facilitation of technology adoption and facilitation of innovation. Finally, it was argued that there may be reverse causation in this relationship, an issue which should be treated with caution in the empirical analyses conducted in the rest of this research.

The theory discussed in this chapter, however, does not yet provide a suitable theoretical framework for analysing FDI in transition economies. Relevant transition-specific factors that may influence the relationship between human capital and FDI will be discussed in Chapter 4 of this thesis after a review of empirical evidence on the relationship between human capital and FDI in the next chapter.

Chapter 3

THE EFFECT OF HUMAN CAPITAL ON FDI: A META-REGRESSION ANALYSIS

Contents

3.1 Introduction

Having established the importance of FDI in the context of European transition economies in Chapter 1 and the reasons why a country's human capital may be a factor affecting their level FDI inflows in Chapter 2, this chapter analyses previous studies that have estimated the effect of human capital on the FDI. A cursory examination suggests that the empirical literature is unable to provide conclusive results about the effect of a country's quantity and quality of human capital on its ability to attract inward FDI. Though the number of studies which control for human capital in FDI studies is relatively small, these studies provide a wide range of results, sometimes contradictory within studies and inconsistent with the results expected from orthodox economic theory. Further, within this limited number of studies there is a wide variety of samples of countries analysed, model specifications and measures of human capital and FDI used, making it very difficult to come to a conclusion regarding the impact of human capital on FDI. Alternatively it may be that this ambiguity of empirical results stems from the lack of a 'universal relationship' between human capital and FDI across different countries since the attractions of different levels of human capital development may differ between countries with different characteristics and different types of FDI. In this setting, meta-regression analysis (MRA) provides a convenient means of quantitatively analysing and estimating the influence of alternative model specifications and data characteristics that shape these results. It provides a quantitative summary of the results found in different studies, enabling the identification and quantification of a genuine underlying effect, beyond the publication bias that may arise as a result of researchers searching for significant results that are in line with economic theory (Stanley 2005 and 2008). MRA also provides an assessment of the sensitivity of estimated results to different characteristics of the studies (Stanley and Jarrell, 1989). Therefore, this analysis can potentially provide explanations as to why the empirical results appear to be "contradictory or overly varied" (Stanley 2005, p. 132). To date, meta-regression methods do not appear to have been applied in this area of human capital and FDI research.

The rest of this chapter is organised as follows. Section 3.2 provides a critical review of studies that estimate the effect of human capital on FDI. Sub-section 3.2.1 reviews studies that estimate this relationship in mixed samples, whilst Sub-sections 3.2.2, 3.2.3 and 3.2.4 reviews studies that focus on developed, developing, and transition economies, respectively. The several studies focusing on (regional) FDI determinants in China are reviewed in Sub-section 2.5. Section 3 reports on the meta-regression investigation performed on studies of the human capital-FDI relationship. The MRA model and the results of its estimation are presented in sub-sections 3.1 and 3.2, respectively. Section 4 considers the implications of the findings for the empirical analyses undertaken in the following chapters of this thesis.

3.2 The effect of human capital on FDI: A review of literature

In the previous chapter it was argued that the mechanism(s) through which a host countries' human capital is expected to affect inward FDI may differ depending on the foreign investors' motivations for undertaking FDI, which in turn may be related to the host countries' level of development and other characteristics. Seeking to identify any such patterns that may exist, empirical evidence on the relationship between human capital and FDI is analysed separately depending on the country, or sample of countries, that this evidence comes from. Accordingly, evidence from mixed samples of countries is first reviewed, followed by that for developed- and developing- economies. Evidence from transition economies is reviewed separately both because of their special relevance to this research programme and their specific characteristics that extend beyond the level of development, discussed partly in Chapter 1. Finally, evidence from China is reviewed in a separate sub-section, even though this is also a transition economy. This is done for two reasons: first, China differs in many ways from other transition economies (as well as from developed- and developing- economies), and, second, a significant portion of the literature on the human capital-FDI relationship comes from studies of regional FDI in that country. The complete list of identified studies that have estimated the effect of human capital on FDI to date, and a summary of study characteristics and results, is presented in Table 3.1 at the end of this section.

3.2.1 Evidence from mixed country samples

The evidence on the human capital-FDI relationship from studies using mixed samples of countries appears to be far from conclusive. In a cross-section analysis, Kucera (2002) finds a positive effect of both literacy rates, and average years of education in the population aged 15 and over, on (average) net FDI inflows during the period 1993-1999. A similar result is found by Shatz (2003) in a large sample of 109 developing, developed and transition economies. He finds a positive effect of human capital on FDI as measured by the value of sales of MNE affiliates (excluding banking) in the host country. Estimating a Tobit regression using data from 1995, he finds FDI to be positively affected by the average years of education in the population aged 15 and over. The author reports that the same result is found when a similar measure is used, that is the proportions of the population with completed primary, secondary and tertiary education. The average years of schooling in the population is also used by Alfaro et al. (2004) in their study of determinants of total capital inflows (i.e. FDI and portfolio capital) in a similar sample of 47 economies. In this study, cross-section analysis is employed to explain the average of FDI inflows per capita across the period 1970-2000 in terms of the initial level of human capital endowment and averages of other determinants. The average years of schooling in the population is found to have a positive effect on per capita capital inflows, but its level of significance varies in different specifications and turns insignificant when different measures are used for capital flows (e.g. gross capital inflows). It is not clear how the effect of human capital on capital inflows estimated by Alfaro et al. (2004) relates to its effect on just FDI inflows, but considering the long-term commitment that FDI involves compared to portfolio investment, it is reasonable to expect that human capital would be a relatively more important determinant of the former. Another weakness of both this study and Shatz (2003) and Kucera (2002) is their failure to exploit the temporal variation in the data, a weakness that is likely to be especially relevant in the case of human capital, the importance of which as a determinant of FDI is considered to have increased over time (e.g. Noorbakhsh et al., 2001). In this respect, studies that use panel data appear to be superior.

However, the results of panel studies also, do not provide conclusive evidence on the effect of human capital on FDI. Blanton and Blanton (2007) and Alsan et al. (2006) both find that FDI inflows were not significantly affected by human capital in the 1980s and 1990s, as measured by (female) enrolment rate in secondary education and the percentage of population who have completed secondary schooling, respectively. In a slightly more recent period, Chousa et al. (2008) do find a significant effect of literacy rates on FDI flows into 17 developed and developing economies in South-East Asia, as does Al-Sadig (2009) for a larger sample of 117 of developed, developing and transition economies. Similarly, in an industry-level dynamic panel analysis covering nearly the same period (1995-2004), Bellak et al. (2009) find FDI flows in 10 developed and transition economies to be positively affected by human capital, here measured as the share of (medium and high) skilled hours worked in total hours worked in each industry. Finally, contrary to theoretical predictions, the effect of human capital on FDI has also been found to be negative. At firm level, Urata and Kawai (2000) investigate the determinants of Japanese FDI in manufacturing in 117 developed and developing economies during the period 1980-1994. The results of their logit estimation suggest that higher enrolment rates in secondary education in a host country decreases its probability of being chosen as a location for investment.

A common weakness of the studies reviewed above, but also other empirical studies addressing human capital, is the inability to control for the quality of education. Choi (2007) attempts to overcome this weakness by including international test scores of primary and secondary school student achievement in maths and science as a measure of cognitive achievement and a proxy for education quality (at primary and secondary level). In this study a panel estimation is employed to investigate the effect of education quality on the intensity of bilateral foreign-owned firms' business activity (measured by affiliate sales) between the US and 32 partner countries in the period 1985-2004. After controlling for differences in quantity of human capital (measured by the share of skilled labour[17]), Choi finds that an increase in the quality of education in the partner country leads to an increase in the intensity of bilateral foreign affiliates' business activity. While this analysis does not provide evidence that education quality affects *inward* FDI in particular, it does suggest that this may be a relevant dimension when measuring human capital in relation to FDI. However, it should be noted that the effect of education quality does not appear to be robust, as it is only significant in one of the specifications reported and it is not clear why this specification is the preferred one.

The use of mixed samples of countries for the purpose of analysing the effect of human on FDI may be inappropriate because the importance of human capital as an

[17] Skilled labour share is defined by the ratio of skilled occupation categories (as defined by the International Labour Organization) in the total employment.

attractor is likely to be different in different groups of countries. For instance, if developing countries tend to receive relatively more FDI in the primary sector where the demand for local labour can be expected to be largely for lower-skilled workers, the effect of human capital on inwards FDI is expected to be small, or even insignificant. For this reason, studies with samples of countries of similar level of development, reviewed in the following sections, may be more informative.

3.2.2 Evidence from developed economies

Evidence from developed economies appears to almost uniformly support the hypothesis that relatively high levels of human capital is a locational advantage for attracting FDI. Nicoletti et al. (2003) estimate a dynamic panel to analyse the determinants of inward FDI in 19 OECD countries in the period 1980-2000. This study finds that human capital, as measured by average years of schooling in the working age population exerts a positive effect on stocks of inward FDI in these countries, a result which is robust across their different specifications. Another variable which may be related to human capital, R&D intensity which is measured as a country's business expenditure on R&D as a percentage of GDP, also appears to exert a robust positive effect on the stocks of inward FDI in these OECD countries. Also in a dynamic panel analysis, Agiomirgianakis (2006) find the secondary school enrolment ratio to positively affect FDI inflows (as a share of GDP) in 20 developed economies in the period 1975-1997.

From the US, evidence in favour of the human capital-FDI relationship comes from studies at state, industry, and firm level which use a variety of different human capital and FDI measures. In a cross section analysis for US states for the years 1987-1992, Nachum (2000) finds that the share of population enrolled in tertiary education has a positive effect on the number of foreign investors in professional and financial services, having controlled for labour productivity. Axarloglou (2005) investigates the determinants of annual FDI flows in 20 manufacturing industries in 10 US states using panel data for the period 1974-1994. Controlling for unit labour costs (or separately labour productivity and labour costs at industry level), they find a state's per capita spending on higher education positively affects the level of FDI inflows it receives. At firm level, Woodward (1992) uses a logit model to estimate the probability of US counties being chosen by Japanese investing firms in a twenty year period starting from 1980. Controlling for the wage and value-added created in manufacturing, the study finds that the median year of schooling in the population aged 25 and older increases a county's probability of being chosen as a location.

Evidence from the European countries on the human capital-FDI relationship is not as strong. Majocchi and Presutti (2009) fail to find an effect of the percentage of the workforce with secondary and tertiary education, or the number of research institutions, on the value of foreign investment in their cross-section data from nearly four thousand foreign affiliates in Italian regions in 2004. Rodriguez and Pallas (2008) estimate the effect of human capital on inflows of FDI at regional level in Spain. Their panel estimation which covers the period 1993-2002 suggests that the percentage of employees who have completed secondary education (or over) affects regional FDI positively, but the results are not robust across specifications. In this analysis, the difference between labour productivity and cost per employee is also found to have a positive effect on FDI inflows.

3.2.3 Evidence from developing economies

The evidence from developing economies tends to suggests that human capital endowment exerts a positive effect on the level of FDI an economy receives. One of the key studies in this field is that of Noorbakhsh et al. (2001), one of the few studies that actually have human capital as the primary focus of their FDI analysis. Noorbakhsh et al. employ a panel estimation to investigate the impact of human capital on FDI flows into 36 developing economies in the period 1980-1994. For human capital, they use secondary school enrolment ratios as well as two stock variables: the number of accumulated years of secondary education present in the working age population and number of accumulated years of secondary *and* tertiary education in the working age population. The results of this study suggest that, controlling for labour cost and availability of labour, all three measures of human capital are significant determinants of net FDI inflows as a percentage of GDP. According the magnitude of coefficients, human capital appears to be one of the most important determinants, but it is interesting to note that it only becomes significant when more recent years (after 1991) are included in the estimation, suggesting that human capital only became a significant determinant in this period.

In accordance with the findings of Noorbakhsh et al. (2001) the average years of schooling in the population has also been found to positively affect FDI into developing economies in the panel studies by Jaumotte (2004 – dynamic panel), Faini (2004) and Desbores and Azémar (2008). Also using a panel estimation, Checci et al. (2007) find that net FDI inflows (as a percentage of GDP) are positively influenced by the share of population who have attained secondary education (or above). However, the share of population with tertiary education attainment does not appear to affect FDI inflows into their sample of 63 developing countries in the period 1985-2000. The authors note that the absence of a significant relationship between the share of population with tertiary education and FDI inflows may be attributed to the inability to control for the sectoral differences of FDI in different geographical regions, but make no attempt to address this problem indirectly by controlling for regional differences. Other panel studies covering samples of developing economies either do not find any evidence in favour of a positive human capital-FDI relationship, or find evidence of a negative relationship. In an earlier study covering the period 1975-1988, Narula (1996) finds an insignificant effect of enrolment rates in tertiary education on inward FDI stocks. Taken together, these results may be interpreted to suggest that tertiary education attainment in particular does not attract FDI to developing economies. However, in the case of Narula (1996), it can be also be argued that another reason for the lack of a positive effect could be due to the (relatively) early period which this study covers, to the extent that human capital has become a (more) important FDI determinant over time, in accordance with Noorbakhsh et al.'s findings above. Majeed and Ahmad (2008) also find an insignificant effect of illiteracy rates of the population on FDI inflows (as a percentage of GDP) in 23 developing countries in the period 1970-2004. Mina (2007) on the other hand, is the only panel study (1980-2002) that finds a negative effect of a human capital measure on FDI inflows in developing economies. This finding may be partly explained by the atypical economies of the Gulf Cooperation Council (GCC) which is Mina's sample. Since these six countries are oil-producing economies, to the extent that FDI is primarily resource-driven, it is less likely to be affected by human capital. However, this explanation does not explain a negative effect on FDI. One reason for this may be the choice of the human capital variable adopted by this study. Measuring human capital merely in terms of the *share* of secondary education in total education may be very misleading because this measure can be high due to low enrolments in tertiary education and/or low coverage in the level of primary education. In this case, high values of this measure would in fact reflect low levels of human capital formation and therefore give rise to the negative effect which is observed in this study.

Nunnenkamp (2002) takes a different approach from the conventional macro-models and analyses FDI using microeconomic data as well as indicators he develops from data obtained through three surveys (1992, 1996 and 1999) of institutions of 28 developing countries. Simple correlations suggest that the per capita FDI stock is only significantly correlated with average years of schooling in the population in 1999 but not earlier – consistent with the conclusion of Noorbakhsh et al. (2001) that human capital has become more important in more recent years. When correlations of this variable with FDI inflows per capita are estimated, however, they are significant in all four periods. Nunnenkamp also includes other variables from the survey related to human capital quality and cost; (1) availability of trained people, education and quality of apprentice schemes and (2) trade unions' power and labour market legislation are included in the as components of indicators termed as "complementary factors of production" and "factor costs", respectively. The first component is mainly found not to be significantly correlated to either of the FDI measures, while the second is negatively correlated to both. However, no conclusion can be drawn from this because these indicators are comprised of many components, those regarding labour being merely a few of them.

The evidence from single (developing) country studies is even less conclusive. Two studies using cross-section Vietnamese data and secondary education human capital measures, Pham (2001) and Nguyen and Nguyen (2007), both find human capital to significantly affect FDI at regional level. In a OLS estimation for (averaged) data covering the period (1988-1998), Pham (2001) find the percentage of population enrolled in secondary education to positively affect the level of committed, as well as implemented, FDI inflows in Vietnamese regions. Similarly, Nguyen and Nguyen (2007) find the number of high school graduates in a region to positively affect both FDI in 2006 and cumulative FDI in the period 1988-2006 as measured by value of inflows (in an OLS estimation) as well as by the number of projects (in a negative binomial estimation). However, this study does not control for the size of the population/cohort, therefore the effect of the human capital variable may be merely reflecting the age structure of the population. Bouoiyour (2003) also finds a positive effect of enrolment rates in secondary schools on the FDI flows that Morocco received in the period 1960-2000. Ismail and Yussof (2003), on the other hand, find no effect of the number of professionals and technical workers in time-series estimations of FDI inflows in Thailand and the Philippines between 1985 and 1999, controlling for the average wage in manufacturing. Moreover, this measure is found to negatively affect Malaysian FDI during this period, while also in a time-series estimation, Tsen (2005) finds that another human capital measure – federal government expenditure on education as a percentage of GDP – has a positive effect on the value of foreign investment in the country's manufacturing industry. However, it is not clear that expenditure on education is a good measure of human capital in FDI studies for two reasons. First, there appears to be no evidence that cross-country expenditure on education determines student performance (Woessmann, 2006). Second, it could be argued that the coefficient on human capital in cross-country studies could be prone to (upward) omitted variable bias if variables that affect both expenditure on education and inward FDI are not included in the model.

Finally, two studies from developing economies follow an innovative approach in measuring human capital. Deichmann et al. (2003) use the student-teacher ratio as an (inverse) measure of education quality. In a logit estimation aiming to explain the decision of 293 foreign firms who invested in Turkey in 1995, they find that the student-teacher ratio (which represents lower quality) exerts a negative effect on the probability of a Turkish region being chosen by foreign investors. However, this proxy chosen for education quality is prone to serious criticism: in addition to only measuring only one (potential) aspect of education quality, research seems to find little evidence of a significant effect of class size on student attainment (Hanushek, 2003; Woessmann, 2006). Mody et al. (1999) on the other hand develop a measure of human capital which is not explicitly related to educational attainment. In their 1993 survey, they ask 173 Japanese firms who are engaged in FDI to rate different qualities, including labour costs and labour quality, in seven Asian countries. These variables are then used to explain the firms' prior as well as future investment in these countries. The cross-section analysis of this data suggests that firms' perceived labour quality in Asian countries is a significant determinant of the both their current shares of investment and their declared likelihood of expected investment in these countries in the next three years, but this is not the case with their perceptions of labour cost. However, as Mody et al. note, firms' perceptions of labour quality may be more related to the experience of workers gained in industry and not necessarily related to formal educational attainment. While this study's reliance solely on subjective perceptions and lack of explicit control for educational attainment may be considered a weakness, its results challenge the appropriateness of the conventional usage of formal educational attainment as a measure for human capital in relation to FDI.

3.2.4 Evidence from transition economies

While the empirical evidence from developing and developed economies tend to provide evidence of a positive relationship between human capital and FDI, even though not conclusive, evidence from transition economies appears to be very mixed and contradictory. The measures of human capital most used in studies covering these economies are those concerning tertiary education. Using stock measures of tertiary education, Majocchi and Strange (2007) and Broadman and Recanatini (2001) fail to find a positive relationship between human capital and FDI in Central and Eastern European Countries (CEEC) and Russia, respectively. The first study estimates a logit estimation using data on 272 Italian investors in seven CEECs in the period 1990-2003 and finds that a country's percentage of the labour force that with higher education attainment does not significantly affect their probability of being chosen as an investment location. In an OLS estimation using Russian regional data for the period 1995-1999, Broadman and Recanatini (2001) find that the percentage of currently employed persons with higher education attainment does not have a significant effect on cumulative FDI. However, when the annual net inflows are considered, the effect of the human capital variable becomes significant in the last two years of the period. Using a similar human capital measure, Serbu (2005) estimates a panel model of (bilateral) FDI stocks from OECD countries to three CEECs (Hungary, Slovakia and Romania) in the period 1997-2000. Controlling for unit labour costs relative to source country which appears not to exert a significant effect, Serbu finds that the share of the economically active population with tertiary education has a negative effect on the stocks of FDI they receive. However, these results appear not to apply to all three countries: in Romania and Slovakia the effect of both human capital and relative unit labour costs is negative, while in Hungary the former affects FDI positively and the latter does not have a significant effect. The author explains the differences as being caused by the different “quality” of FDI in these countries, i.e. Hungary receiving FDI in high-value added sectors (Ernst & Young, 2011), while Romania and Slovakia predominantly received FDI in low-technology manufacturing. In another panel study of six CEECs for the period 1996-2000, Görg and Greenaway (2002) find a negative effect of tertiary level enrolment rate on the stocks of FDI received from the UK. They argue that could possibly be a result of FDI in this region being predominantly vertical and, as a result, being primarily driven by labour cost considerations (which are not controlled for in their regression analysis). Tøndel (2001), on the other hand, finds both secondary and tertiary education enrolment rates to have an insignificant effect on total annual FDI inflows in 25 Central Eastern European and Baltic countries (CEEB) and Commonwealth of Independent States (CIS), as well as in these groups separately.

Similarly, there appears to be little evidence of secondary education measures affecting FDI in transition economies. Kinoshita and Campos (2003) investigate the determinants of FDI using a panel of 25 transition economies between 1990 and 1998. Their findings suggest that per capita FDI stock can be explained by labour costs and availability of natural resources, but not by the quality of labour which is represented by the enrolment rate in general secondary education. The authors provide two potential explanations for this: FDI in these countries is not directed towards the more technologically sophisticated industries or there is lack of cross-country variance as most countries in the sample have similar high rates of secondary school enrolment. When the sample is divided into CEEB and CIS countries in an attempt to control for sectoral differences in FDI, results suggest different determining factors. Labour costs become insignificant for both groups while human capital turns significant but negative in the latter. The negative significant coefficient on human capital is contrary to theoretical expectations and it appears to be related to sectoral effects because the effect of natural resources turns positive (and significant) in this sub-sample. These results appear to suggest that FDI in the primary sector is deterred by higher levels of human capital, a result which appears to be consistent with that of Mina (2007) for oil-producing countries.

Unlike the studies above which use secondary and tertiary level education data, Fung et al. (2008) use the illiteracy rate of the population as a measure for human capital. Their static and dynamic estimations for 15 CEECs in the period 1990-2004 suggest that, controlling for the level of wages in manufacturing, a lower illiteracy rate of the population (i.e. higher human capital endowment) positively affects FDI inflows. Finally, Carstensen and Toubal (2004) use gross enrolment in tertiary and secondary education relative to gross enrolment in all levels of education (i.e. including primary education) as a proxy for the fraction of medium and higher-educated workers in the workforce. In a dynamic panel using bilateral flows to seven CEECs from OECD countries (1993-1999), they find this measure of human capital to affect FDI inflows positively, controlling for unit labour costs relative to the host country. However, as discussed in the previous section, such relative measures may give a misleading picture of human capital endowment. Though, it could be argued that this effect is likely to be smaller in the case of this particular study because it includes both secondary and tertiary education, and because enrolment rates in primary education are more likely to be similar across countries.

3.2.5 Evidence from China

To date, China is the country where the relationship between human capital and FDI has been most studied. In this context, a variety of estimation techniques and human capital measures have been used, which allows for comparisons to be made among studies and potential patterns in results to be identified. These studies investigate the distribution of FDI among Chinese provinces using mostly panel and cross-section regional data as well as logit estimations using firm level data of foreign investors across China.

A wide range of both stock and flow human capital measures are used, starting from literacy rates to numbers of scientists and engineers. One of the most frequently used measure of human capital in Chinese studies of FDI is the (il)literacy rate of the population. Lower levels of illiteracy rate (i.e. higher levels of human capital) were found to have a positive effect on provincial FDI by Broadman and Sun (1997) in an OLS cross-section estimation, Cheng (2007) in a logit of firm-level Japanese investors' data and Coughlin and Segev (2000) in a panel model. On the other hand, the same measure is found to have the opposite effect or no effect on provincial FDI in another panel study by Zhang and Fu (2008). Another measure of human capital which may be considered analogous to the literacy rate, the percentage of population (above age 6) with primary education or above, is found to have an insignificant effect in panel studies when its current values are used (Cheng and Kwan 2000a; Gao, 2005) but a positive one when lagged values are used (Gao, 2005). The same effect is observed for analogous measures of junior and senior secondary education (Cheng and Kwan 2000a; Gao 2005) and tertiary education (Gao, 2005). The measure for human capital in these studies (and in Cassidy and Andreosso-O'Callaghan 2006), however, has the weakness of covering very young, school-age population; as a result, it may be distorted by different age structures across regions. Similar stock variables of education are also found to have a positive effect on FDI in other studies. Using firm-level data of Japanese and South Korean investors, respectively, Cheng (2006) and Kang and Lee (2007) find the percentage of adult population with secondary education to have a positive effect on FDI inflows, whilst Cassidy and Anderosso-O'Callaghan (2006) find a positive effect of the population aged 6 or over with tertiary education on provincial levels of Japanese FDI stock. Other studies use stock human capital variables, but are more specific in the types of skills they measure, e.g. the number of scientists and researchers in the workforce (Wei et al. 1999), number of engineers, scientists and technicians as a percentage of total employees (Sun et al. 2002), or the percentage of technical or skilled workers (Hong and Chin 2006, and Hong 2007, respectively). These studies, too, find a positive effect of human capital on inward FDI.

Studies of FDI in China that choose flow measures of human capital, on the other hand, appear to give less conclusive results. The percentage of population that is enrolled in secondary education appears to have a positive effect on FDI in one study that uses this measure (Zhang, 2001). However, when the same measure is considered at tertiary level, both positive (Fung et al. 2002; Fung et al. 2003) and insignificant results (Fung et al. 2006; Li et al. 2008; Hong et al. 2008) have been found. Finally, Cheng and Kwan (2000b) use the number of teachers and staff (per 10,000 population) in universities and secondary education as well as the ratio of farming to non-farming population, but finds no significant effect of these measures on FDI.

Finally, Lin (2011) and Du et al. (2012) investigate the effect of labour quality at firm-level and finds a positive effect of their education measures, however the methodology of these studies appears to be seriously flawed. First, they use data from a survey of firms that are already operating in China and, as such, it cannot examine the factors that affect the whole population of potential investors' location decisions. Further, in Lin (2011) the educational level of firms' current employees is used as a proxy for human capital, therefore the positive effect of labour quality on FDI that this study finds appears to be consistent with the explanation that foreign investors employ higher-qualified employees.

Table 3.1 below summarises the characteristics of studies that have estimated the effect of human capital on FDI to date and their empirical findings.

Table 3.1: Empirical studies estimating the effect of human capital on FDI

* In this table, 'singificant' refers to coefficients significant at 5% level or less

Study	**Sample**	**Period**	**Data/ Estimation technique**	**Dependent variable**	**Human capital measure (result*)**	**Independent variables related to human capital (results*)**	**Comments**
	1 - MIXED						
Urata and Kawai (2000)	Japanese manufacturing FDI in 117 developing and developed economies	1980-1994	Logit	Dummy, 1 if the country is the chosen as the location for investment	Enrolment rate in secondary education (-)	Wage (-)	When sample is divided in developing and developed economies, the results stay the same for the first group, but the human capital becomes positive and wage becomes insignificant for the latter group

Kucera (2002)	85 developed and developing economies	1993-1999	Cross-section OLS	Annual FDI inflows, averaged over a seven year period.	Literacy rate (+)		The effect of human capital is not found to be robust across specifications. However, authors report that the average years of educational attainment for population aged 15 has a higher level of significance.
Shatz (2003)	109 developed, developing and transition economies	1995	Tobit	Sales of US MNE affiliates in the host country (excluding banks)	Average years of total education in the population age 15 and over (+)		The absolute sizes of the education coefficients and their t-statistics are highest for total and primary education, while they fall with the increase of the level of education
					Average years of primary education in the population age 15 and older (+)		
					Average years of secondary education in the population age 15 and older (+)		
					Average years of total education in the population age 25 and older (+)		

Alfaro et al. (2004)	47 developing, developed and transition economies	1970-2000	Cross-section OLS	Inflows of capital (FDI + portfolio capital) per capita, averaged across the sample	Average years of schooling in the population, initial value (+)		Effect of human capital is not robust across specifications
Alsan et al. (2006)	75 developed and developing economies	1980-2000	Panel	Annual gross FDI inflows	Percentage of population aged 25 or above who have completed secondary schooling (insignificant)		
Blanton and Blanton (2007)	Developing and developed economies	1980-1997	Panel	Annual net FDI inflows as a percentage of GDP	Female enrolment rate in secondary education (insignificant)		
Bellak et al. (2009)	10 developed and transition economies	1995-2004	Dynamic panel	Total stock of inward FDI in each industry	Low-skilled hours worked in each industry as a share of total hours worked (-)	Labour cost (insignificant), labour productivity (insignificant); Government-financed R&D as a percentage of GDP (+)	Effect of human capital is robust across specifications
Al-Sadig (2009)	117 developed, developing and transition economies	1984-2004	Panel	Annual net FDI inflows per capita	Illiteracy rate (-) Enrolment rate in secondary education (+)		

	2 - DEVELOPED						
Woodward (1992)	Survey of 540 Japanese investing firms in US counties	1980-1989	Logit	Dummy, 1 if the region is the chosen as the location for investment	Median year of schooling completed in the population age 25 and older (+)	Value-added per manufacturing hour (insignificant); Hourly wage in manufacturing (insignificant)	Effect of human capital is not robust across specifications
Nachum (2000)	US states	1987 and 1992	Cross-section OLS	Number of foreign investors in financial and professional services	Share of population in higher education (+)	Labour productivity (insignificant)	
Nicoletti et al. (2003)	10-19 developed economies	1980-2000	Dynamic panel	Total stock of inward FDI	Average years of schooling in the working age population (+)	R&D intensity: country's business expenditure on R&D as a percentage of GDP (+)	Effect of human capital is robust across specifications
Agiomirgianakis (2006)	20 developed economies	1975-1997	Dynamic panel	Annual FDI inflows as a percentage of GDP	Secondary school enrolment ratio (+)		
Rodriguez and Pallas (2008)	Spanish regions	1993-2002	Dynamic panel	Gross inflow of FDI	Percentage of employees who have completed upper secondary education or over (+)	Difference between labour productivity and average cost per employee (+)	Effect of human capital is not robust across estimation techniques

Narula (1996)	Developed economies	1975-1988	Panel	Stock of inward FDI per capita	Gross enrolment rate in tertiary education (+)		
Axarloglou (2005)	20 manufacturing industries in 10 US states	1974-1994	Panel	Annual FDI inflows	Real per capita state spending on higher education (+)	Average hourly earnings in each industry in each state (-); Labour productivity (insignificant)	
						Unit labour costs (insignificant)	
				Annual FDI inflows relative to the total of the states in the sample	Real per capita state spending on higher education, relative to the other states in the sample (+)	Average hourly earnings in each industry in each state (insignificant); Labour productivity (+)	
						Unit labour costs (insignificant)	
Majocchi and Presutti (2009)	3984 foreign investors in Italian regions	2004	Cross-section OLS	Value of foreign investment	Percentage of workforce with secondary and tertiary education (insignificant)	Number of research institutions (insignificant)	
	3 - DEVELOPING						
Narula (1996)	Developing economies	1975-1988	Panel	Inward FDI stock per capita	Gross enrolment rate in tertiary education (insignificant)		

Mody et al. (1998)	6 developing economies (Asia)	1993	Cross-section OLS	Share of their foreign investment in Asia	Perceived labour quality (+)	Labour costs (insignificant)	
			Logit	Likelihood of expected investment in Asia	Perceived labour quality (insignificant)	Labour costs (-)	
Noorbakhsh et al. (2001)	36 developing economies	1980-1994	Panel	Net FDI inflows/GDP	Secondary school enrolment ratio (+)	Labour cost (insignificant); growth rate of labour force (+)	Human capital is one of the most important FDI determinants, but not statistically significant when regressions are estimated for the periods 1983-1988 and 1983-1991
					Number of accumulated years of secondary education present in the working age population (+)	Growth of labour force (+)	
					Number of accumulated years of secondary *and* tertiary education in the working age population (+)	Growth of labour force (+)	
Pham (2001)	Vietnamese provinces	1988-1998/1991-1998	Cross-section OLS	Committed/Implemented FDI inflows	Percentage of population in middle secondary school (+)		
Bouoiyour (2003)	Morocco	1960-2000	Time-series	FDI inflows (excluding privatisation)	Secondary school enrolment ratio (+)	Unit labour costs in industry (insignificant)	

Deichmann et al. (2003)	293 foreign investors in Turkish regions	1995	Logit	Dummy, 1 if the region is chosen as the location for investment	student/teacher ratio (-)		
Ismail and Yussof (2003)	Malaysia, Thailand and the Philippines	1985-1999	Time-series	Annual FDI inflows	Number of professional and technical workers in the country (- in Malaysia, insignificant in Thailand and the Philippines)	R&D intensity: country's business expenditure on R&D as % of GDP (- in Malaysia, insignificant in Thailand and the Philippines); Average manufacturing wage (insignificant)	
Faini (2004)	92 developing economies	1980-2000	Panel	FDI stock/GDP	Average years of schooling in the population (+)		
Jaumotte (2004)	71 developing economies	1980-1999	Dynamic panel	Annual FDI inflows	Average years of schooling in population (+)		
Tsen (2005)	Malaysia	1980-2002	Time-series	Value of foreign investment in approved projects in the manufacturing industry	Federal government expenditure on education as a percentage of GDP (+)		

Checci et al. (2007)	63 developing economies	1985-2000	Panel	Net FDI inflows/GDP	Population share with secondary education attainment (+) and with tertiary attainment (insignificant)		
Nguyen and Nguyen (2007)	Vietnamese provinces	1988-2006/2006	Cross-section OLS	Cumulative FDI inflows (1988-2006)	Number of high school graduates (+)	Wage (+)	
				Annual FDI inflows (2006)	Number of high school graduates (insignificant)	Averag wage (insignificant)	
			Negative binomial	Cumulative number of projects (1988-2006)	Number of high school graduates (+)	Averag wage (+)	
				Number of projects (2006)	Number of high school graduates (+)	Averag wage (insignificant)	
Mina (2007)	6 developing economies (Asia)	1980-2002	Panel	Annual FDI inflows	Secondary school enrolment as a percentage of total school enrolment (-)		The sample consists of oil producing countries of the Gulf Cooperation Council (GCC)
Chousa et al. (2008)	17 South and East Asian economies	1996-2005	Panel	Annual net FDI inflows per capita	Literacy rate (-)		
Desbores and Azemar (2008)	28 developing countries (Africa)	1985-2004	Panel	Annual net FDI inflows	Average years of schooling in the population over age 15 (+)		

Majeed and Ahmad (2008)	23 developing countries	1970-2004	Panel	Annual FDI inflows as a percentage of GDP	Illiteracy rate of the population (insignificant)		
	4 - TRANSITION						
	4.1 - European and Commonwealth of Independent States						
Broadman and Recanatini (2001)	Russian regions	1995-1999	Cross-section OLS	Cumulative net FDI inflows	Percentage of currently employed persons that have completed higher education in the initial period (insignificant)	Average wage at initial period (insignificant)	
				Annual net FDI inflows	Percentage of currently employed persons that have completed higher education in the initial period (insignificant/+)	Average wage at initial period (insignificant)	The human capital variable becomes significant in 1998 and 1999.

Tondel (2001)	25 CEEB and CIS countries	1994-1997	Panel	Annual FDI inflows	general secondary enrolment rate (insignificant) and tertiary gross enrolment rate (insignificant)	Average wage (positive)	Human capital variables remain insignificant when sample is divided in CEEB and CIS countries.
Kinoshita and Campos (2003)	25 CEEB and CIS economies	1990-1998	Panel	Cumulative net FDI inflows per capita	general secondary education enrolment rate (insignificant)	Nominal wage rate (negative)	When sample is divided in CEEB and CIS countries, labour costs become insignificant for both groups while human capital becomes negative in the CIS sample

	4.2 - Central and Eastern Europe						
Gorg and Greenaway (2002)	6 CEECs	1996-2000	Panel	Stock of inward FDI from the UK	Enrolment ratio in tertiary education (-)		Authors report that similar results are found for enrolment in secondary education.
Carstensen & Toubal (2004)	7 CEECs	1993-1999	Dynamic panel	Annual bilateral FDI inflows	fraction of medium and higher-educated workers in labour force (gross enrolment in tertiary+secondary education divided by gross enrolment in total enrolments (+)	ULC relative to source country (negative)	The effect of human capital is found to be robust across specifications.

Serbu (2005)	3 CEECs	1997-2000	Panel	Bilateral FDI stocks	Economically active population with tertiary education (-)	ULC relative to source country (insignificant)	Interactions of human capital with country dummies reveal differences between countries: RULC exert a negative effect in Romania and Slovakia but no significant effect in Hungary, while human capital exerts a negative effect in the first two and a positive one in the latter.
Majocchi and Strange (2007)	272 Italian foreign investors in 7 CEECs	1990-2003	Logit	Dummy, 1 if the country is chosen as the location for investment	Percentage of labour force with higher education (insignificant)		
Fung et al. (2008)	15 CEECs	1990-2004	Panel (static and dynamic)	FDI inflows	Illiteracy rate of population over 15 (-)	Average wage in manufacturing (insignificant)	

	4.3 - China						
Broadman and Sun (1997)	Chinese provinces	1992	Cross-section OLS	FDI stock in end of 1992	Illiteracy rate (-)	Average wage (insignificant)	
Coughlin and Segev (2000)	Chinese provinces	1990-1997	Panel	Sum of FDI inflows	Illiteracy rate in the population over 15 (-)	Average wage (-); Labour productivity (+)	
Wei et al. (1999)	Chinese provinces	1986-1995	Panel	Annual flows of pledged/realised FDI	Number of scientists and researchers in the workforce (+)		
Cheng and Kwan (2000a)	Chinese provinces	1985-1995	Dynamic panel	Cumulative of FDI inflows	Percentage of population 6 years or older with Senior high education or above (insignificant)		
					Percentage of population 6 years or older with Junior high education or above (insignificant)		
					Percentage of population 6 years or older with Primary education or above (insignificant)		

Cheng and Kwan (2000b)	Chinese provinces	1985-1995	Dynamic panel	Cumulative FDI inflows from 1979 to the reporting year	Number of teachers and staff in universities per 10,000 population (insignificant)		
					Number of teachers and staff in secondary education per 10,000 population (insignificant)		
					Ratio of farming to non-farming population (insignificant)		
Zhang (2001)	Chinese provinces	1987-1998	Cross-section OLS/panel		Percentage of population in secondary education (+)	Average wage in manufacturing (insignificant)	When the sample is divided in sub-samples covering shorter time periods, the significance of human capital is found to be increasing over time.
Fung et al (2002)	Chinese provinces	1990-1999	Panel	Annual FDI inflows from the US/Hong Kong	Ratio of students enrolled in tertiary education to total population (+)	Average wage (-)	Human capital (wage) has a stronger (weaker) influence on US FDI than Hong Kong FDI

Sun et al. (2002)	Chinese provinces	1986-1998	Panel	Annual FDI inflows	Number of research engineers, scientists and technicians as % of total employees (+)	Average wage (-)	
Fung et al (2003)	Chinese provinces	1990-2000	Panel	Annual FDI inflows from Japan/Hong Kong	Ratio of students enrolled in tertiary education to total population (+)	Average wage (- for Hong Kong, insignificant for Japan)	
Gao (2005)	Chinese provinces	1996-1999	Panel	Annual FDI inflows as a percentage of country's total FDI	Percentage of population 6 years or older with primary education or above, measured in current period (insignificant) and in 1990 (+) Percentage of population 6 years or older with junior secondary education or above, measured in current period (insignificant) and in 1990 (+) Percentage of population 6 years or older with senior secondary education or above, in current period (insignificant) and in 1990 (+)	Average wage in industry (-)	When the sample is divided according to source country, all human capital variables are found to positively affect FDI from developed economies, but not that from developing economies.

					Percentage of population 6 years or older with tertiary education or above, measured in current period (insignificant) and in 1990 (+)		
Cassidy and Anderosso-O'Callaghan (2006)	Chinese provinces	1996	OLS	Japanese FDI stock in 1996 (cumulative 1990-1996)	Percentage of population 6 years or older with tertiary education or above (+)	Average wage divided by labour productivity (+)	
Cheng (2006)/Cheng and Stough (2006)	764 Japanese investors in Chinese provinces	1997-2002	Logit	Dummy, 1 if the province is chosen as the location for investment	Percentage of adult population with Junior high education or above (+)	Average wage in manufacturing (+)	Effect of human capital is significant in either group
Fung et al. (2006)	Chinese provinces	1990-2002	Panel	Annual FDI inflows	Ratio of students enrolled in tertiary education to total population (insignificant)	Average wage (insignificant)	
Hong and Chin (2006)	1775 foreign logistics firms in Chinese cities	1992-2001	Logit	Dummy, 1 if the city is chosen as the location for investment	Percentage of skilled workers (+)	Average wage (-)	

Cheng et al. (2007)	764 Japanese investors in Chinese provinces	1997-2002	Logit	Dummy, 1 if the province is chosen as the location for investment	Illiteracy rate of adults (-)	Average wage in manufacturing (+)	Effect of human capital is insignificant in all sub-samples
Kang and Lee (2007)	10167 South Korean investors in Chinese provinces	1988-2002	Logit	Dummy, 1 if the province is chosen as the location for investment	Percentage of high school graduates in the population (+)	Average wage (-)	
Hong (2007)	1775 foreign logistics firms in Chinese cities	1992-2001	Logit	Dummy, 1 if the city is chosen as the location for investment	Percentage of technical workers in a city (+)	Average wage rate (-)	
Li et al. (2008)	Chinese provinces	1993-2005	Panel	Annual FDI inflows	Ratio of students enrolled in tertiary education to total population (insignificant)	Average wage in industry (insignificant)	
Hong et al. (2008)	Chinese provinces	1990-2003	Dynamic panel	Annual FDI inflows	Percentage of population in higher education (insignificant)	Host country's unit labour costs as a percentage of that of the source country (insignificant)	

Zhang and Fu (2008)	Chinese provinces	1999-2003	Panel	Annual FDI inflows as a percentage of GDP/population	Illiteracy rate (+ or insignificant)	Productivity of foreign funded industrial enterprises (insignificant); Average wage in manufacturing (+)	

3.3 A meta-regression analysis of the effect of human capital on FDI

A search of studies was conducted in order to identify relevant papers for the purpose of this MRA. Search in electronic databases such as EconLit and Social Science Research Network (SSRN) as well as the Internet (using Google and Google Scholar), were conducted with the key words "FDI + human capital", "foreign direct investment + human capital", "FDI + skill", "foreign direct investment + skill", "FDI + education", "foreign direct investment + education", "FDI + labo(u)r quality", "foreign direct investment + labo(u)r quality". Additional studies were identified from the references in the literature. A total of 62 econometric analyses, both published and working papers, were identified which empirically estimate the effect of different measures of human capital on inward FDI. The studies were not assessed for quality before being selected for inclusion in this MRA. Some of these, however, were excluded because of not having reported their estimated effects of human capital on FDI (Bengoa and Sanchez-Robles, 2003; Hong et al., 2008; Dutta and Yeboah, forthcoming); entering only a squared human capital term (Hanson 1996); having reported the same regression results in another paper (Cheng 2006) or analysing FDI and portfolio flows jointly (Alfaro et al. 2004). Of the regressions reported in the remaining studies, only preferred regressions are included in this MRA. If the authors do not explicitly state their preferred regression(s), all regressions are included except for those which are reported as clearly inferior (e.g., random-effects estimation if Hausmann test favours fixed-effects, or regular panel estimation when system GMM is used in the case of dynamic panels). The resulting sample of 341 regressions from 56 studies was initially used to estimate the meta-regression. An initial examination of a leverage plot indicated the presence of several observations with very large squared standardised residuals and one high-leverage observation. After a further investigation using Cook's distances and DFFIT statistics (Belsley et al., 2004), the observations from Kang and Lee (2007) were identified as problematic (see Appendix 3.1 for printouts and explanations). The peculiarity of these regressions appears to arise from the unusually large sample of over 17,000 observations which is many times larger than the typical macro-level studies, and even other firm-level studies included in this analysis. Perhaps partly as a result, the t-statistics in this study

3.3.1 The meta-regression model

The starting point of modelling MRA in economics is a simple model which regresses a study's reported effect (such as estimated coefficients or elasticities) on an intercept and its standard error (Stanley 2008). As the literature on the effect of human capital on FDI uses a variety of measures, scales and estimating techniques, the estimated effects must be standardised in order for them to be comparable across studies. For this purpose, the partial correlation coefficient between the dependent variable, the FDI measure, and the explanatory variable of interest, the human capital measure, in the original studies is calculated[18]. In the simplest MRA, the calculated partial correlation coefficients (PCC) are regressed on an intercept (α) and a measure of precision (the standard error of the PCC):

$$PCC_i = \alpha + \beta_0 \cdot SE_i^{PCC}{}_i + \varepsilon_i \tag{3.1}$$

However since the original studies included in the MRA differ with regard to data, sample-size and specification, the variances of the original estimates are likely to vary, and therefore the errors in the meta-regression ($\hat{\varepsilon}_i$) are likely to suffer from heteroskedasticity (Stanley 2005, p. 321). As a remedy for this potential problem, the method of weighted least squares (WLS) can be used in order to obtain efficient estimates. Accordingly, Equation (1) is divided by the standard errors of the partial correlation coefficient, SE_i^{PCC}, (Stanley 2008), giving a dependent variable which is the t-statistic of the estimated effect in the original studies[19]:

$$t_i^{\mathrm{Re}\,g} = \alpha \frac{1}{SE_i^{PCC}} + \beta_0 + u_i \tag{3.2}$$

[18] Following Greene (2008, pp. 29-31), the partial correlation coefficient between a dependent variable *y* and the independent variable of interest *z* (PCC_{yz}) is calculated using the t-statistic of variable z, t^{Reg}, and the degrees of freedom, dof^{Reg}, from the original regressions:

$$PCC_{yz} = \left(\sqrt{\frac{t_z^{2,\mathrm{Re}\,g}}{t_z^{2,\mathrm{Re}\,g} + dof^{\mathrm{Re}\,g}}}\right)\left(\frac{t_z^{\mathrm{Re}\,g}}{\left|t_z^{\mathrm{Re}\,g}\right|}\right)$$

[19] According Fisher (1954, p.194), the standard error of the PCC is calculated using the formula $SE_i^{PCC} = \frac{PCC_i}{t_i^{\mathrm{Re}\,g}}$. Hence, dividing the partial correlation coefficient by its standard error yields the t-statistic from the original regression $t_i^{\mathrm{Reg}} = \frac{PCC_i}{SE_i^{PCC}}$.

The bivariate equation provides the basis for estimating the "FAT-PET", tests which are used to indicate the presence of publication bias and the genuine effect in the reviewed literature, corrected for such bias. The Funnel Asymmetry Test (FAT) examines the hypothesis H_0: $\beta_0 = 0$ which, if not rejected, indicates the presence of publication bias, its sign identifying the direction of the bias (Egger et al., 1997; Stanley, 2005 and 2008). Referring back to Equation (1), in the absence of publication bias, the observed effects should vary randomly around the true value, independent of the standard error and thus no relationship between the original estimated coefficients and their standard errors are observed (i.e. $\beta_0 = 0$). A significant relationship, on the other hand, may be considered as evidence of publication bias in the literature. Card and Krueger (1995) explain that publication bias may arise when editors are predisposed to accept papers consistent with the conventional view, when researchers consider such results as a means of model selection and when editors and reviewers favour significant results as opposed to insignificant ones. Under estimation bias, the average effect found in the literature may be overestimated and this bias can be identified and quantified using MRA.

In this MRA, as explained earlier, it is not identifying publication bias, but the potential genuine effect in the literature that is of main interest. Stanley (2005, p. 309) explains that MRA can be utilised to "see through the murk of random sampling error and selected misspecification bias to identify the underlying statistical structures that characterise genuine empirical effect...beyond publication bias". Stanley proposes the precision-effect test (PET) as an indication of a "genuine underlying effect" in the sampled empirical literature, referring to the effect net of publication bias (controlled for by β_0 in this equation). PET consists of testing the hypothesis H_0: $\alpha = 0$ in Equation (2), $\hat{\alpha}$ being the estimate of the genuine effect corrected for selection bias. Hence, if the null hypothesis is not rejected, this is considered as evidence of a genuine effect.

The bivariate models presented above are commonly used to quantify publication bias in empirical literature and estimating the underlying genuine effect in the literature but, like any economic research, these tests can be biased when relevant variables are omitted (Stanley 2005). The systematic heterogeneity of the estimated effect of human capital on inward FDI in the literature may reflect differences in these studies in their choice of model specification, data and estimation technique, and these should be accounted for explicitly in the MRA model. Further, when there is a large amount of unexplained heterogeneity and large publication bias, the precision-effect test can be biased in favour of rejecting $H_0: \alpha = 0$, i.e. not finding a genuine effect (Stanley, 2008). Accordingly, following Stanley (2005), a more general meta-regression model is developed which has FAT-PET embedded in it. This model will serve as a means of exploring the sources of heterogeneity in the empirical literature which investigates the effect of human capital on FDI and their influence on the size of the estimated effects in the original literature. Following standard applications of MRA (Stanley 2001; Stanley 2005; Doucouliagos and Stanley 2009; Efendic et al., 2011) additional independent variables are included which relate to characteristics of the original studies with regard to the data, estimation techniques and model specification. These additional explanatory variables augment Equation (2) above:

$$t_i^{\mathrm{Reg}} = \alpha \frac{1}{SE_i^{PCC}} + \beta + \sum_1^K \lambda_k \frac{1}{SE_i^{PCC}} Z_{ki} + u_i \qquad (3.3)$$

where Z_{ki} are k=1,2,....,K are the explanatory variables, each weighted are as large as 65, compared to an average of less than 2 in the sample. Considering the above, the regressions from Kang and Lee (2005) were excluded from the sample and the results in the rest of this chapter were estimated using a sample of the remaining 335 observations from 55 studies[20]. The studies included in the meta-regression are indicated by an asterisk in the list of references.

by $\frac{1}{SE_i^{PCC}}$ and $\hat{\lambda}_k$ are their estimated coefficients which measure their respective impacts on the underlying empirical effect.

The explanatory variables to be included in this MRA analysis are presented in Table 3.2 below, whilst their summary statistics and correlations between them are presented in Appendix 3.2. These include the characteristics of the dependent variable and independent variable of interest for this study, human capital, used in

[20] Initial results suggested a genuine effect in the literature, however the sensitivity analysis suggested that this result is driven by the presence of the outliers in Kang and Lee's (2007) data and it disappears once this study is excluded.

the original studies. The measures of FDI were classified as stock, ***fdistock***, or flow (the reference category).[21] The measures of human capital were classified as flow, ***hcflow***, and stock, the reference category (i.e. enrolment rates vs. educational attainment)[22]. The measures of human capital were further classified according to the level of education they refer to: average/median year(s) of schooling, ***avgyred***; secondary education, ***secondary***; tertiary education, ***tertiary***; or secondary and tertiary education combined, ***sectert***; and primary education[23], the reference category. An additional variable is included in the MRA model for input-based human capital variables, such as expenditure on education, number of staff employed in education and student-teacher ratio. Other variables, discussed next, include characteristics of data used and estimation techniques.

In the previous section it was argued that the effect of human capital may vary according to the (sample of) countries included in the empirical investigation. Accordingly, dummy variables were created which indicate the groups of countries in the original studies: ***developed***, for developed economies; ***transition***, for transition economies; ***mixed***, for mixed samples including countries from more than one group; and ***china***, for regional studies from China. This leaves samples of developing countries as the reference category.

As noted above, there are indications in the literature that the importance of human capital in relation to FDI has become greater through time (Noorbakhsh et al., 2001), implying that the period of time in which the effect of human capital on FDI is investigated may influence the estimated effect of human capital; the median year, ***(ln)medianyr***, of the period covered in the study is used as a proxy for the recentness of the data. To the extent that studies published in refereed journals are of a higher quality, their estimates may be considered more reliable than those from working

[21] The value of foreign-funded projects and the decision of a firm to invest in a country (in qualitative dependent variable models) were classified as flow measures because they refer to a one-off investment. The number of foreign affiliates in a host economy and the value of their sales were classified as stock measures.

[22] Perceptions of labour quality by foreign investors, number of research institutes and number/proportion of population with certain qualifications were classified as stock measures of human capital because they refer to the quality of the current stock of labour in a country. Perception of quality was classified with the measures that do not specify the level of education (average/median years of schooling), while the other measures were classified as tertiary and secondary and tertiary, respectively.

[23] Measures of (il)literacy are included in the 'primary education' category. Illiteracy is made comparable to literacy (and primary education) by multiplying its (coefficient and) t statistic by -1.

papers. Accordingly, a dummy variable, ***published***, is included to distinguish between published and unpublished papers, though it was not possible to identify whether each journal used external referees. Assuming that data collection methods and econometric techniques improve over time, it can be expected that more recent studies are likely to provide more reliable estimates. In order to account for this effect, the year of publication of a study, ***(ln)pubyr***, is included.[24] The length of the period covered in the analysis, ***(ln)period***, also enters the equation as a further measure of the reliability of the original study's estimates (Stanley and Jarrell, 1989). Finally, the more explanatory variables are included, i.e. controlled for, in the original model, the more reliable the estimated effect of human capital on FDI can be considered. Hence, the total number of explanatory variables in the model, ***(ln)tnoexp***, is also included in the MRA[25].

Potential differences that may arise due to different types of data and estimation technique are captured by classifying the studies into those that use: cross-section OLS estimations, ***crosssection***; time-series estimations; ***timeseries***; limited dependent variable models (logit, tobit, negative binomial), ***qualdv***; dynamic panel models, ***dynamic***, and static panel ones, the reference category. As discussed in Section 2.2, FDI inflows are likely to be (in part) determined by previous activity of foreign investors in the country, i.e. values of lagged FDI should be controlled for, making the distinction between static and dynamic panel estimation particularly important. Hence, static and dynamic panels are coded accordingly in the MRA model. Another issue related to modelling the relationship between human capital and FDI is potential endogeneity, as discussed in Section 2.3. Endogeneity may affect the size of the estimated coefficient on human capital, therefore any attempt made to control for endogeneity in the original study is coded and controlled for in this MRA using a dummy, ***endogeneity***. Finally, the presence of relevant control variables related to labour such as unadjusted cost, ***labcost***, and productivity or unit labour costs, ***labprod***, is coded.

[24] For published papers, the year of the publication of the working paper is used in order to achieve comparability between published and working papers. In case there is no information on the year the working paper is published, this is assumed to be two years earlier than the journal publication.

[25] Time and country dummies in fixed-effects panel models are also included because they too may account for the explanatory power of the model.

However, not every study characteristic can be coded and analysed since, in the words of Stanley (2001, p. 137), "the number of studies is limited and most studies entail a unique combination of techniques, independent variables, data, time periods and other research choices".

Table 3.2: Definitions of MRA variables

Variable	Description
tstat	t-statistic of the original human capital estimate.
invsepcc	Precision measure of the original human capital estimates, $\frac{1}{SE_i^{PCC}}$. (see FAT-PET above).
fdirel	Dummy, 1 if flow measures are used for FDI, 0 otherwise.
fdirel	Dummy, 1 if FDI is measured relative to population/GDP/total regional or country FDI, 0 otherwise.
hcinput	Dummy, 1 if input-based human capital measure is used, 0 otherwise.
hcflow	Dummy, 1 if flow measures used for human capital, 0 otherwise.
primary	Dummy, 1 if primary education attainment or enrolment rate, or (il)literacy rate is used for human capital, 0 otherwise.
secondary	Dummy, 1 if secondary education attainment or enrolment rate is used for human capital, 0 otherwise.
tertiary	Dummy, 1 if tertiary education attainment or enrolment rate is used for human capital, 0 otherwise.
sectert	Dummy, 1 if secondary and tertiary education attainment or enrolment rate combined are used for human capital, 0 otherwise.
qualdv	Dummy, 1 if a limited dependent variable model is used, 0 otherwise.
crosssection	Dummy, 1 if cross-sectional sample is used, 0 otherwise.
timeseries	Dummy, 1 if time-series sample is used, 0 otherwise.

dynamic	Dummy, 1 if a dynamic panel is used, 0 otherwise.
panel	Dummy, 1 if a panel model is used, 0 otherwise.
mixed	Dummy, 1 if data from mixed samples is used, 0 otherwise.
developed	Dummy, 1 if data from developed economies is used, 0 otherwise.
transition	Dummy, 1 if data from transition economies are used, 0 otherwise.
china	Dummy, 1 if regional data from China is used, 0 otherwise.
published	Dummy, 1 if study is published in a journal
lnpubyr	(Natural logarithm of) the year of publication of working paper.
lnmedianyr	(Natural logarithm of) the median year of the period of time covered in the original study.
lnperiod	(Natural logarithm of) the number of years the study covers.
lntnoexp	Total number of explanatory variables in the original model (including dummies in FEM panel models)
labcost	Dummy, 1 if cost-related variables such as wage are present in the model, 0 otherwise.
labprod	Dummy, 1 if productivity or unit labour costs are present in the model, 0 otherwise.
endogeneity	Dummy, 1 if an attempt was made to control for endogeneity, 0 otherwise.

3.3.2 Empirical results

As explained in the previous section, the starting point of MRA is to test for publication bias and the presence of a genuine effect in the literature. Publication bias arises in the literature when researchers and/or their reviewers and editors prefer statistically significant results and results that are in line with the theoretical expectations (Card and Krueger 1995; Stanley 2005). Under such circumstances, research that does not provide the preferred results is either less likely to be submitted or published, and the existing literature provides a biased estimate of the effects. Meta-regression analysis provides a means for detecting and controlling for publication bias based on the assumption that smaller samples, having fewer degrees of freedom and hence larger standard errors of estimated coefficients, are inherently disadvantaged in finding significant results. Hence, researchers using small samples have to "search" harder to find the "preferred" significant results by trying different specifications, measures, estimation techniques, etc. However, in this particular MRA, finding publication bias appears to be unlikely for the simple reason that few of these studies have human capital as their main variable of interest. When present in the model, human capital is in most cases entered simply as a control variable, so it is less likely that researchers have been preoccupied with finding a significant effect on this variable. Empirically, the presence of publication bias is tested by estimating Equation 3.2, which has the FAT-PET tests embedded in it.

Since there is usually more than one regression included from each study in the MRA, observations from the same study are expected to be correlated, and therefore a cluster-robust estimation is used for estimating this MRA model. Also, in order for each study to have an equal weight in the estimation, despite their differences in the number of regressions, a weighted regression is estimated (the weight attached to each observation being equal to the inverse value of the number of regressions included in the study it comes from). Hence, both the bivariate, and the multivariate, MRA results reported in Tables 3.2 and 3.3 are obtained from weighted, cluster-robust, estimations.

Table 3.2 below presents the results of the bivariate MRA Model (3.3), the printouts and diagnostics for which are presented in Appendix 3.3. The positive and significant estimated intercept of the MRA model suggests that there is publication bias in the human capital-FDI literature. The estimated coefficient of the precision measure, the standard error of the PCC, is statistically insignificant, suggesting that there is no ‘genuine effect’ in the literature. A potential explanation for this finding could be that the empirical literature which has addressed the effect of human capital on inward FDI generally does not appear to base the choice of the human capital measure on theoretical considerations. As such, the empirical models found in this literature may be mis-specified. Such explanations may, to some extent, be tested by augmenting the bivariate MRA to include study characteristics so as to explore the heterogeneity of results in the literature, as discussed next.

Table 3.3: Bivariate MRA results (dependent variable: tstat)*

	(1)
VARIABLES	Model (3.2)
Constant	2.066***
	(0.404)
Invsepcc	-0.0202
	(0.0139)
Observations	335
R-squared	0.023

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
*Results from a weighted, cluster-robust, estimation.

The multivariate MRA Model (3.3) was initially specified to include all the variables identified as potential sources of heterogeneity in the estimated effect of human capital on FDI, however this model appears to be mis-specified and suffers from severe multicollinearity (see Appendix 3.4 for printouts and explanations). Accordingly, a testing down procedure is followed whereby variables with the highest estimated p-values are excluded from the model two by two if they are found to be jointly insignificant (see Appendix 3.5 for the testing down procedure). The results and diagnostic tests of this parsimonious version of Model (3.3) are presented in Table 3.4 below, whilst Appendix 3.6 presents the printouts for these. According to the Ramsey RESET test, the null hypothesis that the functional form is correct cannot be rejected at the 1% level, although it can be at the 5% level. The level of multicollinearity has decreased significantly relative to the full model. The normality test suggests that the model suffers from non-normality which appears to be a result of outliers because the histogram of residuals appears to be bell-shaped. As this is a fairly large sample, it is assumed that the non-normality will not invalidate statistical inference. According to the F-test, the null hypothesis that regressors are jointly insignificant can be strongly rejected.

Table 3.4: Multivariate MRA results (dependent variable: tstat)*

VARIABLES		(1) Model (3.3)
Constant		-2.378
		(1.475)
Invsepcc		0.0159
		(0.0456)
Dynamic		0.0554
		(0.0343)
Mixed		0.103**
		(0.0462)
transition		-0.0980**
		(0.0393)
china		0.0620*
		(0.0331)
hcstock		0.0394
		(0.0342)
secondary		-0.123**
		(0.0523)
tertiary		-0.0225
		(0.0227)
agvyred		-0.0707
		(0.0552)
labcost		-0.102***
		(0.0353)
labprod		0.0958***
		(0.0307)
lnmedianyr		0.872***
		(0.313)
published		-0.0443
		(0.0376)
Observations		335
R-squared		0.344
F-test	F(10, 54) =	16.55
	Prob>F	0.00
Ramsey RESET test	F(3, 321) =	3.41
		0.01
Variance Inflation Factor (VIF)	Max	24.3
	Mean	6.11
Skewness	chi2(10) =	54.22

	Prob>chi2 =	0.00
Kurtosis	chi2(10) =	12.32
	Prob>chi2 =	0.00

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
*Results from a weighted, cluster-robust, estimation.

The multivariate regression appears to be able to explain some of the diversity in results that characterises the human capital-FDI literature in terms of study characteristics with regard to the sample covered, vintage of data, measure of human capital, and presence of certain control variables in the model.

According to the multivariate MRA results, the estimated effect of human capital on FDI appears to be larger in studies that control for labour productivity (or unit labour costs) in the host country. Controlling for the level of unadjusted labour costs alone, on the other hand, appears to yield lower estimated effects, in accordance with expectations.

A larger effect of human capital appears to be found in studies that cover more recent data, as suggested by the positive sign on the median year covered in the study. This result is consistent with the hypothesis that importance of human capital as an attractor of FDI is increasing over time (Noorbakhsh et al., 2001), as well as with increasing demand for skilled labour in the market in general as posited by the skill-biased technological change hypothesis (Machin, 2004).

In accordance with the expectations, the estimated effect of human capital variables on inwards FDI depends on the sample of countries included in the original studies. Compared to studies of developed and developing economies, the estimated effect of human capital is found to be, on average, higher in studies using mixed samples of countries and regional level studies from China. Perhaps the most striking result is the highly significant negative sign of the transition dummy, suggesting that the estimated effect of human capital on FDI in samples consisting of transition economies is smaller compared to that in all other samples. This finding could be considered consistent with the arguments in Chapter 1 that transition economies are inferior in terms of the mix, quality and appropriateness of human capital in a market economy context, which would make this human capital relatively less attractive to foreign investors.

The choice of the human capital measure also appears to affect the size of its estimated effect on FDI inflows. Namely, using secondary education measures decreases the size of the estimated effect of human capital on FDI compared to using measures referring to other levels of education, or those not specifying the level of education. From a theoretical point of view, there appears to be no explanation as to why foreign investors would value secondary education relatively more than other levels of education (including primary education). However, one potential explanation could be that lower human capital estimates are obtained when using this measure because secondary education is relatively more heterogeneous across countries, especially compared to primary education (Altonji, 2010). To the extent that human capital formation during secondary education is relatively more diverse across countries in terms of the skills offered (e.g. mix of general vs. vocational education), quality and length of education (i.e. number of years of secondary schooling and/or level of compulsory schooling), secondary education measures may be less likely to provide a comparable measure for cross-country analyses. In addition, there are differences in the exact level of education that the original studies use, i.e. lower-, upper- or both levels of secondary education.

The results of the multivariate MRA with regard to publication bias are not consistent with those of the bivariate MRA. Namely, once other study characteristics have been controlled for, the apparent publication bias suggested in the bivariate regression disappears. Considering that the bivariate regression is likely to suffer from omitted variable bias and its problems with its functional form and low R-squared, the results from the multivariate MRA are argued to more reliable. The results with regard to the (non)existence of a genuine effect in the literature, on the other hand, remains the same in the multivariate MRA. Despite the attempt to control for a wide range of study characteristics that were hypothesised to potentially explain the diversity of results found, there appears to be no genuine effect of human capital on FDI. A possible explanation for this finding may be the genuine lack of what was referred to as a 'universal relationship' between human capital and FDI in the introduction to this chapter. Namely, it is reasonable to expect that the (size of) the effect of human capital on inward FDI depends on the type of foreign investor activity, activities in higher value added sectors or stages of production being more affected by human capital compared to lower value added ones. For instance, resource-seeking and market-seeking FDI are likely to be less affected by a host country's human capital. If FDI in the primary sector and services sectors (excluding the information and computer technologies, ICT, sector) are assumed to correspond to these types of FDI, respectively, it follows that a large share of inward FDI is expected to be little affected by human capital. More specifically, resource- and market-seeking FDI still account for approximately 55% of world inward FDI stock in 2006-2008, even after excluding the business activities sector which can be argued to be partly efficiency-seeking because it includes ICT services (UNCTAD, 2010a). Considering that the vast majority of existing studies does not account for such differences and simply estimates the effect of human capital on total inward FDI flows/stocks, it is perhaps not surprising that the empirical evidence is so diverse.

3.4 Conclusion

This chapter has reviewed studies which estimate the effect of a country's human capital on FDI inflows. The review finds that there is a surprisingly wide range of results reported and that studies differ in respect to their measures of human capital, estimation techniques, specifications, and countries and time periods covered. Therefore, a meta-regression analysis was applied with the aim of quantitatively summarising the effect of human capital on FDI and explaining the diversity of results that are found in the existing literature. The results of this analysis suggested that there is no 'authentic effect' of human capital on inwards FDI in the literature and that the heterogeneity in results can be partially explained by different characteristics of the original studies. Notably, the size of the estimated effect of human capital measures of inwards FDI appears to significantly lower in samples of transition economies compared to other samples.

It has been argued that the lack of a 'genuine effect' in the literature could partly be attributed to the lack of attention that human capital receives in the FDI literature in general, which may lead to mis-specification of (at least some of) the models in the existing literature. Accordingly, Chapter 4 will examine the relationship between human capital and productivity at a micro level, using the insights to identify the most appropriate human capital measures which will be used in the empirical analyses for European transition economies in the following chapters. However, the failure to find a 'genuine effect' is also consistent with a lack of 'universal relationship' between human capital and FDI, i.e. the attracting effect of human capital being conditional on the type of activity that the foreign investors seeks to undertake in a location. This hypothesis will be further developed and empirically investigated in Chapter 6.

Chapter 4

SPECIFYING A MODEL TO ESTIMATE THE EFFECT OF HUMAN CAPITAL ON INWARDS FDI IN EUROPEAN TRANSITION ECONOMIES

Contents

4.1 Introduction

The empirical evidence reviewed in Section 3.2 and the results of the meta-regression analysis in Section 3.3 does not appear to provide (conclusive) evidence in support of the hypothesis that high levels of human capital exert a positive influence on inward FDI, especially in the case of transition economies. In Chapter 3 it was argued that one reason for these findings may be the human capital measures used in previous research, which usually tend to be arbitrarily chosen. This, in turn, reflects the absence of a sound theoretical argument to relate inwards FDI to a country's stock of human capital. Section 2.3 of this thesis has previously argued that human capital should influence inward FDI positively based on its effect on future productivity growth derived from macroeconomic growth theories. However, the growth literature does not address the question of how human capital affects productivity growth and what the specific types of knowledge and skills are that enhance individuals' productivity. As such, growth theory does not provide clear guidelines as to the appropriate measures that should be used in empirical analyses to represent human capital as a determinant of aggregate growth and future firm profitability. Section 2.3 has identified the broad channels through which human capital affects a country's productivity growth: increasing individuals' productive capacity and their capacity to adopt/adapt and advance technology. However, the theories discussed in Section 2.3 and economic research in general do not explain what the specific skills that facilitate these processes are, or how/where these are developed. These are both important issues when considering the influence of human capital on FDI, both from a policy perspective and for the measurement of human capital in empirical research. This has been recently recognised, for instance, by Altonji (2010) who stresses the multidimensionality of ability and skills and Hanushek (2010) who proposes an agenda for "new Human capital" research that would advance the level of knowledge on "how skills are produced...and...the effects of skills on individual and societal outcomes" (p. 2). It is argued in this thesis that these issues may be particularly important in the case of transition economies and their stock of human capital which, as discussed in Sections 1.3 and 1.4, differ from those of market economies in many respects. This chapter aims to inform the choice of appropriate human capital measures for investigating the effect of human capital on

FDI by analysing the relationship between human capital and (labour) productivity growth from the perspective of microeconomics and labour economics research.

Chapter 2 of this thesis also provided a review of the theoretical framework to identify the determinants of inward FDI with an emphasis on the potential influence of human capital. The currently espoused theory, however, is limited in its ability to explain FDI in transition economies because it does not capture the specific features of these economies and the process of transition itself. A second aim of this chapter, building on the discussions in Section 2.2, is to fill this gap by providing theoretical grounds for the inclusion of other determinants of inwards FDI which may be particularly relevant in a transition context. In particular, the chapter analyses how key features of transition economies and their education systems may have shaped the relationship between human capital and productivity (and, by implication, FDI) in this specific context. Based on these analyses and the theory reviewed in Chapter 2, this chapter provides a rationale for the choice of appropriate human capital measures and transition-specific controls that an empirical model for explaining inwards FDI in transition should include.

The rest of this chapter is organised as follows. Section 4.2 analyses the relationship between human capital and productivity: in particular it identifies the productivity-enhancing characteristics that human capital encompasses and how these are developed. Section 4.3 provides an extended theoretical framework for estimating the effect of human capital on FDI in the context of transition economies. A critical analysis of alternative available measures of human capital in this context and a theoretical discussion of transition-specific characteristics that should be incorporated in empirical analyses are provided in sub-sections 4.3.1 and 4.3.2, respectively. Section 4.4 summarises the findings of the chapter and their implications for the specification of the empirical models to be used in the following chapters.

4.2 The relationship between human capital and labour productivity growth in a modern economy

The macroeconomic growth literature reviewed in Section 2.3 sought to establish the relationship between human capital and labour productivity growth largely based on two key assumptions stemming from human capital theory (Becker, 1964; Schultz, 1974). First, by using educational attainment to measure human capital (e.g. Lucas, 1988; Romer, 1990; Cosar, 2011), it is assumed that human capital is (primarily) developed through formal education. Second, it is implicitly, or explicitly in the case of Hanushek and Woessmann (2009a,b; 2011), assumed that the productivity-enhancing role of human capital is related to the development of cognitive skills. These assumptions are critically appraised in the rest of this section with the aim of providing a better understanding of how human capital increases productivity both at firm and country level.

As discussed in Section 2.3, in a conventional human capital framework individuals acquire skills through formal education and training. The acquired skills enhance the individual's productivity and, as a result, the wages which they are paid in a competitive labour market. In this simplistic view, human capital is equated to the years of education (and training) an individual has acquired and their earned wage perfectly reflects their productivity. Accordingly, the effect of human capital on productivity at a micro level is estimated using a so-called Mincerian regression (Mincer, 1974) in which (the logarithm of) individuals' hourly wages is regressed on a set of explanatory variables that includes years of education as a measure of investment in human capital. The positive relationship between the wage and attained education which has been estimated in this manner is usually interpreted as evidence of the productivity-enhancing effect of human capital acquired through education (Psacharopoulos and Patrinos, 2004; Blundell et al., 2005; Checci, 2005; Hartog and Oosterbeek, 2007; Colclough et al., 2010; Manacorda et al., 2010; Warunsiri and McNown, 2010). From this it follows that firms seeking to gain a competitive advantage through higher productivity would prefer workers with more human capital, i.e. higher levels of education, to the extent that they do not have to reward them fully for the value of their higher marginal product. However, estimates based on this simplistic human capital approach are limited in their ability to provide reliable information on the causal effect of human capital on productivity. In addition to the concerns about using wages as a measure of productivity discussed in the next section, human capital theory has been heavily criticised for its assumption that it is formal education that actually develops skills and increases productivity.

A key problem with estimating the effect of education on productivity and/or wages is the potential bias that can result if there are systematic differences between individuals who choose to acquire different levels of education. For instance, it is reasonable to expect that both individuals' choices of acquired level of education and their success in the labour market are affected by unobserved differences, a key example of which is innate ability. This idea forms the starting point of the signalling/screening approach to human capital (Arrow 1973; Spence, 1973) which in its extreme form maintains that education does not enhance, but merely signals an individual's productivity or any other productivity-related qualities that are valued by employers. This signal is necessary because asymmetric information means that employers cannot (easily and cheaply) observe an employee's actual productivity[26]. In this framework, employers use education as a screening device and they are willing to pay higher wages for educated employees even though this is not related to the effect of education per se, thus giving rise to a positive relationship between education and wages, just as predicted by human capital theory. The validity or otherwise of the signalling approach does not appear to change significantly predictions about the desirability of educated workers. At the micro level, firms should still prefer a more educated labour force because the resulting signalling facilitates the identification of relatively more productive workers. Even though educational attainment now only signals *relative* ability, under this framework it is still reasonable to expect a positive relationship between educational attainment and inwards FDI to hold since the quality of the matching of workers to jobs is likely to be higher in countries with higher and more diffuse levels of educational attainment.

Empirically, it has proved difficult to distinguish between the signalling and productivity-enhancing effects because, as Weiss (1995) points out, in many cases results may be interpreted to be consistent with both frameworks. However, empirical investigations by and large appear to lend support to human capital theory or the coexistence of these two effects[27]. For the purpose of this thesis, it is sufficient

[26] In order for education to be an effective signal, however, the (reasonable) assumption is made that the costs of obtaining education are sufficiently negatively related to an individual's innate ability so as to make the signalling costs too high for those with low ability. This way, firms' inference of unobserved ability is confirmed by individuals' choices of the quantity of education they acquire, and the inefficiency caused by imperfect information is overcome.
[27] Empirical analyses in this field include Riley (1979), Boissiere et al. (1985), Ashenfelter and Krueger (1994), Ashenfelter and Rouse (1998), Behrman and Rosenzweig (1999), Angrist and

to note that the signalling and productivity-enhancing effects of education are likely to coexist (Blundell et al., 2005; Hussey, 2011), and that there appears to be no convincing evidence from wage equations to undermine the assumption that human capital is (partially) developed through formal education. However, as argued above, even if the signalling critique is valid, more investment in education is likely to increase overall productivity by facilitating the process of matching of high productivity workers with high productivity jobs.

Relatively little appears to be known about the nature of the specific productivity-enhancing characteristics of human capital and explanation of how education develops them. Welch (1970) argues that human capital enhances individuals' ability to adjust to changing economic conditions. By the same token, Schultz (1975) defines the relevant human capital as an 'ability to deal with disequilibria'. Schultz emphasises the role of education in enhancing of the ability to perceive new classes of problems and the skills needed to solve them. More specifically, Schultz (1975) argues that the skills that students acquire in education for solving problems within the classroom "appear to have general properties that contribute to their performance as economic agents in perceiving and solving problems..." (p. 835). Welch (1970) identifies another type of skill that enhances productivity. According to him, in addition to enhancing the ability of individuals to accomplish more with given resources, i.e. the 'worker effect', education enhances the ability to acquire and decode information about the prices and characteristics of new potential inputs, i.e. the 'allocative effect'. According to Welch, education increases productivity by virtue of developing the ability to critically evaluate new inputs prior to their use and to identify and evaluate their productivity effects as they use them. In terms of the discussion of growth theory in Section 2.3, Schultz's 'worker effect' would correspond to the 'productivity-enhancing effect' of education as recognised in the neoclassical framework. The 'allocative effect', or Welch's 'ability to deal with disequilibria', on the other hand, appears to be related to the 'technology development and adoption effect' as maintained by the Nelson-Phelps hypothesis and endogenous growth theories[28]. Accordingly, Nelson and Phelps (1966), Welch

Krueger (1991), Aakvik et al. (2003), Chevalier et al. (2004), Herault and Zakirova (2011), Wallace and Jack (2011) and Hussey (2012).

[28] Welch (1970) posits that the 'allocative effect' includes, but is not limited to, the 'innovation effect' identified by Nelson and Phelps (1966).

(1970) and Schultz (1975) all underscore the increasing importance of education when the rate of technological change is high, an argument consistent with the observed rises in the education wage premia as the modern knowledge-based economy develops (Machin, 2004).

Because agricultural production has undergone great technical change over time, it is argued to be a convenient setting for investigating the human capital-productivity relationship (Welch, 1970; Foster and Rosenzweig, 1995; Foster and Rosenzweig, 1996; Rosenzweig, 2010). The self-employment status of most farmers is another key feature which makes agriculture a convenient sector for this purpose (Schutlz, 1975). Being self-employed, farmers do not have the incentive to acquire education to signal their ability in the labour market and they can be assumed to supply their maximum effort because they themselves claim the full reward for it, i.e. their productivity level is not prone to shirking due to the labour market imperfections such as incomplete contracts. Agriculture is also atypical in that it encompasses diverse activities which are usually not differentiated according to the level of education of the farmer as they are for workers in other sectors, which makes it easier to isolate the effect of human capital on productivity (Welch, 1970). Moreover, because of the diversity of activities involved, Welch argues that farming requires continuous allocative decisions which directly affect productivity. Hence, compared to other economic sectors, the more complex 'allocative effect' of education is likely to dominate over the 'worker effect' in determining the output eventually achieved.

Empirical evidence from the agricultural sectors suggests that there is indeed a positive relationship between the level of educational attainment and productivity. Welch (1970) finds education to have a positive effect on the income of educated farmers relative to uneducated ones. Foster and Rosenzweig (1995, 1996) investigate the effect of education under circumstances of exogenous technical change in the agricultural sector in India. They, too, find a positive effect of farmers' level of education on the profitability of using new technology embodied in imported high-yielding variety seeds. This evidence supports the Nelson-Phelps hypothesis, discussed in Section 2.2, according to which human capital (measured by the level educational attainment) enhances productivity by increasing the capacity for technology adoption. Foster and Rosenzweig (1995) go further and empirically distinguish the precise mechanism through which education affects the success of using the new technology by accounting for farmers' length of experience with it. Accordingly, they distinguish between two potential channels: the improvement of access to external sources of information (e.g. newspapers or instruction manuals) and the ability to obtain and decipher information from their own experience with new technology. In the former case the effect of education on productivity would be immediate, whilst in the latter the effect would increase with time. The empirical results suggest that education has virtually no effect on the immediate use of the new technology, but it increases the rate of productivity growth as farmers gain experience from using it. In line with these findings, Rosenzweig and Schultz (1989) find similar results for the effect of education on the effectiveness of contraceptive use. They find that education has a very small effect on the (self-reported) understanding of, and effectiveness in the use of, contraceptive methods which are 'easy' in terms of the information necessary for their use and a limited scope for misuse. On the other hand, education increases understating and effectiveness of methods which are more complex, i.e. methods for which there is a large scope for misuse and no external information, requiring individuals to decipher information gained with experience. The empirical evidence, thus, appears to support the ideas of Welch (1970) and Schultz (1975), according to which education enhances productivity through the capacity to perceive new problems and acquire and decipher relevant information which are used to solve them. However, it should be noted that the extent to which the findings discussed above can be generalised for different economic sectors is not clear. Also, since these studies do not control for ability, the possibility that the observed positive relationship arises due to individuals with higher innate ability choosing to acquire more education cannot be ruled out. More evidence on human capital formation and the role of education in determining productivity, in particular are discussed later in this section.

The studies reviewed above and in Section 2.3 suggest that the development of cognitive skills is the key productivity-enhancing characteristic of human capital. According to this, employers (including foreign investors) should value only cognitive skills. However, there is considerable economic research that indicates that employers also value other characteristics in employees, even though they do not appear to be directly linked to productivity. Bowles and Gintis (1976) and Edwards (1976) report evidence that behavioural traits such as docility, dependability, consistency and persistence are frequently valued more than cognitive skills in low-skill employees. Kuhn and Weinberger (2005) cite more recent evidence from US survey data which finds communication skills, motivation/initiative, teamwork skills and leadership skills as the four most highly-valued skills, followed by academic achievement in the fifth place. Other non-cognitive skills/traits valued by employers are found to be interpersonal skills, flexibility, honesty/integrity and "work ethic". These findings are consistent with data from Britain, where a higher percentage of employers who report skill shortages claim this to be because of workers' "poor attitude, motivation or personality" as opposed to their lack of technical skills (Green et al., 1998).

Theoretically, Bowles et al. (2001a) argue that behavioural traits that are seemingly unrelated to an individual's productivity may actually influence it under conditions of economic disequilibrium and contract incompleteness. In a dynamic economy, they argue, non-cognitive traits such as the degree of risk-aversion, self-directedness and efficacy (i.e. belief that one's actions can determine the outcomes one experiences) can influence the ability of individuals to capture disequilibrium rents. Whilst this combination of behavioural traits, risk-aversion in particular, appears to be especially related to the entrepreneurial ability of individuals, there are also other productivity-enhancing traits which are more relevant to contractual employment under contract incompleteness. Examples of these traits are a low time-discount rate, i.e. attaching a higher value to retaining one's job in the future; high efficacy, i.e. attaching a higher weight to the one's behaviour as a determinant of the probability of retaining one's job; high utility from having a job relative to being unemployed, e.g. experiencing shame from being fired or receiving unemployment benefits. Bowles et al. (2001a,b) develop a model to explain how such behavioural traits, which they refer to as 'incentive-enhancing preferences', cause employees to supply more effort on the job, all others equal. In conditions of incomplete (employment) contracts where the level of employee effort is endogenously determined, employers value these traits and are willing to pay a premium for them. Empirically, the importance of non-cognitive skills for labour market success is supported by Heckman et al. (2006). Accounting for reverse causation, Heckman et al. find that individuals' perception of control they have over their lives (i.e., degree of efficacy) and their perception of self-worth to be positively related to the amount of education an individual acquires and, controlling for the level of their education, also the wages they receive given their schooling decisions. Finally, Brunello and Schlotter (2011) summarise evidence that non-cognitive skills/traits (e.g. motivation) can affect cognitive test scores and therefore argue that these skills are likely to account for part of the effect of cognitive skills on individual labour market success and country level economic growth that has been found in most economic research, as discussed in Section 2.3.

The research analysed above provides information on the types of skills and traits that may affect productivity at individual, firm and economy level. However, this research does not analyse where or how these skills are developed, although frequently it is assumed that the cognitive ones are developed through formal education. Challenging to some extent the role of education, is recent research which suggests that skill-formation is a life-long process which begins from the time when the child is in the womb and it is prone to multiplier effects, making earlier stages in life crucial (Cunha et al., 2006). This view points to a relatively greater role for the family than formal education, and to earlier stages of education compared to later ones. From a policy perspective, however, it may still be the role of formal education that should be particularly analysed because it is this stage where policy interventions are relatively easier and morally justifiable. Hence, it is important to stress that, in addition to the evidence for the relationship between the level of individuals' education and their ultimate productivity reviewed earlier in this section, there is further evidence to suggest that education develops both cognitive skills (Boissiere et al., 1985; Moll, 1998; Heckman et al., 2006) and non-cognitive skills (Heckman et al., 2006) specifically. The precise manner in which schooling develops these skills, however, has been largely neglected by economic research. As discussed earlier, Schultz (1975) hypothesises that schools develop market-relevant critical evaluation and problem-solving skills due to the general properties of the problems that are solved in the classroom. Market-rewarded behaviours, on the other hand, are believed to be reinforced in schools by their virtue of subjecting students to interactions and systems of reward that are similar to those of the workplace (Bowles et al., 2001a). Consistent with this hypothesis, Edwards (1976) has found that the same behavioural traits that are rewarded with higher grades in high schools are also related to the higher positive ratings by supervisors in the workplace.

In summary, the research reviewed in this section suggests that (foreign) firms seeking high productivity advantages rather than cost advantages are likely to be attracted by economies with superior human capital stocks. This market-relevant human capital is comprised of both cognitive and non-cognitive skills which appear to be at least partially developed through formal education. The nature of these skills appears to be related to both the quality and type of education, rather than just the amount of time that individuals spend in formal schooling. As explained in Section 2.3 the development of cognitive skills appears to depend on the quality of the education system, and not just the amount of instructional time. Further, it was argued in this section that individuals who have pursued general education pathways and/or those that possess problem-solving (as opposed to mere knowledge) may be more attractive to (foreign) firms. Skills of problem-solving and critical thinking and traits of self-directedness and efficacy were stressed to be particularly important in a dynamic market economy with constantly changing conditions and high rates of technological change. The value of these skills can be argued to be even greater in the process of transition towards a market economy which involves major and rapid changes throughout the economy. They are also likely to be particularly important to foreign investors who are expected to predominantly employ high productivity strategies. Namely, the ownership-specific advantage which, as discussed in Section 2.2, is considered a precondition for FDI to take place, can be in the form of their ability to raise capital more easily and cheaply than the indigenous firms and/or in the form of advanced technological know-how. To the extent that the foreign investors engage in more capital-intensive production and/or posses more advanced technology, more highly-educated workers increase their affiliates' productivity. On the other hand, as discussed in Section 1.3, it is unclear whether, and to what extent, education under central planning developed the skills that appear to be valued in a market economy which, in turn, has implications for the measures that are appropriate to be used in this context. The next section aims to address this latter question by critically evaluating measures of human capital used in previous FDI research as well as investigating potential new measures based on the theoretical arguments presented in this section and the specific features of human capital in transition economies discussed in Sections 1.3 and 1.4.

4.3 Explaining inward FDI in transition economies

4.3.1 Choosing appropriate human capital measures

Previous empirical research on FDI determinants has used a variety of measures for a country's human capital. The measures most often used in this literature include expenditure on education, wages, labour productivity, unit labour costs, and different measures of the quantity of educational participation or attainment. However, input-based measures of human capital such as expenditure on formal education (per student) or class size appear to be inferior to other direct measures of output (e.g. completion of education) because empirical analyses do not appear to indicate a consistent relationship between the quantity and quality of educational inputs and student achievement (Hanushek, 2003, 2006; Woessmann, 2006). Therefore, the rest of this section focuses on the remaining measures and proposes new ones which have not been previously used in FDI studies.

In a human capital theory framework, discussed in the previous section, an individual's wage level can be used as a proxy for their level of skills. Based on this view, the average level of wages in the destination country has been used as a proxy for the quality of human capital in empirical studies of FDI in transition economies (Resmini, 2000; Rasciute and Pentecost, 2008). However, this simplistic view is based on the assumption of perfectly competitive labour markets with perfect information and complete contracts where, in equilibrium, each worker is rewarded according to her/his marginal productivity. In reality, the wages of workers are affected by a range of factors that are not related to their productivity. The level of wages (across countries) may differ according to other employee-, firm-characteristics, as well as overall labour market characteristics such as the power of trade unions, employment laws, working conditions and non-pecuniary benefits (Eriksson and Pytlikova, 2011; Magda et al., 2011). Moreover, to the extent that wages are market-determined, they are affected by changes in the supply and demand for different types and levels of skill and the differing patterns of employment by occupation and sector reflecting differences in the technological and capital intensity of production (Freeman, 1986). Therefore not only is the average level of wages an imperfect measure of individuals' productivity, it also is unlikely to provide relevant information to foreign investors who are interested in the availability and wages of employees with the specific types of skills they need. In the case of transition economies, especially in the early phase of transition, the effect of labour market changes is likely to be even stronger because of the mismatch between demand and supply for different types of skills as structural change has proceeded, discussed in Section 1.4.

In the theoretical framework reviewed in Sections 2.2 and 4.2, human capital is argued to affect FDI through the enhancement of labour productivity. Apparently based on this proposition, labour productivity in the destination country has been included as a determinant of FDI which may be considered to reflect its human capital. Labour productivity in the FDI literature has either been included in addition to labour costs (Holland and Pain, 1998), or combined with these and included as (real) unit labour costs[29] (Lansbury et al., 1996; Bevan and Estrin, 2004; Carstensen and Toubal, 2004; Serbu, 2005; Bellak et al., 2007). While such an approach is superior to the inclusion of labour costs alone, it remains limited as a means of analysing the effect of human capital on FDI for several reasons. Firstly, labour productivity depends on the quantity and quality of other factors and their combination with labour in the production process. Transition economies, as discussed in Chapter 1, are particularly deficient with regard to the vintage of their capital, level of technology employed and the quality of management, which implies that economy-level measures of labour productivity are even more unlikely to reflect the underlying level and quality of their human capital. Secondly, foreign investors, due to the introduction of advanced technology, new organisational structures and human resource management policies, etc., are likely to be able to raise labour productivity relative to that in indigenous firms. Consistent with this argument, empirical evidence reviewed in UNCTAD (2007, pp. 150-152) suggests that foreign affiliates tend to have higher labour- and total factor- productivity compared to their domestic counterparts. For the reasons explained above, a more direct measure of human capital is to be preferred when analysing its possible effect on FDI. Thirdly,

[29] Bellak (2008, p. 24) explains that "*Real unit labour costs* reflect the wage share in value added; a positive growth in real unit labour costs indicates a decrease in the share of employers' profit in the value added", whereas "*Nominal unit labour costs* are a measure of inflationary pressures caused by rising wages...and (their) increase...does not reflect *per se* a decrease in profitability as this depends on the possibility to shift an increase in wage costs on output prices".

even if productivity would perfectly and solely reflect human capital, from a policy perspective it is more important to analyse what the productivity-enhancing characteristics of human capital are, and how and where they are developed. Given these weaknesses, FDI studies, like empirical research in labour economics in general, have tended to focus mostly on enrolment rates in education (a flow measure), or measures of educational attainment of the population (a stock measure), as shown in the review of studies in Table 3.1. The appropriateness of using such measures in the context of European transition economies is critically appraised in the rest of this section.

The previous section has provided theoretical arguments and empirical evidence on the productivity-enhancing effects of education through the development of cognitive and non-cognitive skills which are valued in the labour market. Hence relatively high levels of educational participation and attainment of the workforce in a country are expected to attract FDI (in higher-value added sectors where a skilled workforce is needed). As discussed in Section 1.3, transition economies were initially considered to be relatively well-endowed with human capital, but there were major concerns raised as transition proceeded about the relevance and quality of the skills acquired and the composition of human capital in terms of the mix of vocational and general schooling. The deficiencies of these education systems discussed previously may have implications for the level and type of FDI that transition economies can attract. In particular, the lack of qualified employees in the field of management and marketing, discussed in Section 1.3 may deter foreign investors, even if there is a highly qualified workforce in general. In a survey of expatriate managers of foreign affiliates operating in transition economies, Suutari and Riusala (2000) find that foreign investors are faced with severe difficulties in recruiting management-level employees and, as a result, relatively expensive expatriate staff may have to be hired. Foreign investors, especially those in sectors that were not developed in the previous system, may also face difficulties hiring technical staff because of the problems of low skill transferability and labour mobility discussed in Section 1.4. These problems, in turn, were argued to be partly caused by the focus of these education systems on vocational rather than general education, discussed in Section 1.3. Their historically greater emphasis on vocational education is also likely to represent a further reason why education systems in transition economies are generally inferior in the development of skills which appear to be valuable in modern dynamic markets. In the previous section it was argued that the productivity-enhancing cognitive skills developed by education are those general skills that allow individuals to perceive and solve new problems based on the ability to acquire and analyse relevant information. Such skills were argued to be particularly important in a dynamic economy by virtue of enhancing ability to adopt new technology and they are likely to be especially important in the context of European transition economies, considering the rapidly changing economic conditions and their outdated technology. However, education systems in these economies, as discussed in Section 1.3, have neglected precisely skills such as independent critical thinking and problem-solving. A deficiency in these skills may be partly attributed to the focus on vocational education (Bowles and Gintis, 1976), but it appears to start even from primary education, as suggested by the PISA scores reviewed in Section 1.3.

The workforce in transition economies is also likely to differ from that of developed economies with regard to their endowment of the market-relevant behavioural traits that were identified in the previous section. Considering that individuals in the centrally planned system had secure jobs and were unlikely to have been subjected to any performance monitoring, this system is less likely to have enforced productivity-enhancing traits such as efficacy and a low time-discount rate. Suutari and Riusala (2000) and Meyer (2001) argue that the lack of performance-related incentives in the previous system left a legacy of low motivation and high shirking among both managers and employees. In addition, this system is also likely to have enforced conformity and docility, traits which would presumably have previously been rewarded in the workplace and more generally in society. Self-directedness, critical thinking and creativity that were stressed in the previous section as traits that enhance productivity in a market economy, on the other hand, were likely to be inhibited or actively discouraged in a planned economy. Consistent with this, expatriate managers in transition economies report that local employees tend to have little self-initiative and are not innovative or willing get involved in planning (Suutari and Riusala, 2000). The education systems of these economies are likely to have played a role in creating this mix of non-cognitive skills. Discussing the role of education in a market economy, Bowles and Gintis (1976) argue that vocational education enforces adherence to rules compared to critical thinking and creativity. However, in the centrally-planned economies such behaviour appears also to have been enforced throughout formal education. In particular, the emphasis on memorising factual knowledge, traditional instruction methods and the authoritarian teaching style adopted, discussed in Section 1.3, are likely to have contributed to the "preparation" of individuals for the workplace of the centrally-planned economy. Regardless of how/where they were formed, the characteristics of the workforce inherited from the centrally-planned economy have implications for the costs of operations in a country borne by foreign investors. Namely, it appears that relatively more time and resources are required for employee monitoring and control; in addition, less autonomy can be given to local employees and more management involvement is required to run an organisation, further increasing labour costs (especially since highly-paid expatriate managers are likely to be hired). Thus, it appears that education systems under central planning neglected the development of productivity-enhancing skills and traits which in a market economy are typically associated with formal education. Moreover, they are likely to have inhibited such characteristics and developed others which in a market economy can have a 'productivity-constraining' effect. The apparent differences between the human capital developed under central planning and that of market economies is likely to have implications the choice of human capital measures in the context of transition, as discussed below.

The initial discussion above appears to suggest that, from a theoretical viewpoint, quantitative measures of educational participation or attainment represent superior measures of human capital in FDI studies compared to wages, labour productivity or unit labour costs. However, the later discussion in this section suggests that the issue of what specific educational measure(s) should be used is more complex.

Some of the contributions in growth theory, discussed in Section 2.2, have provided suggestions about the specific type and/or level of educational qualifications that are more relevant to technology adoption. Suitable measures of the size of technology-supporting human capital have been argued to be the share of tertiary education graduates in sciences and engineering in the workforce (Cosar, 2011) or of graduates of general rather than vocational education (Krueger and Kumar, 2004).

Alternatively, Vandenbussche et al., 2006 argue that the share of the population who have completed less than tertiary education as *sufficient* for 'imitation', as opposed to innovation, activities, though this does not make these secondary education graduates *superior* in terms of technology adoption to tertiary education graduates who are expected to possess higher-level skills. This view appears to be consistent with the empirical evidence presented in Acemoglu and Autor (2012), according to which tertiary education attainment is complementary to higher task complexity. A further implication of the task-based approach of Acemoglu and Autor (2012) for this empirical analysis is that the level of task complexity required should be taken into account in addition to volume and quality measures of human capital. Though, it is not clear how this could be could be (appropriately) operationalised in a macro-level empirical study of inwards FDI in European transition countries. The measures of current skill complexity in the country similar to those used by Acemoglu and Autor for the host economy appear to be flawed in this context because they do not necessarily reflect the complexity of tasks that foreign investors intend to carry out. The most appropriate way to account for skill complexity would appear to be in a firm-level setting where proxies from the parent firm could be used. For aggregated FDI measures, on the other hand, the best way to control for the effect of task complexity appears to be by using industry-level inwards FDI data and investigating the effect of human capital conditional on the level of an industry's technological intensity. This approach is taken in the empirical investigations presented in Chapter 6 of this thesis.

A deeper analysis of the nature of "market-relevant human capital" and its formation provided in the previous section, on the other hand, appears to suggest that the education measure of human capital should be more concerned with the quality and type of skills offered than the actual level of education. In this respect, it appears to be very important to control for the quality of education by the use of direct measures of cognitive skills, as discussed later in this section, or for the type of education provided. Namely, consistent with Krueger and Kumar's (2004) arguments, it appears that, to the extent that general education is superior to vocational education in providing the generic cognitive skills, enhancing creativity and enforcing critical thinking, it provides a more appropriate measure of the stock of human capital. This especially appears to be the case in transition economies where, because of the large, rapid and persistent structural changes in the economy, vocation-specific skills are likely to be depreciating rapidly.

However, the deficiencies of education systems under central planning identified above also raise questions about the appropriateness of using educational measures in general in European transition economies. Namely, if the previous section stressed critical thinking, creativity and efficacy as the valuable ‘productivity-enhancing’ output of education, these education systems appear to have promoted precisely the opposite: acceptance of knowledge as factual, adherence to rules, and lack of self-directedness. In this sense, education under central planning can be argued to have developed traits that appear to be in practice ‘productivity-constraining’ in a modern market economy. This may partly explain the frequent failure of firm-level empirical studies from ex-communist economies to find a positive effect of the level of workforce formal qualifications on firms’ productivity or innovation (Czarnitzki, 2005; Steffen and Stephan, 2008; Nazarov and Akhmedjonov, 2010).

The (in)adequacy of human capital developed under the previous system suggests that the vintage of the stock of human capital should be taken into account when analysing the effect of human capital on FDI. In particular, this would imply that potential foreign direct investors would be more attracted by younger cohorts of graduates that were educated during the transition period in education systems undergoing reform (and presumably more responsive to the market needs) and by the speed of market-based reforms in public education. This argument appears to be in line with the superior performance of young educated employees compared to older ones reported by expatriate managers of foreign affiliates operating in transition economies (Suutari and Riusala, 2000). In addition, foreign investors may be more interested in the skills of younger employees because they are likely to be more flexible with regard to working culture, which would enable easier and more effective introduction of new working practices and organisational structures. This is especially likely to be the case in transition economies, considering their prevailing work norms and culture (discussed in Section 1.4 and in the next section).

Considering the imperfections of quantitative measures of human capital in transition economies discussed above, it would desirable to use other measures of skills in empirical investigations of FDI. These would ideally be measures of cognitive skills of the workforce, i.e. the quality of human capital, rather than just its quantity as measured by educational attainment. The former could be provided by (country-average) scores of international tests such as TIMMS, IALS and PISA, discussed in Section 1.3. Information on the level of functional competence, i.e. ability to apply concepts effectively in practice and to solve real-life problems, measured by IALS and PISA, appear to likely to be especially relevant when measuring productivity-enhancing human capital according to the discussions in this and the previous section. Such direct measures of cognitive skills have the additional advantage of capturing these skills regardless of where and how they are formed. IALS scores, which are based on a sample of the working-age population, can be argued to proxy for the quality of the stock of human capital in a country; however, data on these are only available for a few of the countries covered in this analysis. On the other hand, PISA scores have the disadvantage of only being measured for primary education/secondary education students and do not necessarily reflect the skills of the current workforce, as explained in Section 1.3. Breton (2009) is particularly critical of using this measure in high-income economies with stocks of education expenditure above $40,000 per adult, where most of the investment in formal education occurs in post-compulsory schooling levels. However, this critique is considered to be less relevant to the empirical analyses presented in this thesis for two reasons. First, as explained in Section 4.2, earlier stages of skill development are argued to remain the most important due to multiplier effects. Second, European transition economies are unlikely to have reached the high level of expenditure stock above which, Breton argues, measures of cognitive skills at compulsory schooling level should not be used.

Another, arguably more direct, way to measure the level and quality of skills in an economy is in terms of the actual availability of employees with relevant skills reported by the firms operating there. As discussed further in Section 5.2, such information for transition economies can be proxied by averaging firm-level survey data on the length of the period required to fill a vacancy for a skilled worker. However, it should be noted that this measure, too, has its limitations: using country-average from a sample of existing firms in the economy reflects the current structure and technological level of the economy and as such it does not necessarily provide relevant information for potential foreign investors who may have different employee needs.

In conclusion, this section has argued that the specific characteristics of European transition economies' education systems may make their stocks of human capital relatively less valuable in a market economy and these should to be taken into account when investigating its effect on inward FDI. The effect of the over-emphasis on narrowly-defined vocational training can be accounted for by proxies related to the proportion of the population who have completed vocational, as opposed to general, upper-secondary education. Some of the other deficiencies in terms of the type of skills and traits developed in the pre-transition systems can be partially accounted for by proxies of the vintage of the stock of human capital. Finally, the differences between the education systems of transition economies and those of market economies make it especially important to have other measures of human capital in addition to quantitative educational attainment ones. Accordingly, innovative measures based on international test scores and availability of skilled labour were argued to provide valuable information which could be used to empirically investigate the effect of human capital on inward FDI.

4.3.2 An extended empirical framework for transition

Section 2.2 provided a review of the main theories that aim to explain the patterns of inward FDI. This review identified an extensive range of factors that have been hypothesised to determine the level and type of FDI that a country receives. The most widely-cited determinants include: the level of, or differences in, factor endowments, including that of capital, skills and natural resources; the size of the host market and its access to other markets; communication and trade costs related to transportation as well as artificial barriers to trade; agglomeration economies; distance between the home and host country; common language and culture. However, the generic theoretical framework that can be drawn from these theories fails to reflect some of the specifics of transition from a centrally planned to a market economy[30]. This proposition is supported by the observation that the empirical

[30] Dunning's OLI paradigm (Dunning and Lundan, 2008) represents an exception in that it recognises some of the factors that relate to transition economies more specifically. However, this taxonomy of FDI determinants tends not to provide theoretical justification for many of the determinants. In addition, the relative importance of these determinants is likely to vary with the context of the host and host country, which the OLI paradigm also does not discuss.

literature on transition economies has identified additional determinants of FDI specific to this context, partly through drawing on the literature for developing economies. However, this latter literature also does not provide a coherent and comprehensive theoretical framework for explaining FDI in transition. The rest of this section extends the theoretical framework from Section 2.2 by providing theoretical arguments for the inclusion of transition-specific factors that have been identified in previous empirical research. In addition, the section provides a discussion of FDI determinants identified in the generic FDI theory, discussed in Section 2.2, which could have a relatively more important role to play in the context of transition.

Following the work of Lucas (1990) and Jun and Singh (1996) on developing economies, the literature on transition economies has recognised high levels of political and macroeconomic risk as potential determinants of FDI (Bandelj, 2002; Kinoshita and Campos, 2003; Carstensen and Toubal, 2004; Fung et al., 2008; Furceri and Borelli, 2008; Leibrecht and Scharler, 2009). The former could deter foreign investors from investing in a country because of a potential failure to reap the returns on their investment due to disruption of their activities in the case of political instability. The latter could deter foreign investors because it increases uncertainty, making it more difficult for them to plan long-term and predict the market demand for their goods. However, in addition to the uncertainty stemming from macroeconomic factors which can affect FDI, there is additional inherent uncertainty in transition economies. Transition is associated with changes in the legal and regulatory framework (e.g. labour market regulation and property rights), government policies (e.g. pattern and level of taxation) and fundamental changes in the whole economic system, i.e. the establishment of new institutions appropriate for a market economy.

This uncertainty effect appears to be one of the reasons why the speed of reform needs to be taken into account when investigating FDI in this group of economies. As discussed in Section 2.2, the importance of the quality of the economic system and its institutions, policies and legal environment as crucial location factors is stressed by Dunning's OLI paradigm (Dunning and Lundan, 2008). The empirical literature on FDI in transition has tended to contextualise these factors in terms of the extent of the rule of law (Kinoshita and Campos, 2003; Kaditi, 2010); progress in institutional and legal reform towards a market economy (Carstensen and Toubal, 2004); or level of regulatory quality, government effectiveness and control of corruption (Kaditi, 2010). Underlying this approach is the argument of North (1990) about the importance of a clear and business-friendly legal framework and the institutions which ensure the rule of law lays in facilitating economic interactions by "setting out the rules of the game" of a market economy. Lack of these, on the other hand, increase uncertainty and contract enforcement costs (Meyer, 2001). In addition, weak institutions can be associated with corruption which is conventionally argued to further increase uncertainty and the costs of foreign investors in the country (Schleifer and Vishny, 1993) and hence deter them from investing. Nevertheless, corruption has been argued to potentially be less of a deterrent in the transition context if it serves to bypass regulations and institutions from the previous system which are not appropriate for a market economy, even though it still increases costs and uncertainty (Meyer, 2001). More generally, in addition to the quality of institutions and speed of reform, foreign investors are likely to be influenced by the level of economic liberalisation a country has reached (Heriot et al., 2008). Namely, they are likely to prefer countries where the government both protects the freedom of economic agents (e.g. free movement of goods and capital, property rights), and refrains from distorting it (e.g. through corruption and excessive bureaucracy). Related to this is another factor specific to transition: the extent of privatisation of state/socially-owned enterprises, especially that of state-owned monopolies. As discussed in Section 1.2, government policies with regard to the method and speed of privatisation may be able to influence FDI both directly through determining the opportunities for foreign investment to take place (e.g. sale vs. management and employee buy-out), and through signalling to foreign investors the level of commitment to establishing a market economy.

Finally, FDI theories reviewed in Chapter 2 recognise language and institutional and cultural proximity as factors that facilitate communication, decreasing transaction costs and hence positively influencing inward FDI. In this context there are likely to be differences between market economies and transition economies specifically due to historical reasons. Firms in the centrally-planned system operated in an environment where the availability and price of production resources, the type and level of output supplied and the price and buyer of this output were set by a state-established central plan. In such an environment, the role of the managers was quite different from that of their counterparts in a market economy and there was little incentive to provide quality products and ensure customer satisfaction (Suutari and Riusala, 2000). Therefore, once the market reforms began, local businesses and their managers lacked the experience and knowledge required to operate effectively in a market economy. This can deter foreign investment in transition economies because, among others, it increases the negotiation costs of the foreign affiliate (Meyer, 2001). This type of uncertainty, however, is expected to decrease as transition progresses as managers/employees of indigenous firms gain knowledge of operating in a market economy, both through formal business education and on-the-job experience and due to spillovers from foreign investors. Another major type of uncertainty related to investment in transition economies, Benacek et al. (2000) argue, is that which stems simply from foreign investors' lack of experience in operating in these economies, considering that the majority of them had virtually no FDI prior to the transition process. This type of uncertainty is, too, likely to be reduced with time, the speed of this process depending on level of investment undertaken in earlier periods. Hence, in this sense, the effect of previous FDI in the country, discussed in Section 2.2, is likely to be stronger in the context of transition economies compared to other countries, which makes it especially important to control for previous foreign investment in the country.

Another related determinant of FDI that can be argued to be especially relevant in European transition economies is the presence of ethnic networks. Recent economic research suggests that the presence of migrants from the host country (i.e. foreign investor's destination) in the source country (i.e. source of foreign investment) has a positive effect on the host country's level of FDI inflows (Kugler and Rapoport, 2007, 2011; Javorcik et al., 2011). Based on the international trade literature, this research argues that the presence of ethnic networks serves to overcome informal barriers such as those related to language and culture, and to reduce information asymmetry that the foreign investor faces when investing abroad (e.g. regarding consumer preferences, contract negotiation and enforcement). Similar to the arguments about agglomeration economies, it is argued here that the presence of ethnic networks can be especially relevant in the case of European transition economies. First, foreign investors, which tend to be from developed countries, are faced with a higher level of information asymmetry because they have had no, or little, economic relations with European transition economies during the previous system. Second, foreign investor are faced with different (or lack of) business experience of local firms, different work norms of employees, and a different- and changing- institutional framework, as a result of which more local knowledge is likely to be required.

Finally, the level of infrastructural development, which appears to be "taken for granted" in developed economies, is frequently included as determinant of FDI in empirical studies of developing and transition economies (Urata and Kawai, 2000; Campos and Kinoshita, 2003; Palit and Nawani, 2007; Bellak et al., 2009). Bellak et al. (2008) argue that the level of development of transport and communication infrastructure is typically lower in transition economies than in developed economies and it can directly affect the level of productivity that foreign investors can achieve in a host country. As such, the extent and quality of the infrastructure affects the potential profitability of locating in a host country and should be taken into account in empirical analyses of FDI in transition countries.

Thus, empirical studies of FDI in transition economies, in additional to generic FDI determinants, should take into account the political and economic risk associated with operating in these countries and institutional factors such as the legal framework and rule of law, corruption, the speed of the reform, the method and speed of privatisation, and the level of economic freedom. Also, the business experience of indigenous firms and the experience of foreign investors in operating in a transition economy should reduce the latter firms' transaction costs, so FDI should be expected to increase with time and with the level of previous FDI. Finally, the level of physical infrastructure, both in terms of transportation and communication, can affect the profitability of foreign investment and should be taken into account.

4.4 Conclusion

This chapter has argued that firms seeking to gain a competitive advantage through higher productivity should prefer employees with more human capital, and this is especially likely to apply to foreign investors. However, the productivity-enhancing effect of human capital is likely to attract FDI only to the extent that it is translated into firm profitability, i.e. it is not fully paid for. The human capital valued in the labour market appears to consist of both cognitive- and non-cognitive skills, at least partly developed through formal education. Further, this chapter has argued that the characteristics of human capital that are productivity-enhancing in a market economy are likely to be even more important in a transition context. On the other hand, it has been argued that education under central planning differed in many respects to that of market economies and is likely to have produced inadequate and inappropriate skills for such economies. Hence, it was argued that measures of human capital in transition economies should take into account the proportion of general vs. vocational educational attainment and the vintage of the human capital stocks of transition economies. For the same reasons, the chapter has argued that, in transition economies, it is the participation rates of younger cohorts in education and the quality of that schooling that are likely to be relatively more important to foreign investors. Further, considering the imperfections of measures of education in these economies in particular, the chapter proposes additional measures of human capital which measure directly the level of cognitive skills and the availability of skilled labour. Finally, the chapter has identified FDI determinants which are either specific to transition, or likely to have a more pronounced effect in this context: economic and political risk, institutional factors, physical infrastructure and previous FDI in the country. The analyses in this chapter will be used to specify the models for the empirical investigations to be undertaken in Chapters 5 and 6.

Chapter 5

Contents

5.1 Introduction

Chapter 2 of this thesis provided an overview of theory which has served to identify country-specific locational factors that are expected to determine inward FDI and assessed theoretical arguments (based on growth theory) for human capital being one of them. However, a review of empirical studies in Chapter 3 found only limited support for the hypothesis that a country's human capital endowment positively affects the levels of FDI it receives. The review of empirical evidence in Section 3.2 revealed inconclusive results, whilst the meta-regression analysis presented in Section 3.3 failed to find an overall 'genuine' effect of human capital on FDI. One potential explanation for these findings has been argued to be the lack of a sound theoretical framework to link human capital to FDI, resulting in potentially mis-specified empirical models in many of the previous studies. Accordingly, the discussion presented in Section 4.2 analysed in more detail the possible mechanisms underlying the relationship between human capital and FDI with the aim of providing guidelines for an empirical investigation and Section 4.3 provided a contextualisation of this discussion for European transition economies. Based on the analyses presented in Chapters 2 and 4, this chapter specifies an empirical model to estimate the effect of human capital on FDI in European transition economies and reports the results from various panel estimators, using different human capital and FDI measures.

The rest of this chapter is organised as follows. Section 5.2 provides a critical discussion of the choice of measures for the empirical specification which draws on the analyses undertaken in Chapters 2 and 4. Section 5.3 discusses the choice of estimation techniques to be used in this investigation. The diagnostic tests and empirical findings from different estimators are presented in Section 5.4, while a robustness check of these models estimated in a stock adjustment framework is conducted in Section 5.5. The last section summarises the results and provides guidelines for the further empirical work presented in Chapter 6.

5.2 Specification of the variables and data

5.2.1 The dependent variable(s): FDI measures

The theoretical analyses in Sections 2.4 and 4.3 provided a number of potential determinants of inward FDI to be used in this empirical investigation. In the empirical analyses presented later in this chapter, both FDI flows and stocks are used as the dependent variable. The definitions of these measures and the appropriateness of using each of them in this empirical investigation are discussed in the rest of this sub-section.

The initial dependent variable in the investigation is the level of net annual FDI inflows (measured in current USD)[31] provided by UNCTAD (2010b), based on IMF's Balance of Payments Manual 5 (IMF, 1993) and OECD Detailed Benchmark Definition of FDI (OECD, 1996). As explained in Section 1.2, according to this definition FDI inflows recorded in the balance of payments include both the initial transaction as well as subsequent transactions between the foreign investor and its affiliates. Accordingly, the FDI inflow data used here include the following components: new equity capital of the enterprise purchased by the foreign investor; the part of the affiliate's reinvested earnings accruing to the foreign investor; and intra-company loans between the foreign investor and its affiliate (UNCTAD, 2010b). Bellak et al. (2008) argue that a flow measure of FDI is more appropriate for empirically investigating FDI determinants in European transition economies because: a stock measure may change due to changes in valuation of already existing stock; a flow measure typically includes reinvested earnings; and the role of local financing (which would be reflected in the stock measure) is typically low in host European transition economies.

Data on FDI inflows in UNCTAD (2010b) is presented on a net basis, i.e. as the difference between credits and debits in the capital transactions between the foreign investor and its affiliate enterprise (IMF, 2009, pp. 107-8). Effectively this means that divestment in the form of repatriated profits, loans to parent enterprises or repayment of inter-company loans are deducted from new FDI inflows[32]. As the purpose of this analysis is to explain investment decisions in terms of locational factors, and these forms of divestment are unlikely to be explained by such factors

[31] The use of USD is not expected to affect the results because any changes in the valuation of stocks that may exist due to exchange rate variability are picked up by the time dummies since they are expected to be universal across countries. The 'universality' of ER shocks is automatic in the case of the countries that have the same currency, i.e. Euro, and those whose currencies are pegged against the Euro; and it is expected to hold also for countries with floating exchange rates assuming that their exchange rates with the Euro and US Dollar will move together due to arbitrage effects.

[32] In the case of banks, however, deposits, bills and short-term loans between the direct investor and its affiliate are excluded (UNCTAD, 2010b).

except for the share of reinvested profits, *gross* FDI inflows appear to be the more appropriate measure. However, this measure could not be used because it is not reported by UNCTAD. Other concerns related to the FDI measure are those related to the comparability and overall quality of FDI data are discussed below.

Comparability of FDI data can be hampered if there is discrepancy between the reporting practices of individual countries or the threshold for distinguishing direct investment from other investment, i.e. if the 10% threshold recommended by IMF and OECD is not adopted (Duce, 2003). The first type of problem usually happens due to lack of data on reinvested earnings, since these do not involve cross-border transactions and FDI data is usually collected primarily from foreign exchange records of central banks (Zhan, 2006). However, this appears to be less of a problem for the sample of countries used in this investigation. Fujita (2008, p.112) records that in 2006 all the countries included in this sample report all components of FDI, except for Albania which does not report reinvested earnings. Another concern with FDI inflow data is the overestimation that may result from the so-called 'round-tripping' or 'trans-shipping' which is not translated into economic activity in the host country, but is channelled either back to its originating country or to a third country through special purpose entities (UNCTAD, 2006). UNCTAD (2006, 2007 and 2010a) provides examples of countries where round-tripping is believed to be account for a significant portion of FDI, among which are transition economies such as China and Russia but none of the European transition economies included in this empirical analysis.

Dunning and Lundan (2008) further note that FDI (stock and flow) data merely represent a proxy for the direct activities of foreign investors, because their foreign-based affiliates also use financing from other sources and are involved in non-ownership-based activities. Though in the case of transition economies which, as discussed in Sections 1.2 and 4.3, were/are relatively capital-scarce and where local firms do not have the experience of operating in a market economy, these factors are likely to be relatively less distorting. A bigger concern in this study, however, is the use of aggregate measures of FDI. In Chapter 2 it was argued that the determinants of FDI vary depending on foreign investors' motivation and/or sector of economic activity. Hence, use of aggregated FDI data at country level is likely to be the single most important limitation of macro-level studies of FDI determinants. Therefore, in empirical analyses presented in this chapter proxies are used to control for FDI in the primary and financial sectors where, as argued in Section 6.3, the effect of human capital is likely to be relatively small.

Finally, some empirical studies of FDI determinants use stock data in a partial stock adjustment framework where foreign investors adjust their stock of investment towards their equilibrium or desired level (Jun and Singh, 1995; Cheng and Kwan, 2000a; Kinoshita and Campos, 2006; Riedl, 2010). Similarly, Bajo-Rubio and Montero-Muñoz (1999) and Martinez-Martin (2009) argue that stocks are a better measure of FDI, based on the assumption that foreign investors' strategies are long-run phenomena which may not be properly captured by (relatively volatile) annual investment.

Cheng and Kwan (2000a) also favour stocks as a better measure of FDI, though on the grounds that profitability of investment depends on "the marginal return to capital, which is generally a decreasing function of the stock of capital" (p. 382). However, considering the agglomeration effects that are expected in the case of FDI, discussed in Section 2.2, and the potential effect of the experience of foreign investors gained in a transition context, discussed in Section 4.3, it is also plausible that, in the time period under discussion, the marginal return to (foreign) capital is an increasing function of the previous stock. Thus, whilst not necessarily in the manner originally proposed by Cheng and Kwan, previous FDI stock is likely to be relevant for current investment.

Another argument in favour of using FDI stocks as the dependent variable is provided by Dewit et al. (2009). According to these authors, stock measures of FDI are preferable to flow measures when estimating the effect of independent variables that "adjust only in the medium or long run" because flows are short-run measures which tend to fluctuate heavily (Dewit et al., 2009, p. 102). This argument appears to be particularly relevant for the empirical investigations in this thesis, considering that the human capital measures used are likely to change slowly over time, as explained in the rest of this chapter.

Based on the above arguments in favour of a stock measure, both types of measures of FDI are used in this chapter's empirical analysis. Before undertaking this analysis, however, the correlation between stock and flow measures was checked both across countries and for each country individually across time. Across countries, current flows of FDI appear to be very highly correlated with both current and lagged stocks of FDI[33], as suggested by the (average) correlation coefficients of 0.9 and 0.85, respectively. These correlations appear to suggest that there are increasing short-run marginal rates of return to capital, as inflows appear to be larger in countries that already have large stocks of FDI. This is also suggested by the positive correlation between flows and (current and lagged) stocks of FDI across time, though the magnitude varies in different countries (Table 5.1 below).[34]

Table 5.1: Correlation between FDI flows and stocks

	Stocks	Lagged stocks
Across countries (average 1994-2008)	0.9	0.85
Within countries (1994-2008)		
Albania	0.97	0.96
Bosnia and Herzegovina	0.73	0.54
Bulgaria	0.94	0.97
Croatia	0.88	0.91
Czech Republic	0.51	0.39
Estonia	0.88	0.84
Hungary	0.67	0.48
Latvia	0.66	0.48
Lithuania	0.78	0.72
Macedonia, FYR	0.73	0.62
Poland	0.87	0.68
Romania	0.97	0.89
Slovak Republic	0.44	0.31
Slovenia	0.55	0.4

Source: Own calculations based on UNCTAD (2010b)

[33] Correlations of FDI inflows with the previous year's stock is also estimated because of expected agglomeration economies (discussed in Section 2.2)

[34] In countries such as Albania, the correlation is exceptionally high, partly because the initial stock of FDI is very low.

In the following empirical analysis, specifications with FDI stocks as a dependent variable are estimated as a robustness check and the results presented in Section 5.5.

5.2.2 Human capital measures

The results of the meta-regression analysis presented in Section 3.3 suggest that the estimated effect of human capital on inward FDI is smaller in transition economies compared to any other sample. It was argued there that this finding may be due to a lower quality and/or relevance of the skills developed under communism in a market economy (discussed in Sections 1.4 and 4.3) or alternatively by the choice of human capital measures employed in FDI studies in transition economies. Therefore the rest of this section provides a critical review of the human capital measures for which comparable data is available to inform the choice of measure(s) in this empirical analysis. The possible ways to control for the characteristics of education provided under communism that may affect an expected conventional relationship between human capital and FDI are also considered.

Table 5.2 below presents the measures of human capital available for European transition economies. Measures referring to literacy rates and enrolment and completion rates at primary/compulsory education level are unlikely to be able to discriminate between levels of human capital in European transition economies because these are universally high across countries and across the period covered in this study (see Appendix 5.1 for the descriptive statistics). Therefore, measures related to non-compulsory, i.e. upper-secondary and tertiary, education appear to be more appropriate in this context. The choice of secondary education variables appears to be in contradiction with the MRA results (Section 5.3) which suggests that the use of such measures yields lower estimated effects on FDI. However, as argued in Section 5.3, this may be due to differences in the exact education level (e.g. lower-, upper-, or all secondary education) or differences in the type of secondary education provided (e.g. quality, mix of general-vocational education, or duration of studies) and there seem to be no theoretical rationale for secondary education being less valued by foreign investors compared to other levels of education.

Table 5.2: Human capital measures for European transition economies

Source/Measure
WDI (2010)
Literacy rate
UNESCO (2010)
Gross- and net- enrolment rate in primary education (ISCED 1)
Gross- and net- enrolment rate in secondary education (ISCED 2+3)
Gross- and net- enrolment rate in tertiary education (ISCED 5+6)
UNICEF (2010)
Gross enrolment rates in compulsory education (ISCED 1+2)
Gross enrolment rates in upper-secondary education (ISCED 3)
Gross enrolment in general upper-secondary education
Gross enrolment in vocational/technical upper-secondary education
Students enrolled in tertiary education (ISCED 5+6)
Students enrolled in tertiary education per 100,000 inhabitants
Barro and Lee (2010)
Percentage of population who have completed primary education
Percentage of population who have completed secondary education
Percentage of population who have completed tertiary education
Average number of years of schooling attained by population
Hanushek and Woessmann (2009a)
Level of students' cognitive skills
Share of top-performers in cognitive skill tests

Note: UNESCO's (2006) International standard classification of education (ISCED) classifies levels of education as follows: pre-primary (0); primary (1); lower-secondary (2); upper-secondary (3); post-secondary non-tertiary (4); tertiary, first stage (5); and 6 tertiary, second stage (6).

As discussed in Section 3.2, previous studies tend to represent a country's human capital by only one measure of human capital, however this does not appear theoretically justified. The inclusion of different measures can identify the relative importance of different types/quality/levels of skills to foreign investors. For instance, following the work of Hanushek and Woessmann (2009a), the effect of direct measures of cognitive skills vs. level of education attained can be compared. Similarly, following the work of Vandenbussche et al. (2006), Soukiazis and Cravo (2008), Di Liberto et al. (2011), Cosar (2011) and Acemoglu and Autor (2012) in economic growth theory, the (relative) effect of specific levels of education can be compared. Accordingly, in the empirical analyses presented in this thesis two volume measures of human capital are included in the baseline model, which is later augmented with other measures, as discussed in the rest of this chapter. Following the contribution of Acemoglu and Autor (2012), the level of task complexity can be argued to be an additional human capital variable in the empirical analyses in this thesis. However, a proxy for task complexity similar to Acemoglu and Autor's does not appear to be available for European transition economies. Moreover, as argued previously in Section 2.3, it is not clear that such a task-based approach is appropriate in a macro-level FDI study.

As for the choice between stock measures which refer to the population residing in a country and flow measures which refer to (annual) enrolments in education, it appears that the former provide a more appropriate measure for human capital endowment because they provide information on the total amount of formal education (i.e. human capital) that is potentially available for employment (Le et al., 2005; Islam, 2009) and not just the cohorts that are currently being educated. Considering the arguments above, the human capital measures considered in this study are the percentage of population (aged over 15) who have completed secondary education, and the percentage of population (aged over 15) who have completed tertiary education (***TERTedu***), *as their highest level of education*[35]. However, first it should be noted that this secondary education measure as defined in the original Barro and Lee (2010) appears to be an imperfect measure of the percentage of population who have completed secondary education because it excludes the portion of population who have completed secondary education and have continued to complete tertiary education. In this case, a *higher* value of share of population with secondary education in a country could arise merely because a smaller percentage of the population have completed also tertiary education, thus actually representing a *lower* level of human capital. Accordingly, a new measure is calculated as the sum of the percentage of population who have completed secondary education and that of the population who have completed tertiary education which

[35] As this measure refers to the highest level of education attained, the use of the percentage of population who have completed primary education as a human capital measure would be very misleading in the case of European transition economies where educational attainment is generally high. Namely, in this context where the proportion of population without any education is uniformly low (Barro and Lee, 2010), a higher percentage of population who have completed primary education would actually mean that a smaller proportion of the population have completed higher levels of education, i.e. it would represent a lower level of human capital.

will be used to measure ***the total share of population who have completed secondary education*** (***SECedu***). However, further problems/limitations remain with the Barro and Lee education data.

First, they do not provide data on the development of human capital outside of formal schooling, which is expected to account for a significant proportion of human capital for two reasons. As explained in Section 4.2, research argues that skill formation starts early in childhood and this age is important because skill formation exhibits multiplier effects. In addition, evidence suggests that formation of both cognitive, and non-cognitive, skills continues after formal schooling (Heckman et al., 1999; Brunello and Schlotter, 2011), which appears to represent a major limitation of these measures. This limitation could be overcome to some extent by adding a proxy for the level of at least formal training, but such data do not appear to be available for the sample of European transition economies investigated here.

Second, education data presented in Barro and Lee (2010) are not (necessarily) observed values of the variables, but estimates of these through backward or forward extrapolation based on benchmark data available from censuses/surveys and enrolment data. As a result, the data suffers from measurement error, which introduces a new component into the error term. The correlation of the error term and the explanatory variables, in turn, can cause biased and inconsistent estimates (Gujarati, 2004, pp. 526-27; Baum, 2001, pp. 216-17). Accordingly, the use of (previous versions of) Barro and Lee data have been argued to cause bias in economic growth regressions, especially when differenced values are used (Krueger and Lindahl, 2001; de la Fuente and Doménech, 2006; Cohen and Soto, 2007; Portela et al. 2010). However, in the most recent version of the data this measurement error has been reduced and the reliability of the data, both in levels and in changes, has been shown to have improved (Barro and Lee, 2010, p. 4, 12-13). Considering this, and the lack of other (superior) sources of stock education variables for the sample of countries covered in this sample, the data of Barro and Lee (2010) appears to be the best available dataset for the purpose of this empirical analysis.

Finally, as Barro and Lee (2010) only provide data in 5-year intervals, an estimation of the between-values is needed in order enable the use of the maximum number of possible observations in this empirical investigation. As the “true” missing values are unlikely to be more related to any other variables than to the actual data points available, interpolation of the data was considered to be more appropriate than multiple imputation based on other variables. Linear interpolation based on the time variable also seems a reasonable solution since ***SECedu*** and ***TERTedu*** are stock variables which vary smoothly over time and are typically expected to follow an increasing trend. Hence, constant growth of these variables within the 5-year periods was assumed and the between-values were obtained by linear interpolation[36]. This practice was previously used with Barro and Lee data by numerous studies (e.g. Chen, 2004; Apergis, 2009; Seck, 2009; Shirotori et al., 2010). However, it is recognised here that this procedure exacerbates the measurement error already present in the Barro and Lee data and the potential endogeneity bias that this could cause.

The analysis in Chapter 4 suggests that general (upper) secondary education is likely to be superior in developing the type of skills that appear to be valuable in a modern market economy. In this sense, it may appear that Kinoshita and Campos (2003) chose an appropriate measure for human capital: the enrolment rate in *general* secondary education. However, in addition to referring only to current students, the use of this measure alone is also unlikely to be a good measure of the total human capital endowments of a country by virtue of totally disregarding vocational/technical enrolments. An overview of the data on upper-secondary enrolments by type of education in Section 1.4 revealed considerable variation in the general-vocational mix of upper-secondary provided both across countries and across time (which is not necessarily related to changes in total enrolments). This means that the use of general (or vocational) secondary measures alone could seriously distort the estimated effect of human capital on FDI. Based on general secondary figures, for instance, Hungary one of the fastest reformers and a country attracting relatively higher-value added FDI (Ernst & Young, 2011) but with a high share of vocational enrolments, is relatively less endowed with human capital compared to Albania which is a relatively poor performer but has drastically expanded general education at the expense of vocational education. This becomes a problem once it is recognised that the mix of education provided is unlikely to be exogenously

[36] The interpolation was conducted using the *ipolate* command in Stata, whereby ***secedu*** and ***tertedu*** are specified to be a function of the ***time*** variable. This essentially fits a linear trend between each two observed years, i.e. here between years 1995 and 2000, 2000 and 2005 and 2005 and 2010.

determined. Namely, it is reasonable to expect that the “survival” of vocational education in Hungary is observed because the skills it provides are demanded by the labour market which, in turn, may potentially be attributed to the successful reform of its education system. This is consistent with evidence of changes within vocational education programmes (e.g. substitutions of engineering programmes with business ones) discussed in Section 1.4 in the few European transition countries that have maintained relatively high shares of vocational enrolments. Considering the arguments above, ***the general-vocational ratio at the outset of transition*** (***genvocratio***), and not throughout the whole period of study, is used here as a control for potential effects of the mix of education. The ratio of general-to-vocational enrolments is calculated using data from the TransMONEE database (UNICEF, 2010).

The analyses in Section 4.3 also suggest that the communist education systems differed from those of developed economies in many ways and they may have developed skills and traits that may be irrelevant or even ‘productivity-constraining’ in a modern market economy. Therefore, it may be especially important to consider the ‘vintage’ of human capital stock in the case of European transition economies because foreign investors may value human capital developed under communism relatively less than that developed during transition in a (presumably) reformed and more market-responsive education system. To control for potential vintage effects, two proxies were developed aiming to represent the percentage of the workforce that was (at least partly) educated after the beginning of transition. The first proxy, ***edutr1***, is a ***time-invariant variable representing the share of population aged 16-30 in a country’s working age population in 2008***, considering that these generations were educated in the communist system only up to (lower) secondary education (i.e. up to age 14) or less using WDI (2010) data[37]. The second proxy, ***edutr2***, is a time-variant variable calculated as ***the share of population who were educated in the communist system only up to age 12 or less in a country’s working***

[37] This variable was calculated by dividing population aged 0-14 at the outset of transition (year 1992) by the population aged 15-64 in 2008. Because data was available for the age group 0-14 as a whole, this variable could not be calculated for earlier years because this would also capture generations educated under the communist education system, e.g. those aged 0-14 in 1986 include individuals who were 14 in 1986 and thus completed education before transition began.

age population in the respective year using Barro and Lee's (2010) and WDI (2010) data[38].

Further, it was argued in Chapter 4 that traditional measures of educational attainment are imperfect because they fail to account for differences in the quality of education provided and the formation of cognitive skills that takes place outside formal education. In this respect, it was argued that direct measures of cognitive skills may provide more relevant information on a country's human capital to potential foreign investors. Accordingly, ***a standardised measure of cognitive skills (cognitive)*** developed by Hanushek and Woessmann (2009a) from maths and science scores in International Student Achievement Tests (such as PISA and TIMSS discussed in Section 1.4) is also used in this analysis[39]. This measure was chosen as opposed to individual PISA and TIMSS scores in order to maximise the sample size, since some European transition countries have participated in only one of the studies[40]. As there is only one observation per country available for the standardised measure of cognitive skills, the level of cognitive skills (and quality of education it proxies) is effectively treated as time-invariant. This is a limitation because, as discussed in Section 1.4, there is considerable variation in some of the transition economies' scores (e.g. Bulgaria and Poland), despite the general expectation that educational reform is likely to take considerable time to take affect educational outcomes. From an empirical point of view, the estimation of this variable may become a problem if fixed effects estimators are used, an issue which is addressed later in Section 5.3.

As explained in Chapters 1 and 2, it has been previously argued that the share of students performing at the top end of the distribution in International Student Achievement Tests, i.e. those that can thoroughly evaluate information, is of

[38] First, the population in the relevant age groups in years 2000, 2005 and 2010 (15-20, 15-25 and 15-35, respectively) were obtained from Barro and Lee (2010) and divided by the working age population (WDI, 2010) in the respective years. Then linear interpolation was used to obtain the annual values for the period 2000-2010.

[39] The international tests used by Hanushek and Woessmann (2009) include: First International Mathematics Study (FIMS); First International Science Study (FISS); Second International Mathematics Study (SIMS); Second International Science Study (SISS); Third International Mathematics and Science Study (TIMMS); Programme for International Student Assessment (PISA). Though, the countries covered in this sample have participated only in (one or both) of the last two.

[40] The International Adult Literacy Survey (IALS) scores were argued in Chapter 4 to represent an even more appropriate measure of cognitive skills for the purpose of this analysis since it is based on a sample of working-age population, however this could not be used as only four European transition economies were included.

particular importance in a knowledge-based economy. An analogous measure for the workforce of a country may be particularly important to foreign investors to the extent that they are able to attract the most able individuals, an assumption that appears to be reasonable considering that they pay higher wages than their local counterparts, as explained in Sections 1.2 and 2.3, Accordingly, another variable from Hanushek and Woessmann (2009a), the share of top-performers[41] in a country, ***top***, is used as an additional measure of human capital which is intended to proxy for the share of individuals at the top of the skill distribution of the workforce.

Finally, as discussed in Chapter 4, a new measure of human capital is proposed in this analysis which provides information on the balance between the demand and supply of skilled workers. This measure, ***vacancy***, is calculated as ***a country-average of the length of period required for filling a vacancy for a skilled worker as reported by firms already operating in the economy*** in EBRD-World Bank's Business Environment and Enterprise Survey (BEEPS, 2002, 2005; interpolated for in-between years in the same manner as the Barro-Lee data on education). Vacancies for skilled workers as opposed to those for managers and professionals were chosen because it was considered that these workers are likely to be more relevant to foreign investors. This argument is based on the assumption that it is relatively easier and/or inexpensive for foreign investors to hire expatriates in the top-management positions which are fewer in number; and that the category of professional workers is likely to be dominated by teachers and doctors, professions which are unlikely to be relevant for a foreign direct investor in the manufacturing sector. However, as explained in Section 4.3, this skilled-worker vacancy duration measure is limited in that it depends crucially on the current structure of the economy and the technological level of the firms currently operating on the economy and may not necessarily reflect the availability of type of skilled employees that foreign investors seek. This problem is partly addressed in the next chapter by calculating specific values of this variable for each industry.

5.2.3 Control variables

The review of generic FDI theories in Chapter 2, in conjunction with the discussion of the transition context in Section 4.3, have identified a range of factors that are

[41] Hanushek and Woessmann take a score of 600 points or one standard deviation above the OECD mean as a threshold for superior performance.

theoretically expected to affect FDI inflows in European transition economies. Drawing on these discussions, a list of key control variables to be included in the model is now provided, together with a critical discussion of the respective measures available. Due to degrees of freedom considerations, an attempt was made to keep the number of controls in the model as small as possible, which has also sometimes affected the choice of controls and/or measures used for them.

The level of labour costs was recognised by many FDI theories reviewed in Section 2.2 as a potential determinant of the profitability, and hence, location decisions of foreign investors[42]. In Section 4.3 it was further argued that the effect of the level and quality of human capital in a host economy is expected to attract foreign investment to the extent that its relative cost is not higher than in other economies. Therefore, the cost of labour is controlled for in this empirical investigation using ***the average gross wage paid in the host country, wage***, as reported by WIIW (2011). As explained in Section 1.4, this measure has the disadvantage of excluding non-labour costs (e.g. contributions to social security) and therefore does not account for the whole amount of labour costs borne by the foreign investor. However, in the absence of data for European transition economies on any alternative measures, the average gross wage is used here as a measure for labour costs. In empirical analyses with a focus on the relationship between the availability of *skilled* labour and inward FDI, an average wage measure is imperfect because it does not necessarily reflect the price of skilled labour, particularly if there are skill shortages in a country. ***The distribution of earnings as measured by the Gini coefficient, gini*** (UNICEF, 2010), was initially used in this empirical investigation as a proxy for the relative wages of skilled labour. This was done following arguments and empirical evidence according to which the increase in the premium of skill and educational attainment during the transition period, i.e. the decompression of wages discussed in Section 1.4, was the main factor driving the widening of wage differentials in transition economies (Orazem and Vodopivec, 1997). However, upon reflection it was decided that this is an imperfect proxy because higher earnings inequality may reflect the *relative wages* of skilled workers, which it was intended to proxy, but will also reflect the

[42] As explained in Section 4.3, labour costs have been sometimes used as a proxy for human capital, however this was argued to be inappropriate and therefore in this analysis it is considered as a control variable.

proportion of skilled workers in the workforce, and therefore it effect is a priori ambiguous.

The size of the host market was identified in Section 2.3 as one of the key determinants of inward FDI, in particular in the case of market-seeking investment. In empirical studies this has been measured either by a country's size of population (Meyer, 1996) or GDP (Furceri and Borelli, 2008), or by market growth, i.e. growth rate of GDP (Agiomirgianakis et al., 2006). Alternatively, or in addition, GDP per capita levels have been used as a measure of purchasing power of the population (Furceri and Borelli, 2008). In the empirical analyses in this thesis, the size of the host market is measured by its level of GDP, ***gdp***.

Some authors argue that foreign investors may not be only interested in the host country's market, but also its *access to other markets* (Head and Mayer, 2002; Carstensen and Toubal, 2004). Taking into account the size of the adjoining countries seems to be especially relevant in the empirical analysis presented in this thesis considering that the sample is mostly comprised of small and highly open economies. Carstensen and Toubal (2004) have done this by using the host country's *potential market size*, measured as an average of the host market and its neighbouring markets weighted by the inverse of the costs of transportation between them. A similar measure, but using the distance between countries' capitals in lack of data for transportation costs, has been considered in this empirical analysis. However, the assignment of either of these weights appears to be arbitrary and depends on the way distance/cost is measured; for instance, the adjoining markets are going to have larger weights if miles are used instead of kilometres. Therefore after careful consideration, it was decided to use only the ***gdp*** measure for market size.

Natural resource endowments were identified in Section 2.3 as potential determinants of FDI. In addition to a country's human capital endowment, which is the focus of investigation, endowment of natural resources is controlled for in this model. The presence of this control is particularly important when estimating the human capital-FDI relationship because, as argued in Sections 6.3, natural resource driven-FDI is likely to be relatively less attracted by the level and quality of host countries' human capital. The availability of natural resources is intended to serve as a control for the level of resource-seeking FDI a country receives. Previous studies of FDI in transition economies have used different measures of natural resources. For instance, Deichmann et al. (2003) and Kinoshita and Campos (2003) use a measure developed by De Melo et al. (1997) to distinguish between three levels of natural resource endowment (poor, moderate and rich); Shepotylo (2010) uses proven oil and gas reserves by BP (2010); Cuervo-Cazurra (2008) use a dummy variable to indicate oil-producing countries; and Vavilov (2005) uses annual levels of oil production. However, all these measures appear to have drawbacks, especially when considering the rationale for their inclusion in this particular empirical analysis. First, few European transition economies have significant oil/gas reserves; for most of them, other natural resources such as ores and metals are likely to be more important. In addition, for the purpose of this study, i.e. where natural resources are intended to proxy for the (actual) level of resource-seeking FDI, measures of utilisation of natural resources rather than reserves are likely to be more appropriate. Based on these arguments, an alternative measure for natural resources (***primexport***) is calculated which indicates the ***share of primary commodities, excluding food items and agricultural raw materials, in total exports*** (based on UNCTAD, 2010c). A similar measure, exports of raw materials as a share of GDP, has been previously used by Sachs and Warner (1995) and Ali et al. (2010).

In a similar manner, it is argued in Section 6.3 that *FDI in the financial sector* is market-driven and it is less likely to be affected by human capital availability in the host country. To control for this particular type of market-seeking FDI, the share of foreign banks in the economy (***forbank***) as reported by EBRD's Transition Reports (EBRD, various years) is included as a proxy for the level of FDI that a country received in the financial sector. An alternative measure available from EBRD, the market share of foreign banks (as measured by the share of their assets in total bank assets in the country), was considered more appropriate, but significantly fewer observations were available.

Trade costs are another factor which is likely to affect FDI, as suggested by the theory reviewed in Section 2.2. In theory, the effect of trade costs is ambiguous: FDI can provide a substitute for trade in the case of market-seeking FDI, but these two can also be complementary, especially in the case of efficiency seeking FDI where, for instance, intermediate products need to be imported and/or final products exported. Ideally, the measure of trade costs would include transportation costs, tariff costs and non-tariff barriers. However, data on transportation costs are not available for the sample of countries included in this analysis. Previous FDI studies covering CEECs have used the share of tariff revenues in the total value imports provided by the EBRD Transition Report (EBRD, various years), but have found it to be insignificant and argued this to be because of the generally low tariff rates (Bellak et al., 2008; Leibrecht and Scharler, 2009). Alternatively, the trade freedom component of the Economic Freedom Index (EFI) by Heritage Foundation (2010) can be used. The latter has the advantage of taking into account both tariff and non-tariff restrictions, such as direct government intervention and quantity, price, regulatory and customs restrictions. Because of this, the better availability of data and considering the low variability in the share of tariff revenues in imports across these countries and time period, the ***trade freedom component of the EFI (tradefree)*** is used in the empirical analysis presented in this chapter. As explained later in this section, other components of this index (excluding investment freedom) are also used in this analysis as a measure of economic freedom in general. The reason why the component of trade costs in particular is entered as a separate variable is that, as explained above, the effect of trade costs on FDI is a priori ambiguous, which is not the case with economic freedom. First, however, the correlation coefficient between the trade freedom component and the composite index excluding this component was checked to see whether these are sufficiently different to warrant their separation. The partial correlation was found to be relatively low, at 0.53, therefore the two are entered as separate variables in the empirical investigations.

The level (and cost) of physical and communication infrastructure were identified in Section 4.3, as a factor that can affect the level of FDI a country receives. Following, Bellak et al. (2009) a composite measure of information and communication technology (ICT) infrastructure is created by adding the ***number of telephone lines and broadband- and cellular- subscriptions per 100 inhabitants (ictinfra)*** provided by World Bank (WDI, 2010). This variable provides information on the ease of communication, but given the lack of comprehensive and comparable data on other infrastructure indicators[43], similar measures have been previously used as a proxy for

[43] WDI (2010) provides data on the road and rail networks of countries, but these are usually not available for the whole period covered in this empirical analysis.

the level of infrastructure development (Kinoshita and Campos, 2003). Thus, the ICT infrastructure measure is used in this analysis as a proxy for both the ease/cost of communication and infrastructural development more generally. This measure can also be considered as a proxy for the level of technological development of the host country.

As discussed in Sections 2.3 and 4.3, foreign affiliates may benefit from ‘agglomerating’, i.e. locating near other foreign firms, e.g. due to linkages with suppliers and/or customers and availability of a workforce with relevant skills. *Agglomeration economies* have been measured by lagged FDI stock in studies using the stock of FDI as the dependent variable (Kinoshita and Campos, 2003; Nicoletti et al., 2003). Similarly, in studies with FDI flows as the dependent variable, lagged flows have sometimes been used (Agiomirgianakis et al., 2006), though is it not clear that this is appropriate considering that lagged FDI flows do not represent total foreign investor activity in the host country. However, it also not clear that the estimated effect of previous FDI stock necessarily represents agglomeration effects. Namely, in a partial-adjustment setting (discussed in the previous section), the coefficient on previous FDI stock can represent agglomeration effects, but also the speed of adjustment to the optimal level of FDI stock.

Finally, it may be argued that foreign investors ‘agglomerate’ in destinations where other (successful) firms in their industry or related industries are based, regardless of these firms’ ownership. Apparently under this assumption, Resmini (2000) uses the output share of the manufacturing sector in the host country as a measure of agglomeration economies. However, the adequacy of this measure is questionable on the basis of the differences that are likely to exist between the technological levels of foreign investors and the domestic manufacturing sectors of transition economies. In the context of transition where, as discussed in Section 1.2, domestic firms were lagging in terms of product quality and technological level (and thus the small pool of workers with relevant knowledge, skills and experience), it appears unlikely that foreign investors could benefit from ‘agglomerating’ with domestic firms. Further, it can be argued that in a transition context there are additional benefits from agglomerating with foreign investors in particular, regardless of their sector. This is because, as argued in Sections 1.2 and 4.3, the newly created domestic private sector in transition economies had no experience of operating in a market economy and there was lack of skills in business management and supporting services. To the extent that existing foreign firms in the market provide such services, contribute to the development of skills and a new business culture more generally, they are likely to attract more foreign investment. Based on the above arguments, ***the stock of FDI in the previous year (l1FDIstock)*** is used in a partial stock-adjustment framework[44] (in estimations in Section 5.4 where a robustness check is conducted using stock of FDI as a dependent variable). Finally, the presence of foreign investors may have reinforcing effects, i.e. positively affect the (increase in) stocks of FDI by sending a positive signal to new potential investors and helping to reduce the inherent uncertainty related to lack of information regarding the host economy, a factor which was argued to be especially important in a transition context, as explained in Section 4.3.

Progress in the privatization process and overall progress in transition, i.e. reform towards a market economy, are transition-specific factors which could affect FDI inflows. As explained in Section 4.3, rapid economic reform is likely to be important to foreign investors because it reduces the uncertainty from changes throughout the economy related to transition. Privatisation is a component of this reform which, as argued in Section 4.3, can serve as a signal for the commitment of the government to establishing and supporting a market economy. Accordingly, studies of FDI in transition economies have frequently used measures of the speed/volume or type of privatisation method as a proxy for institutional reform. Holland and Pain (1998) and Bevan and Estrin (2004) use a qualitative measure of privatisation methods according to the opportunities they create for foreign investors (e.g. sale to outside owners has a higher rating than voucher distribution or management-employee buyouts). Lansbury et al. (1996) and Bellak et al. (2008), on the other hand, use the share of private sector output and the value of privatisation revenues, respectively. However, in this analysis it is argued that there are superior measures of institutional quality and reform which can be used; nonetheless, a dummy variable indicating major privatisations is used as a 'shock' variable, as discussed below.

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[44] This variable is not used in the model with FDI inflows as the dependent variable because even though it is a lag, and thus predetermined, it is not strictly exogenous because it is correlated with the time-invariant part of the error term.

In the empirical analyses presented in this chapter, ***the overall transition score awarded by the EBRD (various years) in their Transition Report***, ***transition***, is used as a measure of progress in transition. This is a composite index derived from the qualitative assessment of nine areas of reform including: large- and small-scale privatisation, enterprise restructuring, price liberalisation, trade and foreign exchange system, competition policy, banking and non-banking financial institutions, and infrastructure reform (EBRD, 2010, pp. 248-50). A composite index is favoured in this analysis for the following reasons. First, this appears to be the most comprehensive measure of progress in transition, as opposed to the ones related to privatisation discussed above. Second, because the interest here is not to identify any particular areas of reform, but simply control for overall progress, this measure has the advantage of providing sufficient information for the purpose of this analysis while not having to enter additional (potentially correlated) measures. This is an important consideration in this research since the size of sample is relatively small.

However, it is argued here that the *privatisation* of socially- and publicly-owned enterprises itself has to be controlled for in FDI studies focusing on European transition economies. As explained in Section 1.2, privatisation-related FDI has accounted for a significant share of FDI in these countries during (part of) the transition period, but privatisations of enterprises represent one-off opportunities for foreign investors and their timing is not (necessarily) determined by the variation in host country characteristics across time. An initial review of FDI inflow levels of the individual economies in this sample reveals sudden and sharp increases which appear to be explained by major privatisations waves and/or privatisations of large strategic enterprises, which should ideally be controlled for in empirical investigations of FDI determinants. Accordingly, various sources, including UNCTAD's World Investment Reports (UNCTAD, various years), EBRD's Transition Reports (EBRD, various years) and Kalotay and Hunya (2000), were reviewed and checked against the apparent outlier years for each country in an attempt to identify instances when the effect of privatisation-related FDI was particularly large. A dummy variable***, privatisation,*** was subsequently created which ***indicates years when FDI-related***

privatisations of large enterprises and/or large waves of privatisations took place in each of the host economies[45].

The EBRD transition score above measures the progress in transition from a centrally-planned to a market economy. However, market economies may differ with regard to their level of *economic liberalisation and quality of institution, including rule of law,* which, as discussed in Sections 2.2 and 4.3, determine the quality of the business environment and thus can affect the level of FDI a country receives. In this empirical analysis, the ***Economic Freedom Index (EFI)*** provided by The Heritage Foundation (2010), ***econfree***, is used to indicate the level of business friendliness of an economy. This index is calculated as an (simple) average of 10 indicators based on a wide range of both qualitative and quantitative information (Heritage Foundation, 2010, pp. 457-68). As explained earlier in this section, the indicator of trade liberalisation is used as a separate control variable. Therefore, the index for the purpose of this empirical investigation was recalculated as the average of the rest of the components: business freedom, which measures the ease of starting, operating and closing a business; the magnitude of the tax burden and the share of government spending in GDP; the quality of the property rights laws and their enforcement; the level of corruption; monetary freedom, as indicated by price stability and the presence of price controls; financial freedom, which combines banking security with the extent of regulation/influence imposed by the government; the legal and regulatory framework of the labour market; and investment freedom, i.e. the freedom of individuals to move capital both across activities within the economy, and across borders. The last component draws upon qualitative information on whether there is discrimination against foreign investors, whether there are restrictions on land ownership and investment in any sectors, how common is expropriation of investment without 'fair' compensation, whether there are foreign exchange controls or capital controls (e.g. in repatriation of profits) and the level of transparency and bureaucracy in investment policy implementation. Because this latter component is

[45] Information to construct this variable comes primarily from UNCTAD and EBRD reports. These reports were reviewed to identify any cases where large privatisations were made by foreign investors in the countries in the sample, in which case the dummy takes the value of one. In addition, the information in Kalotay and Hunya (2000) was used in some instances, with the dummy taking the value of one if the share of privatisation-related FDI in an economy exceeds the threshold of 40% of total FDI inflows.

highly correlated with the composite index (with a correlation coefficient of over 0.7), it is not included here as a separate control variable.

Political- and economic- risk have been identified in Section 4.3 as factors that can potentially affect FDI in developing and transition economies. In studies of transition economies, economic risk is often measured by the inflation rate (Kinoshita and Campos, 2003; Furceri and Borelli, 2008; Leibrecht and Scharler, 2009). Alternatively, political- and economic- risk have often been measured by (components of) the Country Risk Indicator (Euromoney, 2010), the International Country Risk Guide (PRS, 2010), Country Credit Ratings (Institutional Investor, 2010) in Bandelj (2002), Carstensen and Toubal (2004), Fung et al. (2008), and Leibrecht and Scharler (2009). However, as Bandelj (2002) points out, economic conditions usually have a significant weight in the calculation of these indicators and it may not be appropriate to include them in models of FDI determinants which always have a measure of a country's GDP level (total or per capita) or GDP growth rates. Accordingly, after a review of these indicators' methodologies, it was decided not to include any of these indicators because, in addition to economic performance, they tend to include information which is already captured by the Economic Freedom Index (e.g. rule of law, corruption, business environment and FDI restrictions). However, in this sample there are a few years where some of the economies in the sample were harshly affected by political instability, namely, Albania during the social unrest in 1997 during the war in neighbouring Kosovo in 1998-99. Accordingly, a ***dummy variable, instability, is created to indicate these country-year pairs when these host countries have been affected by an unusually high level of political instability***.

Another potential FDI determinant in European transition economies identified in Section 4.3 was the (prospect of) EU accession. Accordingly, the inclusion of a dummy variable for the announcement of EU accession was considered, however ultimately it was decided not to include this variable because it is expected to be highly correlated with, and/or endogenously determined by, other independent variables in the model (e.g. progress in reform or GDP).

Finally, there are other factors which have been identified in Sections 2.2 and 4.3 which could not be included due to data limitations. The level of ethnic networks between countries which is typically proxied by the stock of migrants could not be included because limited data availability for European transition economies (WDI, 2010), which would significantly reduce the size of the sample. Similarly, factors related to cultural characteristics of European transition economies cannot be controlled for.

Table 5.3 below summarises the variable names, descriptions and data sources used in the empirical investigations, whilst the rest of this chapter discusses the estimation techniques and reports the empirical results for the models based on the discussions in this section.

Table 5.3: Variable names, definitions and sources

Variable name	Expected sign	Description	Source
FDIflow	dependent var	Inward FDI flows (in current USD)	UNCTAD (2010b)
FDIstock	dependent var	Inward FDI stock (in current USD)	UNCTAD (2010b)
l1FDIstock	+	Inward FDI stock (in current USD), first lag	UNCTAD (2010b)
SECedu	+	Percentage of population over age 15 who have completed secondary education, including those who have completed tertiary education (see section 5.2.1)	Barro and Lee (2010)
TERTedu	+	Percentage of population over age 15 who have completed tertiary education as their highest level of education	Author's calculations based on data from Barro and Lee (2010)
genvocratio	+	The ratio of general to vocational enrolments in upper-secondary education in 1990	Author's calculations based on data from UNICEF (2010)
edutr1	+	Share of population aged 16-30 in a country's working age population in 2008 (population aged 0-14 in 1992/population aged 15-64 in 2008)	Author's calculations based on data from WDI (2010)
edutr2	+	Share of population who were educated in the communist system only up to age 12 or less in a country's working age population in the respective year (see Section 5.2.2 for explanations)	Author's calculations based on data from Barro and Lee (2010) and WDI (2010)
vacancy	-	A country-average of the length of period required to fill a vacancy for a skilled worker	Author's calculations based on data from BEEPS (2002, 2005)
cognitive	+	Standardised measure of cognitive skills derived from maths and science scores in International Student Achievement Tests	Hanushek and Woessmann (2009a)
top	+	Share of top performers (i.e. those achieving a score of 600 points or one standard deviation above the OECD mean) in International Student Achievement Tests	Hanushek and Woessmann (2009a)
wage	-	The average gross wage paid in the host country	WIIW (2011)
l1wage	-	The average gross wage paid in the host country, first lag	WIIW (2011)
l2wage	-	The average gross wage paid in the host country, second lag	WIIW (2011)
gini	-	The distribution of earnings, as measured by the Gini coefficient	UNICEF (2010)

gdp	+	Size of the host market as measured by its GDP level (in current USD)	WDI (2010)
l1gdp	+	Size of the host market as measured by its GDP level (in current USD), first lag	WDI (2010)
l2gdp	+	Size of the host market as measured by its GDP level (in current USD), second lag	WDI (2010)
forbank	+	Share of foreign-owned banks in the economy (i.e. number of foreign banks/total number of banks)	Author's calculations based on data from EBRD (various years)
primexport	+	Share of primary commodities, excluding food items and agricultural raw materials, in total exports	Author's calculations based on data from UNCTAD (2010c)
l1primexport	+	Share of primary commodities, excluding food items and agricultural raw materials, in total exports , first lag	Author's calculations based on data by UNCTAD (2010c)
l2primexport	+	Share of primary commodities, excluding food items and agricultural raw materials, in total exports, second lag	Author's calculations based on data from UNCTAD (2010c)
tradefree	?	Trade freedom component of the Economic Freedom Index	Heritage Foundation (2010)
econfree	+	Economic Freedom Index, excluding the trade freedom component (i.e. the simple average of all other components)	Author's calculations based on data from Heritage Foundation (2010)
ictinfra	+	Sum of the number of telephone lines, broadband subscriptions, and cellular subscriptions, per 100 inhabitants	Author's calculations based on data from WDI (2010)
transition	+	The overall transition score awarded by the EBRD	EBRD (various years)
privatisation	+	Dummy variable, equals to 1 in years when FDI-related privatisations of large enterprises took place (see Section 5.2.3)	Constructed by the author based on EBRD (various years), UNCTAD (various years) and Kalotay and Hunya (2000)
instability	-	Dummy variable, equals to 1 in years when a country is affected by political unrest, either an internal conflict or one in the region (see Section 5.2.3 for explanation)	Constructed by the author

5.3 Empirical approach

To empirically test the hypotheses developed in this thesis, panel data for 12 European transition economies for the period 1995-2008 is used. Panel data offers the advantage of "more variability, less collinearity among variables, more degrees of freedom and more efficiency" (Baltagi, 1985, p. 4). The choice of countries (within European transition economies) and the time period covered in this empirical analysis were determined by data availability. The countries included are Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia[46]. Because there is relatively little variation in human capital measures across time in the sample (see Appendices 5.1 and 5.2 for the descriptive statistics and between-to-within variation ratios), the random effects (RE) estimator which utilises both within-, and between-, country variation appears to be more suitable than a fixed effects (FE) estimator for the purpose of this analysis. By utilising only within country variation, the FE estimator may have a bias towards short-run effects if long-run equilibrium relationships between variables are reflected in between-country variation reflecting long-term national differences. In addition, the use of within variation only means that "the coefficients of variables with small within standard deviations are not well identified" (Baum, 2006, p. 223) in FE estimation. Finally, the RE estimator can accommodate time-invariant variables, it is more efficient and its results can be used for making inferences for a wider population, i.e. not just the countries in the sample (Wooldridge, 2002; Baum, 2006). The possibility of including time-invariant variables makes this model particularly appealing in this analysis because some of the new measures of human capital introduced in this analysis are (assumed to be) time-invariant. Based on these considerations, the initial specification used in this research is the following random effects model:

[46]Bosnia and Herzegovina, FYR Macedonia, Kosovo, Montenegro and Serbia were not included because data for these countries is not available. For Bosnia and Herzegovina and FYR Macedonia there is no data for the main human capital variables (from Barro and Lee, 2010). For Kosovo there is no data for most variables in the model, while the data for Montenegro and Serbia are not always measured consistently, i.e. some variables are measured for these republics separately and others are measured for both of them combined or data for Serbia sometimes includes Kosovo. Considering the political changes in this period however (i.e. the independence of Kosovo from former Yugoslavia and the separation of Serbia and Montenegro), FDI in these countries is unlikely to have been driven (mainly) by economic factors which provides a rationale to exclude them from the sample in any case.

$$FDIflow_{it} = \beta_0 + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_i' \; X_{it} + (u_i + \varepsilon_{it}) \quad ....(5.1a)$$

Where β_0 is the overall constant, X_{it} is a vector of control variables discussed in the previous section, and $(u_i+\varepsilon_{it})$ is the composite error term which consists of the individual-specific error component, u_i , and the combined time series and cross-section error component, ε_{it}. In the RE model, the overall constant represents the mean value of all country constants in the sample which the cross-section error component, u_i , represents the (random) deviation of each country's constant from this mean value (Gujarati, 2004, p. 647-48). However, a crucial assumption of this model is that u_i is not correlated with the independent variables in all time periods, in which case they would be correlated with the composite error term and the RE estimator would be inconsistent (Wooldridge, 2002). Therefore, the appropriateness of using RE model(s) in this analysis is tested using the Hausman test (Baum, 2006, p. 212 and 230-1).

If the cross-section country component is found to be correlated with the independent variables, the FE model can be used (Equation 5.1b below) can be used. In contrast to the RE model where the 'individuality' of each country is accounted for by the cross-section error component, u_i, in the FE model this is done by letting the constant vary for each country, as indicated by its subscript *i* added to the constant term (Gujarati, 2004, p. 642) below:

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_i' \; X_{it} + \varepsilon_{it} \quad ....(5.1b)$$

The FE model has an advantage over the RE model because by using only variation within countries (i.e. across time), it resolves omitted variable bias that cross-section estimates tend to suffer from; however, that is, assuming that the omitted variables (i.e. unobserved effects) are constant over time (Wooldridge, 2010).

The baseline specification (5.1b) is further extended to test the transition-specific hypotheses developed in this thesis[47]. First, to the extent that general education is superior to vocational education in providing the generic cognitive skills, enhancing

[47] As explained in the next section, the Hausman test suggests that the RE estimator is inconsistent or the models estimated in the rest of this chapter, therefore FE models are only specified/reported in the rest of this chapter.

creativity and enforcing critical thinking, as argued in Section 4.3, it would appear necessary to provide a more appropriate measure of the stock of human capital. This especially appears to be the case in transition economies where, because of the rapid and persistent structural changes in the economy, 'traditional' vocational skills are likely to be depreciating rapidly. Therefore, it appears that the relative importance of vocational education should be taken into account when measuring stocks of human capital in these economies. To test the hypothesis that countries that emphasised general education have managed to attract more FDI, the baseline model above is augmented with the ***ratio of general to vocational enrolments in secondary education at the outset of transition*** (***genvocratio***).

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_3 genvocratio_i + \beta_i' \; X_{it} + \varepsilon_{it} \quad ...(5.2)$$

Second, if the education system and workplace under central planning developed traits that are 'productivity-constraining' in a modern market economy, the vintage of the stock of human capital should be taken into account when analysing the effect of human capital on FDI. Based on this, in Section 1.4 it was argued that potential foreign direct investors would be more attracted by younger cohorts that entered the market and/or were educated during the transition period, in an education system that is reformed or undergoing reform. To test this hypothesis, the baseline specification (Model 5.1) is augmented with proxies for the ***percentage of the workforce educated after the collapse of communism (edutr1 and edutr2).***

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_3 edutr1_i + \beta_i' \; X_{it} + \varepsilon_{it} \quad ....(5.3)$$

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_3 edutr2_{it} + \beta_i' \; X_{it} + \varepsilon_{it} \quad ....(5.4)$$

Finally, the baseline model is augmented with three alternative measures of human capital, not previously used in investigations of the effect of human capital on FDI, that were introduced in Section 5.2. Accordingly, the following models with the number of weeks required for a firm to fill a vacancy for a skilled worker, ***vacancy***, and the standardised measure of students' cognitive skills, ***cognitive***, and share of top performers in international student tests, ***top***, were estimated:

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_3 vacancy_{it} + \beta_i' \; X_{it} + \varepsilon_{it} \quad ....(5.5)$$

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_3 cognitive_i + \beta_i' \ X_{it} + \varepsilon_{it} \text{ ....(5.6)}$$

$$FDIflow_{it} = \beta_{0i} + \beta_1 SECedu_{it} + \beta_2 TERTedu_{it} + \beta_3 top_i + \beta_i' \ X_{it} + \varepsilon_{it} \text{ ....(5.7)}$$

In the specifications above there is a theoretical possibility of reverse causation in the case of some of the variables. The analysis in Section 2.3 suggested that there is a possibility of reverse causation in the case of the human capital variables, i.e. that FDI can cause an increase in human capital, but it was argued that the presence of this problem is likely to depend on the actual measures of education used in the empirical investigation. In Section 2.3 it was argued that foreign affiliates can develop human capital in the host country directly through training, or indirectly, by increasing the education premium for educated individuals. As the human capital measures ***SECedu*** and ***TERTedu*** refer to the percentage of population who have already completed a certain level of education, reverse causation is not expected to be a problem in this empirical analysis. First, this measure refers to formal education and, as such, it does not reflect any direct effect of FDI through further (on-the-job) training; in this sense, an actual limitation of the education measures appears to be advantageous. Second, as this measure refers to individuals who have already completed a certain level of education, any potential indirect effect of FDI through increasing the education premium would be realised a time lag of *at least* the length of the period required to complete studies (i.e. typically 3 years for higher education). As such, the education variables are argued to be pre-determined, at the very least, if not strictly exogenous.

As explained in Section 1.2, it can be argued that FDI can affect productivity growth, and thus the level of a country's GDP (***gdp***). FDI can also affect the level of wages paid in the host country (***wage***), as argued in Section 2.3. Finally, it is argued here that the share of primary commodities in total exports (***primexport***) can increase as a result of FDI in extractive industries in the previous period. Ideally, a system-GMM (general method of moments) estimator (Blundell and Bond, 1998) for dynamic panels would be used which accounts for potentially endogenous variables by using lagged levels of endogenous variables and their lagged differences as instrumental variables for current differences and levels, respectively. However, this estimator (as well as other GMM estimators such as Arellano and Bond, 2001 and Arellano and

Bover, 2005) is designed for panels with a large number of cross section units (N) and small number of time periods (T) (Roodman, 2006), which makes it inappropriate for the sample of 12 countries covered in this analysis. Therefore, in an attempt to guard against potential reverse causation lags of the above variables are entered into the model (Baltagi, 1995), as previously used in FDI studies by Bandelj (2002), Bevan and Estrin (2004), Bellak et al. (2009 and 2008) and Furceri and Borelli (2008). Lags of these variables are entered in the model in addition to contemporaneous levels.

Another potential problem which has been recently received attention in panel models is cross-sectional dependence, i.e. dependence of (idiosyncratic) errors across cross-sectional units, which may arise due to spatial dependence, omitted unobserved common components (e.g. common shocks) and economic distance (Pesaran, 2004; Sarafidis et al., 2009). Theoretically it is plausible for FDI inflows among European transition economies to be correlated across the sample for any of the reasons above. First, inflows into these countries are likely to be simultaneously affected by global FDI trends (i.e. common shocks) increasing in times of economic expansion and contracting during global financial crises when companies do not have the means or the will to finance investment. Second, there may be spillover effects from foreign investment in neighbouring countries (i.e. economic distance), either due to backward or forward linkages (as described in Section 1.2, only in this case in a cross-country setting) or due to foreign investors' reduction of uncertainty from the experience gained in the region which, in the case of transition economies may be especially relevant due to their isolation during communism (as discussed in Section 4.3.2). On the other hand, the inflows into these economies may also be negatively correlated if these countries are seen as alternative locations (i.e. a form of spatial dependence), competing for a given amount of FDI inflows during a certain period. This and exposure to common shocks related to global economic trends appear to be a type of 'universal time-related shocks' which can be removed from the errors by including time fixed effects, as Roodman (2006, p. 26) suggests. Accordingly, year dummies are added in each of the above specifications, though as Sarafidis et al. (2009, p. 150) note, this will only control for these common effects if they have a homogeneous impact on the cross-sectional units, which is not necessarily the case. In this particular analysis it is plausible that the effect of global FDI trends differ in different European transition economies, depending, for instance, on the countries of origin, sectoral composition of their FDI stock or their (perceived) economic stability. Therefore, tests are conducted for each specification in this analysis to test for any remaining cross-sectional dependence due to heterogeneous impact (Sarafidis et al., 2009) or ‘economic distance’.

5.4 Estimated results

5.4.1 Diagnostic testing: Choosing the appropriate estimators

Model (5.1) was initially estimated using the RE- and FE- estimators. The normality test rejects the null hypothesis of normality (based on skewness and kurtosis) of fixed effects errors. Therefore, logarithmic transformation is used and in this formulation, at the 5% level, the null hypothesis of normality cannot be rejected. Although FDI inflows are measured on a net basis and can theoretically take negative values, there are no negative FDI inflows in the dataset which would preclude the use logarithmic transformation. Accordingly, all specifications presented in this research are estimated in natural logarithms.

Subsequently, other diagnostic tests for the log-log version of Model (5.1) and raw correlations between the variables are examined (see Appendix 5.3 for the printouts). Apart from the ***lntop*** and ***lncognitive*** with coefficients of 0.47-0.78, no other human capital variables appear to be particularly correlated with FDI stocks/flows in the sample. The variance inflation factor (VIF) suggests that there is a high level of multicollinearity (with a maximum VIF of 777.28 and mean of 78.75). The extremely high multicollinearity is likely to be caused partly by the presence of first and second lags of ***lnwage***, ***lngdp*** and ***lnprimexport***, which, as expected, are highly correlated with the current levels of the variables. The logarithmic transformation appears to have rectified the problems with normality that were present in the levels equation, but the year dummies do not seem to have absorbed (all) the within-year clustering because both Frees’ (1995) and Pesaran’s (2004) tests[48] (De Hoyos and Sarafidis, 2006) point to the presence of cross-sectional dependence. Moreover, modified Wald’s test (Baum, 2006, p. 222) suggests that the model suffers from

[48] Friedman’s (1937) test cannot reject the null of no cross-sectional dependence, however tests by Frees (1995) and Pesaran (2004) are preferred because they can provide the *absolute* correlation between cross-sectional units prevents negative and positive correlations in the data adding up to cancel each other, “hiding” the cross-sectional dependence presence in the data and giving rise to a false rejection of the null hypothesis (De Hoyos and Sarafidis, 2006). As discussed in the previous section, in the case of FDI inflows both negative and positive cross-sectional dependence is theoretically plausible and the difference in these tests suggests that this appears to be the case in this dataset.

group-wise heteroskedasticity, and Wooldridge's test for panel data (Drukker, 2003) suggests that errors are serially correlated. The likely consequences of these problems and potential remedies that can be used to improve the validity of statistical inference from this model are therefore considered next.

Without the presence of cross-sectional dependence, Newey-West estimates of standard errors (SE) clustered by cross-sectional unit (Newey and West, 1987) could be used, which are heteroskedasticity and serial correlation consistent (also referred to as HAC SEs). However, in the presence of cross-sectional dependence, these SE estimates are still likely to be biased, making hypothesis testing invalid (Driscoll and Kraay, 1998; Petersen, 2009; Cameron et al. 2011). In many economic applications such dependence is expected to be positive, giving rise to understated standard errors and over-rejection of standard hypothesis tests (Cameron et al., 2011; Cameron and Miller, 2011). However, in this particular analysis the direction of the bias due to cross-sectional dependence is less clear because, as argued in the previous section, both negative and positive correlations may arise. In order to estimate SEs robust to cross-sectional dependence by country, observations can be clustered by time period (Baum et al., 2010), but this imposes the assumption that errors for a given country are independent over time which, as suggested by the serial correlation test, appears to be violated in this dataset. As a result, the standard errors are again likely to be biased, in this case most likely downward due to positive correlation across time, giving rise to over-rejection of standard hypothesis tests (Wooldridge, 2002). Thus, both these potential solutions have their limitations because they are unable to (simultaneously) provide SE estimates that are robust to both contemporaneous and serial dependence. Accordingly, recent contributions by Thompson (2011) and Cameron et al. (2011) propose combining standard one-way cluster-robust variance estimators (such as Newey-West) be extended to two or more non-nested dimensions (i.e. two-way or multi-way clustering). Effectively, this means that arbitrary error correlations are allowed within two or more clusters of observations, simultaneously. For instance, in this analysis, clustering by year allows for contemporaneous errors correlation across countries such as those arising from common shocks and clustering by country (i.e. the standard HAC SEs) which allows for within-country error correlations, the combination of which provides standard errors that are robust to heteroskedasticity, serial correlation and cross-sectional dependence, simultaneously.[49] Accordingly, ***two-way cluster-robust estimations***, ***based on computations of the variance matrix (with a small-sample adjustment) illustrated by Thompson (2011) and Cameron et al. (2011)*** [50]***, are estimated here in addition to conventional panel estimators.*** However, it should be noted that this method relies on large numbers of clusters (i.e. countries and years here) in both dimensions[51] and despite the small-sample adjustment available, may not necessarily provide unbiased estimates in this analysis. Therefore, the results obtained using this estimator are presented as a robustness check in the appendices.

Considering the drawback of a small number of clusters in the data, an alternative spatial correlation consistent covariance estimator proposed by Driscoll and Kraay (1998) may be more appropriate in this empirical investigation. According to their Monte-Carlo simulations, this estimator's performance is similar to that of the Newey-West time-series estimator (which two-way clustering, above, is based on), but "despite the fact that it relies on large-T asymptotics, it dominates that of common alternatives which do not take spatial dependence into account, even when the time dimension is quite short" (Driscoll and Kraay, p. 550). Like the two-way cluster covariance matrix method above, the SE estimates obtained this way are also robust to disturbances being heteroskedastic, serially correlated and cross-sectionally dependent, simultaneously and therefore are appropriate for this empirical investigation. Accordingly, the ***models in this analysis are estimated using the Driscoll-Kraay estimator, as adjusted for use with unbalanced panels by Hoechle (2007)***.[52]

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[49] In this particular analysis there may be reasons to cluster also by other variables, e.g. by geographical region or by the status of country in the EU accession process if countries within a cluster are more likely to compete for a certain amount of FDI, or if they are affected differently by common shocks, but the number of clusters in this case would be too small for this type of computation (Baum, 2010).

[50] Two-way/multi-way cluster-robust SE's have been automated for Stata in Schaffer's (2005) *xtivreg2* command for FE and OLS, but they cannot be computed for RE. This command is explained in Baum et al. (2003; 2007; 2010). Alternatively, the *cluster2* command by Petersen (2009) could be used, but this is only available for OLS estimation.

[51] For instance Nichols and Schaffer (2007) suggest at least 20 clusters in balanced panels or 50 in reasonably balanced panels. Similarly, Rogers (1993) suggests that each cluster should contain a maximum of five percent of the observations in the sample.

[52] The computation of the variance matrix has been automated for Stata by Hoechle's (2007) *xtscc* command. Like the two-way clustering above, this robust estimator is only available in an OLS and FE setting.

As explained in the previous section, the RE estimator is preferred to the FE estimator because of its efficiency but it is it not necessarily consistent, and at this point it also appears to be less desirable considering that it cannot accommodate the computation of a heteroskedasticity-, serial correlation- and cross-sectional dependence consistent variance matrix. Nevertheless, standard diagnostic tests are considered to discriminate between FE, RE and OLS. A standard Hausman test suggests that the null of no systematic difference between FE and RE coefficient cannot be rejected at the conventional 5 percent level of significance. However, Wooldridge (2002) argues that this test can be invalid in cases where the disturbances are not independent and identically distributed (i.i.d). Accordingly, alternative formulations of the Hausman test which allow for temporal dependence (Wooldridge, 2002, p. 290) and for temporal and spatial dependence (Hoechle, 2007) were estimated[53] which unlike the standard test suggest that the null can be soundly rejected. Therefore, ***it appears that RE estimates are not consistent and therefore FE estimation is preferred.*** Finally, the F test for fixed effects (Baum, 2006, p. 114) indicates the presence of significant country effects, implying that ***a pooled OLS estimation would be inappropriate for this model.*** Based on the above considerations, only results from FE models are presented in the rest of this section.

As explained in the previous section, the use of FE models is inconvenient in this empirical analysis because it 'wipes out' the effect of time-invariant variables and it is inefficient in estimating the effect of variables with little within variance. The second drawback in particular, as Plümper and Troeger (2007) note, has been by-and-large ignored until recently and it should be taken seriously because it not only causes the estimated SEs to be larger (and thus the significance of results to be lower), but also "leads to highly unreliable point estimates and may thus cause wrong inferences in the same way a biased estimator could" (p. 125). As a solution, Plümper and Troeger have proposed the fixed effects vector decomposition (FEVD) estimator, for the estimation of time-invariant variables initially (Plümper and Troeger, 2004) and argue in their later contribution that this can be extended to include variables with low within variation (Plümper and Troeger, 2007). The FEVD approach appears to be appropriate in this analysis not only because of the presence

[53] Wooldridge's version of the test is automated for Stata in the *sigmamore* option of the test, while Hoechle's version was estimated based on the code provided by Hoechle (2007, pp. 305-6).

of time-invariant variables in some of the models, but also because the main variable(s) of interest, ***(ln)SECedu*** and ***(ln)TERTedu***, show very little within variation which may cause the standard FE estimators to yield imprecise point estimates, as noted by Plümper and Troeger (2007) and Greene et al. (2010). Therefore, results from the ***Fixed-Effects Vector Decomposition estimator, developed by (Plümper and Troeger, 2004, 2007), are also presented here in addition to those from the Driscoll-Kraay estimator.***

The FEVD estimator uses a three-step procedure in which the fixed effects from the conventional FE estimator are "decomposed" into: the observed component, explained by the variables with (little or) no time variation; and the unobserved component, i.e. the residual, which is taken to represent the 'truly unobserved unit heterogeneity' and replaces the fixed effect (see Box 5.1 for a more detailed explanation). First, however, it should be noted that the validity of the FEVD estimator when including only time-invariant variables has been seriously questioned in some recent contributions (Breusch et al., 2011a; Greene, 2011a). Nevertheless, the prevailing consensus after a long and controversial discussion[54] appears to be that the FEVD estimator becomes useful if variables with small between-to-within variance ratios (or 'slowly changing variables') are also included in the procedure, which is the case in the empirical investigation presented here. Namely, Greene et al. (2010, p. 5) argue that "it is the very presence of slowly changing variables and the fact that their estimates in a FE setting can be imprecise in a mean-squared error sense...may justify the use of the FEVD..." and go on to explain that the inconsistent FEVD estimator may be more reliable than the consistent FE because of its lower variance, in accordance with arguments put forward in Plümper and Troeger's (2004, 2007) original contributions. However, a remaining drawback is that the diagnostic problems identified in this empirical investigation cannot be addressed within a FEVD framework.

[54] Contributions include Beck (2011), Breusch et al. (2011a, b), Greene (2011a, b), Plümper and Troeger (2011).

Box 5.1: The FEVD estimator (based on Plümper and Troeger, 2004, 2007)

The three-step FEVD procedure:

The effect of time-invariant variables and those with low within variation or high between-to-within variance ratios is estimated as follows:

Stage 1: A standard FE model is estimated with time-variant variables, X_{it} :

$$FDIflow_{it} = \beta_{0i} + \kappa' X_{it} + \varepsilon_{it} \quad \text{......................................(5.8)}$$

Stage 2: The estimated fixed effects from *Stage 1*, β_{0i} , are regressed on the explanatory variables with little- or no- within variation (X_{it} and Z_i , respectively), i.e. they are 'decomposed' into: the observed component which is explained by these variables; and the unobserved component, θ_i , which are "taken to represent truly unobserved unit heterogeneity" (Greene et al., 2010, p. 4):

$$\hat{\beta}_{0i} = \alpha_0 + \kappa' X_{it} + \lambda' Z_i + \theta_i \quad \text{..(5.9)}$$

Stage 3: The full model from stage 1, including all time-invariant and time-varying explanatory variables, but with the fixed effects now being replaced by the residuals from *Stage 2*, θ_i , is estimated by pooled OLS:

$$y_{it} = \alpha_0 + \kappa' X_{it} + \lambda' Z_i + \mu\theta_i + \varepsilon_{it} \quad \text{.................................(5.10)}$$

Plümper and Troeger (2004, p. 8) argue that the degrees of freedom have to be adjusted in this stage since only one variable (θ_i) is entered to account for all remaining unobservable individual effects. This is done automatically by the 4.0 beta version of the *xtfevd.ado* command used here.

The selection of variables with high between-to-within variance ratios

Based on Monte Carlo simulations, Plümper and Troeger (2007) provide the conditions under which FEVD is a superior estimator to standard FE, i.e. conditions under which a variable should be included in stage 2 of the FEVD estimation. They suggest that a between-to-within ratio of 2.8 or above should be included, though they explain that this threshold varies greatly depending on the correlation between the unit effects and the (almost) invariant variables and can be much lower than this. In this analysis these ratios appear to be higher in the case of the main the human capital measures ***lnSECedu*** and ***lnTERTedu***, with ratios of 4.40 and 3.63, respectively (see Appendix 5.2). Apart from these, ***lngdp*** and ***lnvacancy*** also appear to stand out from the rest with ratios of 2.37 and 2.50, respectively. Accordingly, *these four variables are included in the second stage of the FEVD procedure in addition to the strictly time-invariant ones.*

5.4.2 Estimated results

Based on the analyses of different estimators in Section 5.3, the Driscoll-Kraay estimator and the FEVD estimator are preferred in this empirical investigation. Namely, FE with Driscoll-Kraay SEs is preferred to panel-robust FE because they are heteroskedasticity-, serial correlation- and cross-sectional dependence-consistent; and they are preferred to two-way cluster-robust SEs because of their superior finite-sample properties. FEVD, on the other hand, is preferred to the other versions of FE for estimating the effect of slowly-changing (***SECedu***, ***TERTedu***, ***gdp***, ***vacancy***) or time invariant variables (***genvocratio, edutr1***, ***cognitive***, ***top***). Accordingly, results obtained using the FE estimator with Driscoll-Kraay SEs and the FEVD estimator are presented in the main text in rest of this section, whilst those from the other estimators are presented in the Appendices.

Before proceeding with the estimation of baseline Model 5.1 which includes both ***SECedu*** and ***TERTedu***, five models were estimated: two which include only one of these human capital measures separately, two which include measures ***top*** and ***cognitive*** separately, and one with only these four human capital variables without controls[55]. The results of the first four models do not suggest significant effects of the human capital variables on FDI. When these four human capital measures are entered together without control variables, ***top*** is found to be significant and positive, whilst ***cognitive*** is found to be marginally significant, but negative. However, these results do not appear to be robust to the inclusion of control variables as discussed below.

The full Model 5.1 was initially estimated using the Driscoll-Kraay estimator and this model was tested down, excluding control variables with t-statistics smaller than 1 (see Appendix 5.5 for printouts of the testing down procedure). The level of multicollinearity in this model has decreased significantly compared to the full model and it is now at acceptable levels with a maximum VIF of 6.4 and mean VIF of 2.39 (See Appendix 5.3). The parsimonious version of Model (5.1) is considered as a baseline model for the empirical investigations in the rest of this chapter.

[55] The market size variable, ***gdp***, is the only variable kept in the model as a control since in the dependent variable is not scaled.

The results of the Driscoll-Kraay estimator for Model (5.1) do not appear to support the hypothesis that human capital exerts a positive effect on FDI inflows (Column 1 in Table 5.4 below). This finding is confirmed by the panel-robust FE estimator and two-way cluster-robust estimator (see Appendix 5.6 for printouts). As the human capital variables ***SECedu*** and ***TERTedu*** have relatively little variability across time, the FEVD estimator could be more suitable for identifying their effect on FDI inflows. However, this estimator, too, fails to find a significant effect of these variables on FDI inflows. The other 'slowly-changing' variable in the model, ***gdp***, on the other hand, is found to be insignificant in all FE estimations, but it is highly significant and positive in the FEVD estimation. This appears to suggest that its estimated insignificance of this variable may be observed due to the country fixed effects having 'soaked up' its explanatory power (Beck, 2001, p. 285). The difference in results between the FE estimator(s) and FEVD is consistent with the superiority of FEVD estimator in estimating the effect of 'slowly-changing' variables, in line with the arguments and empirical findings of Plümper and Troeger (2007) and Greene et al. (2010). This finding also indirectly suggests that the failure to find a significant effect of these human capital measures on FDI inflows (in a FE context) is not caused (primarily) by these measures' low within variation and the inefficiency of the FE estimator related to it.

Table 5.4: Model 5.1 results (dependent variable: lnfdiflow)

	(1)	(2)
VARIABLES	Driscoll-Kraay FE	FEVD
lnsecedu	-0.120	-0.329
	(1.189)	(0.536)
lntertedu	-0.770	-0.492
	(0.648)	(0.583)
lngdp	-0.247	0.531**
	(0.365)	(0.226)
lntransition	5.076**	5.076
	(1.945)	(3.278)
lntradefree	-0.496	-0.496
	(0.384)	(0.733)
lneconfree	1.129	1.129
	(0.765)	(1.314)
lnforbank	0.335**	0.335
	(0.131)	(0.274)
privatisation	0.403***	0.403***
	(0.111)	(0.112)
instability	-0.611***	-0.611*
	(0.138)	(0.355)
Observations	161	161
Number of groups	12	12

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Year dummies included, but not reported

In terms of the other controls, the indicator of progress in transition, ***transition***, is found to have a positive and significant effect on FDI inflows in the FE estimations[56] (Column 1 in Table 5.4). According to these results, for a European transition economy in the sample, a 1% increase in the value of the EBRD transition indicator is, on average, associated with an increase of annual FDI inflows by 5.08%, *ceteris paribus*[57]. Calculated at the mean of the sample, an increase from 3.22 to 3.26 of the EBRD progress in transition score is associated with an increase of USD 163.4 Million in annual FDI inflows. There are two results consistent with market-seeking

[56] The same effect is not found in the FEVD estimation in Column 2, the reason likely being due to panel-robust and Driscoll-Kraay FE estimators controlling for the effects of heteroskedasticity, autocorrelation (and cross-sectional dependence), which cannot be done in the case of FEVD.

[57] The effect of the transition indicator appears to be surprisingly large, perhaps due to its correlation with other variables. Further investigations using the more efficient System GMM estimator in Chapter 6 can shed light on this issue.

FDI. In the results from more efficient FEVD estimator, market size (***gdp***) is found to have a significant effect, with a 1% increase in this variable being associated with a 0.53% increase FDI inflows, on average. Calculated at the mean of the sample, an increase of USD 480 Million in a country's GDP is associated with an increase of 17 Million USD in annual FDI inflows. Similarly, the proxy for FDI in the banking sector (***forbank***) is significant and positive. Finally, controls for political instability (***instability***) and the proxy for one-off privatisation-related FDI (***privatisation***) are highly significant, which is not surprising considering that the latter has accounted for significant portions of FDI in European transition economies in certain time periods, as discussed in Section 5.2.3. This stresses the importance of controlling for these factors when seeking to explain FDI determinants in transition economies, which tends to be ignored in the previous literature. The significance and size of the control variables in Model (1) from the Driscoll-Kraay estimator are similar in the panel-robust FE estimation and two-way cluster robust estimation (Appendix 5.6 provides these results).

Table 5.5 below presents results for the two transition-specific human capital hypotheses developed in Section 5.2.2 (see Appendix 5.7 for printouts). Overall, there does not appear to be evidence in support of the hypotheses that the emphasis on general education during the previous system or the share of population educated after the fall of communism affect FDI inflows positively. The ratio of general to vocational enrolments in upper-secondary education at the outset of transition, ***genvocratio***, is found to be statistically insignificant (Column 1), as is the share of population aged 16-30 in the working age population in 2008, ***edutr1*** (Column 2). As these are time-invariant variables, Models (5.2) and (5.3) could only be estimated using the FEVD estimator.

The effect of the second proxy for age structure, ***edutr2***, is positive and significant in the Driscoll-Kraay estimation, as hypothesised (Column 3), a finding that is supported by the panel-robust and two-way cluster-robust estimators (see Appendix 5.7 for printouts). However, before drawing too many inferences from this result, it is noted that no significant effect of this variable on inward FDI is found in any of the remaining estimations in this thesis. The coefficients on ***TERTedu*** and ***gdp***, surprisingly, are negative and significant in the Driscoll-Kraay estimator, but they are insignificant in the results of the other estimators.

Table 5.5: Models 5.2-5.4 results

	(1)	(2)	(3)
VARIABLES	Model 5.2	Model 5.3	Model 5.4
lnsecedu	-0.319	-0.365	-0.799
	(0.530)	(0.531)	(1.651)
lntertedu	-0.428	-0.574	-1.020**
	(0.771)	(0.527)	(0.387)
lngenvocratio	-0.0552		
	(0.366)		
lnedutr1		-1.414	
		(1.508)	
lnedutr2			11.36***
			(2.787)
lngdp	0.514**	0.425**	-1.087**
	(0.229)	(0.214)	(0.429)
lntransition	5.076	5.076*	-0.931
	(3.255)	(2.985)	(3.983)
lntradefree	-0.496	-0.496	-0.478
	(0.727)	(0.716)	(0.368)
lneconfree	1.129	1.129	-0.318
	(1.321)	(1.301)	(1.085)
lnforbank	0.335	0.335	0.334**
	(0.267)	(0.241)	(0.122)
privatisation	0.403***	0.403***	0.379**
	(0.111)	(0.110)	(0.123)
instability	-0.611*	-0.611*	
	(0.358)	(0.356)	
Observations	161	161	107
Number of groups	12	12	12

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Year dummies included, but not reported. Models 5.2 and 5.3 estimated using FEVD; Model 5.4
estimated using Driscoll-Kraay FE.

The results obtained for the alternative innovative measures of human capital, ***cognitive*** and ***vacancy***, are presented in Table 5.6 below (see Appendix 5.8 for printouts). Similar to the volume measures of human capital, the level of (students') cognitive skills in a country (***cognitive***) and the share of top performers in cognitive tests (***top***) do not appear to attract FDI inflows into European transition economies

(Columns 2 and 3). The availability of skilled labour, as measured by the (average) number of weeks required to fill a vacancy for a skilled worker (***vacancy***) also does not appear to have a significant effect on FDI inflows, a finding which is supported by panel-robust and two-way cluster robust FE estimators (Column 1). Though, the reliability of the latter specification is questionable: the small number of years/observations available appears to be insufficient to identify the effect of explanatory variables on FDI inflows, as indicated also by the lack of statistical significance found for all the variables in the model.

Table 5.6: Models 5.5-5.7 results (dependent variable: lnfdiflow)

	(1)	(2)	(3)
VARIABLES	Model 5.5	Model 5.6	Model 5.7
lnsecedu	0.493	-0.412	-0.337
	(1.715)	(0.523)	(0.486)
lntertedu	0.346	-0.550	-0.598
	(6.932)	(0.664)	(0.634)
lnvacancy	-0.255		
	(6.467)		
lncognitive		2.416	
		(3.885)	
lntop			0.507
			(0.395)
lngdp	0.638	0.501**	0.417*
	(3.151)	(0.218)	(0.231)
lntransition	5.193	4.164	4.164
	(70.00)	(3.421)	(3.194)
lntradefree	-1.026	-0.607	-0.607
	(10.18)	(0.765)	(0.739)
lneconfree	-4.196	1.308	1.308
	(4.599)	(1.210)	(1.197)
lnforbank	0.221	0.538	0.538
	(3.320)	(0.351)	(0.332)
privatisation	0.575	0.395***	0.395***

	(0.556)	(0.125)	(0.124)
instability		-0.669*	-0.669*
		(0.363)	(0.362)
Observations	48	148	148
Number of groups	12	12	12

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Year dummies included, but not reported. Results obtained using FEVD.

5.5 Robustness check: A FDI stock adjustment model

As a robustness check, the effect of FDI on human capital is estimated using the FDI stock as the dependent variable in a stock (or partial) adjustment model framework. According to neoclassical stock adjustment models, the optimal stock of capital is not achieved instantaneously, but it is realised in smaller sequential changes (Lucas 1967; Gould, 1968; Lucas and Prescott, 1971; Blundell et al., 1995). The slow adjustment tends to be explained by the presence of costs of adjusting current stock which are increasing at the margin, either due to direct installation/dismantling costs or to losses from sudden disruptions of production activities. As a result of this inability to instantaneously achieve the optimal capital stock, the current level of investment will depend both on past investment and investors' expectations about other factors that are expected to affect firms' profitability. The stock adjustment model has been previously used to explain FDI in a country/industry level setting, among others, by Jun and Singh (1995), Cheng and Kwan (2000a), Kinoshita and Campos (2003), Blattner (2006), Bobonis and Shatz (2007), Riedl (2010) and Kinoshita (2011).

The stock adjustment model explains the current level of investment as a means of adjusting the current stock of FD towards its corresponding optimal level. Following Chow (1967) and Cheng and Kwan (2000a), it is assumed that capital adjusts according to the following process:

$$d \ln Y_{it} / dt = \alpha(\ln Y_{it}* - \ln Y_{it}) \qquad (5.11)$$

Thus, the adjustment process is such that the percentage change in current capital stock is proportional to the gap between the optimal stock of capital, $Y_{it}*$, and current stock of capital, $Y_{it.}$

In empirical applications Equation (5.11) is replaced by its discrete version:

$$\ln Y_{it} - \ln Y_{it-1} = \alpha(\ln Y_{it}* - \ln Y_{it-1}) \quad \text{...(5.12)}$$

which, after collecting terms, becomes:

$$\ln Y_{it} = (1-\alpha)\ln Y_{it-1} + \alpha \ln Y_{it}* \quad \text{...(5.13)}$$

Thus, the current level of investment is driven by the adjustment effect towards the equilibrium level, and the shift of the equilibrium level as a result of changes in other factors. The speed of the adjustment process is indicated by the coefficient on the lagged capital stock variable, (1-α), which has to be a positive fraction in order for the adjustment process to be stable. However, in addition to the adjustment effect, (1-α) can also reflect an agglomeration effect, as discussed in Sections 5.2 and 5.3. Accordingly, in previous FDI studies it has been interpreted as a combination of the two effects (Cheng and Kwan, 2000a; Kinoshita and Campos, 2003). However, in order to estimate the above equation, the unobserved optimal level of investment is still needed, which has to be specified in terms of its determinants, X_{it}:

$$\ln Y_{it}* = \beta_i' \ X_{it} + z\eta_i + \varepsilon_{it} \quad \text{...(5.14)}$$

Substituting (5.14) into (5.13) gives a dynamic panel equation which can be empirically investigated:

$$\ln Y_{it} = (1-\alpha)\ln Y_{it-1} + \beta_i' \ X_{it} + z\eta_i + \varepsilon_{it} \quad \text{...................................(5.14)}$$

The estimated coefficients β_i in a dynamic panel model are short-run coefficients, representing the effect of the *new* information on the respective regressors, controlling for their (joint) *"historical" effects*. Greene (2008, p. 469) explains: "With the lagged dependent variable, we now have in the equation the entire history of the right-hand-side variables, so that any measured influence is conditional on this history; in this case, any impact of (the independent variables X_{it}) represents the effect of new information". Thus, in addition to indicating the speed of adjustment towards the equilibrium level, the lagged dependent variable serves as a control variable in the model, incorporating the effect of potential "omitted" variables.

Finally, it should be noted that in this empirical investigation it is not the speed of adjustment of FDI stocks *per se* that is of interest; however, the dynamics in the underlying process must be modelled nevertheless because, as Bond (2002, p.1) warns, 'this may be crucial for recovering consistent estimates of other parameters'. Accordingly, the following stock adjustment version of the baseline Model (5.1), and augmented models (5.4) and (5.5) are estimated for robustness[58]:

$$\ln FDIstock_{it} = (1-\alpha)\ln FDIstock_{i,t-1} + \beta_1 \ln SECedu_{it} + \beta_2 \ln TERTedu_{it} + \\ + \beta_i' \; X_{it} + \delta t_t + z\eta_i + \varepsilon_{it} \qquad ....(5.15)$$

$$\ln FDIstock_{it} = (1-\alpha)\ln FDIstock_{i,t-1} + \beta_1 \ln SECedu_{it} + \beta_2 \ln TERTedu_{it} + \\ + \beta_3 \ln edutr2_{it} + \beta_i' \; X_{it} + \delta t_t + z\eta_i + \varepsilon_{it} \qquad ....(5.16)$$

$$\ln FDIstock_{it} = (1-\alpha)\ln FDIstock_{i,t-1} + \beta_1 \ln SECedu_{it} + \beta_2 \ln TERTedu_{it} + \\ + \beta_3 \ln vacancy_{it} + \beta_i' \; X_{it} + \delta t_t + z\eta_i + \varepsilon_{it} \qquad ....(5.17)$$

Where

FDIstock is the stock of FDI (in USD) as reported by UNCTAD (2010b).

SECedu (***TERTedu***) is the share of population who have completed secondary (tertiary) education (see Section 5.2 and Table 5.3 for explanations);

edutr2 is the share of population aged 16-30 in a country's workforce;

vacancy is the length of period required to fill a vacancy for a skilled worker;

$\boldsymbol{X_{it}}$ are the control variables: ***gdp, tradefree, econfree, transition, forbank, privatisation, instability.*** (see Section 5.2 and Table 5.3 for explanations);

$\boldsymbol{t_t}$ are time dummies;

$\boldsymbol{\eta_i}$ is an unobserved time-invariant individual effect; and

$\boldsymbol{\varepsilon_{it}}$ is an unobserved white noise disturbance.

However, the inclusion of the lagged dependent variable in turn creates other problems for estimation which have to be addressed. The correlation of the lagged value of FDI stock with the fixed effects gives rise to "dynamic panel bias" (Nickell, 1981; Bond, 2002), which can be accounted by the methods discussed in the rest of this section and in Chapter 6.

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[58] As discussed later, only models analogous to Models (5.1). (5.4) and (5.5) in the previous section are estimated because the other contain time-invariant variables which cannot be estimated using the estimator used here.

In a Within Groups (i.e. FE or LSDV) estimator, the observations are transformed into deviations from individual means (i.e. across time), eliminating the time-invariant fixed effects which are the source of inconsistency. However, this transformation gives rise to negative correlations between the transformed lagged dependent variable and transformed error term, thus causing downward bias (Nickell, 1981; Kiviet, 1995). This correlation (and hence downward bias) does not decrease with a large N, but it does decrease by increasing the time-dimension (Nickell, 1981). In a Monte Carlo study, Judson and Owen (1999) find this "dynamic panel bias" to be significant even with a panel of 30 periods, which renders the use of Within Groups (LSDV) estimator inappropriate in this sample with a small time-dimension of 14 years at best. Instrumental variable (IV) and Generalised Method of Moments (GMM) estimators (Anderson and Hsiao, 1982; Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998), discussed in Section 6.6, have been developed to deal with this type of bias, but their properties hold for a large number of individuals. Monte Carlo evidence suggests that they can be biased and imprecise in small-N samples such as the one in this analysis; in particular, their relatively large variances favour LSDV in a small-N context, despite its inconsistency (Arellano and Bond, 1991; Kiviet, 1995; Judson and Owen, 1999). Accordingly, Kiviet (1995) suggests 'correcting' LSDV for dynamic panel bias as the best approach to be adopted in this context. Kiviet proposes 'subtracting' the bias from the estimated LSDV coefficients in a balanced-panel setting based on his derived approximation formula of the bias, which is later refined in Kiviet (1999) and Bun and Kiviet (2003) and extended to accommodate unbalanced panels by Bruno (2005a). Monte Carlo studies find the resulting 'bias-corrected' LSDV estimator to be preferred to both LSDV- and IV and GMM- estimators for small-N dynamic panel data such as the one used in this analysis (Kiviet, 1995; Judson and Owen, 1999; Bruno, 2005a, b). Accordingly, the partial adjustment FDI stock model in this section is estimated using the ***corrected dynamic LSDV (LSDVC) estimator by Bun and Kiviet (2003), as extended by Bruno (2005a) for implementation for unbalanced panels.*** As System GMM is preferred to Difference GMM in this empirical investigation (see Section 6.6 for a discussion), the results presented in the rest of this section use bias approximations based on the System GMM estimator as an initial consistent estimator. However, it should be noted, being a within-estimator, the LSDVC estimator wipes out the effects of time-invariant variables, and thus precludes estimating some of the models proposed in this analysis.

Table 5.7 below summarises the results of the stock-adjustment models estimated using LSDVC (see Appendix 5.9 for printouts). In all three specifications the coefficient on the lagged FDI stock is positive and significant, as expected; it is below one, indicating a stable dynamic process and it lies in the 'credible' range, i.e. between the LSDV and OLS estimates, thus not indicating any specification problems and/or lack of consistency in estimation (Bond, 2002; Roodman, 2006; see Section 6.6 for explanations).

Similar to the model with FDI inflows as the dependent variable, the partial adjustment model does not appear to support the hypothesis that foreign investors are attracted by a higher level of human capital as measured by traditional volume measures: the percentage of population who have completed secondary (tertiary) education, ***SECedu (TERTedu)***. The empirical evidence also does not appear to support the hypothesis that foreign investment is attracted by higher shares of population who have completed education after the fall of the communist system, as proxied by ***edutr2*** (Column 2) or by the availability of skilled workers in the economy, as proxied by ***vacancy*** (Column 3).

Table 5.7: Models 5.15-5.17 results (dependent variable: lnfdistock)

	(1)	(2)	(3)
VARIABLES	Model 5.15	Model 5.16	Model 5.17
L.lnfdistock	0.783***	0.812***	0.800***
	(0.0610)	(0.0993)	(0.171)
lnsecedu	-0.0284	-0.917	-0.937
	(0.566)	(0.866)	(1.791)
lntertedu	-0.400	-0.360	0.150
	(0.278)	(0.391)	(0.976)
lngdp	-0.0492	0.0502	0.986**
	(0.196)	(0.284)	(0.476)
lntransition	0.348	-1.606	-0.361
	(0.613)	(1.261)	(1.832)
lntradefree	0.158	0.325	0.401
	(0.171)	(0.278)	(0.392)
lneconfree	0.0331	-0.0316	-1.471
	(0.319)	(0.404)	(0.902)
lnforbank	0.0205	-0.153	-0.401
	(0.0551)	(0.138)	(0.249)

privatisation	0.0830***	0.0775**	0.0438
	(0.0284)	(0.0339)	(0.0550)
instability	0.148		
	(0.145)		
lnedutr2		1.313	
		(0.946)	
lnvacancy			0.288
			(0.230)
Observations	154	107	48
Number of groups	12	12	12
LSDV-OLS range (lagged dependent var)	0.66-0.84	0.59-0.86	0.30-0.97

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Year dummies included, but not reported. Models estimated using LSDVC.

5.6 Conclusion

This chapter has provided a critical appraisal of alternative measures of human capital available for European transition economies. It has been argued that stock measures of education are superior to enrolment rates because they reflect the educational attainment of the whole workforce, and that secondary and tertiary education measures are superior to measures of primary education or literacy because the latter are uniformly high across European transition economies in the period covered in this study. Accordingly, the effect of the percentage of working age population who have completed secondary/tertiary education on FDI inflows/stocks was tested for a sample of European transition economies in the period 1995-2008. Consistent with the findings of the meta-regression analysis in Chapter 3, panel-robust FE, FEVD and two-way cluster-robust FE all fail to find a positive relationship between these measures and FDI inflows. These results are confirmed by a stock-adjustment model using with aggregate FDI stock estimated by the dynamic corrected LSDV estimator.

Similar to the volume measures of human capital, insignificant results are also found for the level of students' cognitive skills as measured by average scores in International Student Achievement Tests; for the share of top-performing students in these tests; as well as for a proxy of skilled labour availability as reported by the firms operating in the economy. Further, empirical results by and large do not support two transition-specific human capital hypotheses developed in this thesis: that foreign investors are expected to be attracted by a younger population, educated in a post-communist education system and by a higher proportion of a population that has completed general (as opposed to vocational) secondary education.

Thus, there appears to be no robust evidence linking higher availability or quality of human capital with the level of FDI inflows/stocks a country receives. One reason for this finding may be that human capital is not necessarily important for all types of FDI and the weak sectoral control variables used here have been unable to (sufficiently) account for these sectoral differences. Therefore, the next chapter looks more closely at the structure of FDI according to economic activity and the hypotheses developed earlier in this analysis are tested for FDI in economic sectors where foreign investors are expected to attach a higher weight to the level and quality of human capital in their decision-making.

Chapter 6

A SECTOR STUDY OF THE EFFECT OF HUMAN CAPITAL ON FDI IN EUROPEAN TRANSITION ECONOMIES

Contents

6.1 Introduction

Using various estimation techniques and human capital measures, the analysis presented in Chapter 5 empirically investigated the relationship between European transition economies' level of human capital and their FDI inflows/stocks. This investigation did not find support for the hypothesis that a country's stock of human capital attracts FDI, regardless of whether that stock was developed during or after communism. Measures of the quantity of education attained by the workforce which are commonly used in literature were not found to affect inward FDI, a result which is consistent with the lack of a 'genuine effect' in previous research as suggested by the meta-regression analysis presented in Chapter 3 of this thesis. It has been previously argued in this thesis (Section 5.2.1) that the use of aggregate FDI measures is a major weakness of empirical studies because the relative importance of (locational) factors is likely to depend largely on foreign investors' motivations for undertaking FDI (Section 2.2) and the technological intensity of the specific economic activities undertaken in the host country (Section 4.2). Accordingly, the use of aggregate measures has also been argued to be one potential explanation for lack of the empirical support for a human capital-FDI relationship found in previous research and in the analysis presented in Chapter 5. Therefore, this chapter analyses the sectoral composition of FDI in European transition economies; it provides arguments as to which type of foreign investors (i.e. in which economic sectors) are (more) likely to be affected by the host country's human capital endowment; and empirically tests the (relative) importance of human capital endowment for FDI in different economic activities.

The rest of this chapter is organised as follows. Section 6.2 provides a statistical overview of the sectoral composition of FDI stocks in European transition economies. Section 6.3 examines the theoretical arguments on the determinants of FDI at sector level and identifies sectors where foreign investors' decisions are likely to be (more strongly) affected by human capital. Section 6.4 provides a review of related studies that investigate FDI determinants using disaggregated data. The empirical investigations using sector- and industry- level manufacturing FDI data are presented in Sections 6.5 and 6.6, and Section 6.7 concludes with a summary of the empirical findings.

6.2 The sectoral composition of FDI stocks in European transition economies

The Vienna Institute for International Economic Studies (wiiw) provides a FDI database for Central, East, and South-East European transition economies (WIIW, 2011) which contains data on stocks of FDI according to economic activity as classified by NACE Rev 1.1[59]. The data reported in this database is collected by the host countries' Central Banks through enterprise surveys. The database contains data for all the countries included in the analysis presented in the previous chapter, but not always for the whole period under consideration here (1995-2008). Tables in the rest of this section refer to data for 2007 because this was the most recent year for which data is available for the whole sample. The data, summarised in Table 6.1 below, suggest that nearly a third of the FDI stocks in the European transition economies in this study's sample are in the manufacturing sector, while the rest is highly dominated by services. The second major sector is the financial sector which accounts for just over a fifth of the FDI stock, followed by real estate, renting and business activities; financial wholesale and retail trade and transport, storage and communication (which is dominated by the telecommunication sector where major privatisations occurred during transition). However, the sectoral distribution differs significantly across the economies in the sample. Manufacturing appears to be a major FDI receiving sector, with a share above the weighted average, in the Slovak Republic, Czech Republic, Macedonia, Poland, Romania, Lithuania and Hungary, while in most of the other countries FDI is mainly concentrated in services. Notably, the financial sector accounts for the largest shares of FDI in Estonia, Latvia and South-East European countries (Croatia, Slovenia, Albania, Bosnia and Herzegovina), but it also makes up a significant share of FDI (11% or above) in each of the remaining countries in the sample.

[59] The database reports FDI according to the more recent version of NACE Rev 2.1 for only two of the countries included in this analysis. The database also provides data on FDI inflows, but these tend to be reported for fewer years and they are missing altogether for some countries. Other sources of sector-level comparable FDI data for large sets of countries are Eurostat and OECD. However, Eurostat covers only a few of the countries included in this analysis, while OECD provides outflows of OECD members by sector and by partner country *separately*, but not outflows broken down by sector *and* host country.

Table 6.1: Distribution of FDI stocks according to economic activity (2007)

NACE Rev 1.1 code and economic activity		FDI stock (MN EUR)	Share (%)
D	Manufacturing	138,297.1	31.9
J	Financial intermediation	91,699.5	21.2
K	Real estate, renting and business activities	61,978.2	14.3
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	55,974.5	12.9
I	Transport, storage and communication	35,350.6	8.2
E	Electricity, gas and water supply	21,358.1	4.9
F	Construction	7,851.3	1.8
C	Mining and quarrying	5,954.2	1.4
H	Hotels and restaurants	3,381.4	0.8
A&B	Agriculture, hunting, forestry and fishing	1,905.1	0.4
	Other	9,574.8	2.2
	Total	**433,324.6**	**100.0**

Source: Own calculations based on WIIW (2011)

Within manufacturing, around half of the FDI stock is concentrated in the manufacturing of transport equipment; basic metals and fabricated metal products; food industry; chemical industry; electrical and optical equipment (Table 6.2 below)[60]. However, this again is not a uniform distribution across the economies in the sample. FDI in the automotive industry, for instance, has gone exclusively to five countries: almost 85% is concentrated in Hungary, Czech Republic and Poland, with the rest being split between the Slovak Republic and Romania. The same countries appear to be major destinations for FDI in the food and chemical industries and manufacture of basic metals, fabricated metal products and electrical equipment, though FDI in these sectors is not as concentrated as in the automotive industry. Of the smaller economies in the sample, Croatia and Slovenia appear to be the only destinations that have been more successful at attracting FDI in the major manufacturing sectors above. Slovenia has been particularly successful in attracting FDI in the chemical industry, whilst Croatia has significant FDI stocks in this industry as well as in the food industry and manufacturing of electrical equipment.

[60] The FDI stock figures presented in Table 6.1 are consistent with the data presented in Figure 1.3 in Section 1.2 because: (1) FDI stocks here are measured in Euros, whilst those in Figure 1.3 are measured in US Dollars and (2) FDI stocks here refer only to the sample of economies which are included in the empirical analyses in this thesis, whilst those in Figure 1.3 also include Bosnia and Herzegovina, Kosovo, Montenegro and Serbia.

Table 6.2: Distribution of manufacturing FDI stocks (2007)*

NACE Rev 1.1 code and manufacturing activity		FDI stock (MN EUR)	Share (%)
DM	Transport equipment	25,205.6	18.9
DJ**	Basic metals and fabricated metal products	18,110.6	13.5
DA	Food products, beverages and tobacco	15,169.3	11.3
DG	Chemicals, chemical products and man-made fibres	12,547.0	9.4
DL	Electrical and optical equipment	11,613.2	8.7
DI**	(Other) non-metallic mineral products	7,367.9	5.5
DK	Machinery and equipment n.e.c.	7,047.3	5.3
DF**	Coke, refined petroleum products and nuclear fuel	6,802.1	5.1
DH**	Rubber and plastic products	6,700.3	5.0
DD/DE**	Wood and wood products; pulp, paper and paper products; publishing and printing	5,648.5	4.2
DB/DC	Textiles/leather and textile/leather products	2,635.4	2.0
DN**	Furniture; manufacturing n.e.c.; recycling	1,272.3	1.0
	Other	13,597.1	10.2
Total* **		**133,716.7**	**100.0**

Source: Own calculations based on WIIW (2011)

*Albania and Bulgaria excluded (data for Albania available for 2003-5, and not available for Bulgaria)

**The share of the sector is likely to be underestimated because data is not available for all countries

***The total does not equal that in the previous table because it does not include Albania and Bulgaria

****n.e.c. refers to 'not elsewhere classified'

In summary, this review of sectoral data reveals a diversity of distribution of FDI across the economies in the sample. Economies appear to differ greatly with regard to their shares of FDI in manufacturing compared to that in services, as well as their shares in different types of services or manufacturing activities. To the extent that the characteristics of different sectors where FDI takes place are associated with different motivations for foreign production and the foreign investors' decisions are affected by different factors, these differences in the sectoral composition of FDI among European transition economies may be conveniently used to assess the relative importance of these factors. The next section will argue that foreign investors are likely to assign a different relative importance to different locational factors, in particular to human capital endowment, depending on their motivation for foreign production, which in turn is (partly) reflected in the economic activity they undertake in the host economy. Accordingly, the sectors where human capital is expected to be relatively more attractive to foreign investors will be identified and the hypotheses developed in the previous chapters will subsequently be tested using data at the sector level.

6.3 Assessing the importance of human capital for different economic sectors/types of FDI

As discussed in Section 2.2, FDI can be broadly categorised into four types according to the motivation for foreign production: (natural) resource-seeking, strategic asset or capability-seeking, market-seeking and efficiency-seeking (Dunning and Lundan, 2008). The rest of this section will look more closely at the characteristics of these types of FDI and assess the extent to which FDI in different economic sectors can be associated with these.

Resource-seeking FDI is motivated by access to the natural resources of a host country in order to minimise costs and/or ensure the security of supplies, as explained in Section 2.2. This type of FDI is typically associated with primary sector activities, i.e. agriculture, fishing, mining and quarrying (Schulz, 2007; Dunning and Lundan, 2008; Hallam, 2009; Gerlach and Liu, 2010), and as such it does not seem to account for a significant share of FDI in transition economies (Table 6.1 above). As the key determinant of this type of FDI are a country's natural resource endowments (which are location-bound), foreign investment will be relatively less affected by other factors, including human capital. Moreover, resource-seeking FDI typically involves transfers of resources to the home country which are then used as inputs in manufacturing or sold as final products (Schulz, 2007; Gerlach and Liu, 2010), which means that foreign affiliates have little interaction with the local economy; this has been argued to be a further reason why other factors that are normally expected to affect FDI are likely to be irrelevant (Schulz, 2007; Walsh and Yu, 2010). Consistent with these arguments, empirical analyses appear to suggest that FDI in the primary sector is affected by factors such as market size, market growth, macroeconomic stability, institutional quality or tax incentives (Dahl, 2002; Stöwhase, 2002; Schulz, 2007; Walsh and Yu, 2010). By the same token, it is argued here that human capital is unlikely to be a significant factor in attracting FDI in the primary sector, but also in some services such as tourism which, as Dunning and Lundan (2008, p. 68) point out, are also intended to exploit location-bound resources.

As discussed in Section 2.2, ***strategic asset or capability-seeking FDI*** is intended to acquire expertise and technological capability. As such, it can be argued to the type of FDI that is most affected by the availability of skilled labour. Though previous studies do not associate it with any particular economic sector, it appears that this type of FDI is more likely to be found in higher technology intensive industries, to the extent that their technologies are high skill-complementary. This type of foreign investment is typically directed towards developed countries (Hsu and Chen, 2009) and it is not expected to be significant in European transition economies.

Market-seeking FDI is intended to supply goods or services to the host country market or its neighbouring countries, as explained in Section 2.2. Because it is primarily motivated by access to markets, this type of FDI is relatively less likely to be affected by host country's factor endowments, and more so by the size and growth of the host market and that of the neighbouring countries (Schulz, 2007; Dunning and Lundan, 2008; Walsh and Yu, 2010). Hence, it is argued here that human capital is again less likely to be a significant factor in foreign investors' decision-making if FDI is undertaken for market-seeking purposes. Market-seeking FDI is typically associated with the tertiary sector due to the non-tradable and non-storable nature of (most) services which requires them to be produced in the host country where they will be consumed[61] (Schulz, 2007; Riedl, 2010). Hence, FDI in the tertiary sector, including banking, retailing, real estate, business activities, transport and telecommunication which are major FDI recipients in European transition economies, is considered in this analysis as predominantly market-seeking and therefore less likely to be affected by the availability and cost of production factors, including human capital[62]. The classification of FDI in the secondary sector, on the other hand, is less straightforward, because it is likely to be driven both by efficiency considerations (discussed below) and by access to markets, the latter becoming especially relevant for products with high transportation costs and host countries with more trade barriers (Schulz, 2007; Riedl, 2010).

[61] Note that although export of services is not always technically impossible (e.g. in banking or insurance), it is not likely to be practical and may cost more than operating a subsidiary in the local market, as Goldberg (2007) explains in the case of the banking sector.

[62] There are some services in the information and communication technology (ICT) sector that are tradable due to telecommunication advances, but they cannot be controlled for because of the level of aggregation of data available for this sector study. However, such services are likely to account for a very small portion of services in the sample under consideration here, so it is unlikely to affect the results.

Efficiency-seeking FDI, as discussed previously in Section 2.2, aims to reduce production costs through a combination of resource- and market-seeking investment, typically through carrying out different stages of production in different countries so as to exploit differences in factor prices. Therefore, it is argued here that the availability and price of skilled labour is likely to be one of the factors considered by the efficiency seekers. As this type of FDI is predominantly related to the manufacturing sector (Schulz, 2007), it is argued here that if foreign investors' decisions are indeed affected by the availability and/or price of human capital then this relationship is most likely to be identified in this sector. Therefore, models similar to those developed in Chapter 5 of this thesis are going to be estimated in this chapter using the level of FDI stocks in manufacturing sector instead of the aggregate measure used previously.

Finally, as discussed in Section 4.2, previous research indicates complementarity between the skills and the level of technology. Based on this, it is argued here that the effect of human capital is likely to differ between different manufacturing activities according to their level of technological intensity. In this case, the level of technological intensity of foreign investment can be argued to be a proxy for the level of complexity of the task that foreign investors intend to carry out in the host economy, which, according to the arguments and evidence presented in Acemoglu and Autor (2012), is expected to determine the required skill intensity of the workforce in the host country. The proposition that FDI in different manufacturing industries may differ with regard to the relevance they are likely to attach to human capital availability is tested using dummy variables to distinguish between groups of industries with different levels of technological content, as classified by OECD/Eurostat. The classification of industries and the specification of this model are discussed in more detail in Section 6.6, after a review of the related empirical literature and an empirical investigation using aggregate manufacturing FDI data.

6.4 Related empirical studies

Mainly due to data limitations, only a few studies investigate the determinants of FDI at sector level (see Table 6.3 below for a summary). As in the case of the FDI literature in general (discussed in Chapter 3), human capital tends not to be included and, when it is, it is not clear that the measures used actually reflect human capital availability in the host country. For instance, Urata and Kawai (2000), Nachum (2000), Bellak et al. (2009), Walsh and Yu (2010) and Kinoshita (2011) use measures that reflect the (share of) population currently enrolled in education which, as argued in Section 5.2.2, is an imperfect measure because it does not reflect the stock of human capital in the workforce. Tsen (2005) uses a measure of federal government expenditure, which again is a 'flow' measure reflecting only current investment in education and, as argued in Section 4.3, it is not clear from empirical analyses that higher levels of expenditure are associated with better educational outcomes. Finally, Bellak et al. (2009) use the share of low-skilled hours in total hours worked in each industry as a proxy for human capital. This proxy has the great advantage of measuring the skill level for specific industries, but it may merely reflect the technological level of the current firms in the market which may not be determined primarily by the skill level of the available workforce. In the empirical analysis presented below the relationship between human capital and FDI at sector level will be tested using arguably more appropriate measures of human capital: the share of population who have completed secondary/tertiary education (controlling for vintage effects), the level of cognitive skills and the availability of skilled labour as reported by firms currently operating in the manufacturing sector.

Table 6.3: Sector/industry level FDI studies

Study	Sample	Period	Estimation technique	Dependent variable	Human capital measure (result)	Independent variables related to human capital (results)	Comments
1. FDI in manufacturing							
Urata and Kawai (2000)	Japanese firms' manufacturing FDI in 117 developing and developed economies	1980-1994	Logit	Dummy, 1 if the country is the chosen as the location for investment	Enrolment rate in secondary education (-)	Wage (-)	When the sample is divided in developing and developed economies, the results stay the same for the first group, but the human capital becomes positive and wage becomes insignificant for the latter group
Resmini (2000)	EU firms' FDI in 12 CEEC's	Panel (FE)	Logit	Dummy, 1 a certain manufacturing sector of a certain country is chosen as the location for investment		Wage differential between home and host country (+ in science-based and capital-intesive sectors, insignificant in traditional and scale-intensive ones)	This model provides information similar to the macro-level ones with country-industry pairs as a dependent variable in Riedl (2010) and Bellak et al. (2009), below.

Tsen (2005)	Malaysia	1980-2002	Time-series	Value of foreign investment in approved projects in manufacturing	Federal government expenditure on education as a percentage of GDP (+)		
Bellak et al. (2009)	10 developed and transition economies	1995-2004	Panel (difference GMM)	Total stock of inward FDI in different manufacturing industries in different countries (i.e. country industry pairs)	Low-skilled hours worked in each industry as a share of total hours worked (-)	Labour cost (insignificant), labour productivity (insignificant); Government-financed R&D as a percentage of GDP (+)	Effect of human capital is robust across specifications.
2. FDI in services							
Nachum (2000)	US states	1987 and 1992	OLS	Number of foreign investors in financial and professional services	Share of population in higher education (+)	Labour productivity (insignificant)	
2. FDI in more than one sector							
Bajo-Rubio and Sosvilla-Rivero (1994)	Spain	1964-1989	Time-series (cointegration analysis)	FDI inflows in manufacturing/non-manufacturing		Unit labour costs (insignificant in manufacturing, - in non-manufacturing)	
Stöwhase (2002)	Bilateral inflows between 12 EU economies.	1995-1999	OLS/GLS	FDI inflows in the primary/secondary/tertiary sector		Labour cost (insignificant)	

Schulz (2007)	63 developed and developing economies	1993-2003	OLS and panel (FE and GMM)	Aggregate FDI inflows, and FDI inflows in the primary/secondary/tertiary sector, as a share of GDP		Labour cost (- in manufacturing , insignificant in other sectors)	Labour cost included only in the cross-section OLS regressions.
Bénassy-Quéré et al. (2007)	US FDI to 18 EU economies	1994-2002	Panel (FE)	Companies' stock of capital expeditures in different industries		Unit labour costs (+ or insignificant)	Potential differences between sectors are not investigated.
Riedl (2010)	8 transition economies	1998-2004	Dynamic panel (system GMM)	FDI stock in different manufacturing and service industries in different countries (i.e. country-industry pairs)		Unit labour costs (- in manufacturing, insignificant in services)	
Walsh and Yu (2010)	26 developed, developing and transition economies	1999-2008	Panel (system GMM)	Aggregate FDI inflows, and FDI inflows in the primary/secondary/tertiary sector, as a share of GDP	Enrolment rates in primary, secondary and tertiary education (insignificant)		
Kinoshita (2011)	25 CEEB and CIS economies	1990-1998	Dynamic panel (system GMM)	FDI stock in the tradable sector as a share of total FDI stock	Tertiary education enrolment rate (+)	Nominal wage rate (negative)	Tradable sector includes: agriculture, manufacturing, mining, retail, hotels and restaurants

Most of the previous studies regress FDI in the primary/secondary/tertiary sector, or more than one of these in separate regressions for comparison, on a set of country level determinants (Bajo-Rubio and Sosvilla-Rivero, 1994; Stöwhase, 2002; Schulz, 2007; Tsen, 2005; Walsh and Yu, 2010). Only a few use more disaggregated industry-level data, but either no attempt is made to differentiate between the potentially different effects of explanatory variables according to industry (Bénassy-Quéré et al., 2007; Bellak et al., 2009), or only differences between FDI in service vs. manufacturing industries (Riedl, 2010) or tradable vs. non-tradable industries (Kinoshita, 2011) are investigated. The analysis presented below will use both these approaches to investigate the effect of human capital on FDI. Since, as argued in the previous section, human capital is more likely to affect manufacturing (i.e. the secondary sector) than resource-based and service industries (i.e. the primary and tertiary sectors), the hypotheses developed in the previous chapter will first be tested here using data for the (total) manufacturing sector FDI. In Sections 4.2 and 6.3 it was further argued that human capital is likely to be relatively more important in some manufacturing industries than in others, depending on their capital intensity and the complementarity of that capital to skilled labour. Therefore, manufacturing FDI data will be broken down further and these potential differences are investigated using data for country-industry pairs as the cross-sectional unit of the panel analysis.

6.5 Evidence from aggregate manufacturing data

The specification adopted in this part of the sector study is similar to that developed in Chapter 5, except that the dependent variable and some of the independent variables are now measured at sector level. The dependent variable used in this investigation is the annual (aggregate) level of FDI stock in the manufacturing sector, ***(ln)manFDIstock***, i.e. sector D in 1-digit NACE Rev 1.1 classification, as reported by WIIW (2011)[63]. Other related measures similar to that used by Kinoshita

[63] The data, originally reported in Euros, was converted to US Dollars based on the historical exchange rate data provided in X-rate (2011) in order to be compatible with the GDP data (***gdp***). As the exchange rates are reported on a monthly basis (as an average of daily values), the annual exchange rate was calculated as the average of the monthly values reported, weighed by the number of days. As previously noted in Chapter 5, the use of USD is not expected to affect the results because any changes in the valuation of stocks that may exist due to exchange rate variability are picked up by the time dummies since they are expected to be universal across countries. The 'universality' of ER shocks is automatic in the case of the countries that have the same currency, i.e. Euro, and those whose currencies are pegged against the Euro; and it is expected to hold also for countries with

(2011) were considered, but they do not seem to be appropriate for this analysis. First, specifying the dependent variable as a *share* of a sector's FDI stock in total FDI was considered; however, this can be misleading because it only provides information on the *relative* size of the FDI in manufacturing, which is determined by the factors that attract FDI in this sector, but also other factors that attract FDI in the other sectors. For instance, even though two countries may have the same level of manufacturing FDI, the share of manufacturing FDI will be lower in the country which also has abundant natural resources and hence more resource-seeking FDI. Second, the use of FDI stocks in tradable vs. non-tradable sectors was considered, but this does not appear to be an appropriate classification for this purpose of this analysis because it includes primary-sector activities (e.g. agriculture or mining) where the effect of human capital is likely to be smaller, as argued in Section 6.2.

As previously explained in Section 5.5, in a model with a stock measure, the (expected) persistence of FDI has to be accounted for by including the lagged dependent variable in the model and the 'dynamic panel bias' arising from the inclusion of this variable can be addressed using a number of methods. As in the case of the aggregate FDI stocks model developed in Section 5.5, the number of countries in this sample is too small to allow a GMM approach, and therefore dynamic panel bias is corrected by using ***Bun and Kiviet's (2003) corrected dynamic LSDV estimator, as extended by Bruno (2005a) for implementation for unbalanced panels***.

Accordingly, the following LSDV Models are estimated here with similar regressors to those used in Chapter 5, with the exception of two variables which are now measured at sector level. Namely, a new dummy variable, ***manprivatisation***, is created which indicates years when major privatisations of *manufacturing* enterprises occurred in order to control for one-off privatisation-related changes in FDI stock and ***manvacancy*** now reflects the average of the number of weeks it took firms *in manufacturing* to fill a vacancy for a skilled worker. These two variables were created in the same manner as their economy-wide counterparts, ***privatisation*** and ***vacancy,*** explained in Section 5.2. Table 6.4 below presents the list of variables used

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floating exchange rates assuming that their exchange rates with the Euro and US Dollar will move together due to arbitrage effects.

in this chapter, as well as their definitions and sources whilst Appendix 6.1 presents their descriptive statistics and the raw correlations.

Table 6.4: Variable names, definitions and sources

Variable name	Expected sign	Description	Source
manFDIstock	dependent var	Inward FDI stock in manufacturing according to NACE 1.1 classification (in current USD, converted from EUR)	WIIW (2010)
indFDIstock	dependent var	Inward FDI stock in country *i* in manufacturing industry *j* according to NACE 1.1 classification (in current USD, converted from EUR)	WIIW (2010)
SECedu	+	Percentage of population over age 15 who have completed secondary education, including those who have completed tertiary education (see Section 5.2.1)	Barro and Lee (2010)
TERTedu	+	Percentage of population over age 15 who have completed tertiary education as their highest level of education	Author's calculations based on data from Barro and Lee (2010)
genvocratio	+	The ratio of general to vocational enrolments in upper-secondary education in 1990	Author's calculations based on data from UNICEF (2010)
edutr1	+	Share of population aged 16-30 in a country's working age population in 2008 (population aged 0-14 in 1992/population aged 15-64 in 2008)	Author's calculations based on data from WDI (2010)
edutr2	+	Share of population who were educated in the communist system only up to age 12 or less in a country's working age population in the respective year (see Section 5.2.2 for explanations)	Author's calculations based on data from Barro and Lee (2010) and WDI (2010)
manvacancy	-	A country-average of the length of period required to fill a vacancy for a skilled worker by manufacturing firms	Author's calculations based on data from BEEPS (2002, 2005)
cognitive	+	Standardised measure of cognitive skills derived from maths and science scores in International Student Achievement Tests	Hanushek and Woessmann (2009a)
top	+	Share of top performers (i.e. those achieving a score of 600 points or one standard deviation above the OECD mean) in International Student Achievement Tests	Hanushek and Woessmann (2009a)
medium	NA	Dummy variable indicating high-tech industries (see Section 6.6 and Appendix 6.3)	Constructed by the author based on OECD (2011)/Eurostat (2011)

high	NA	Dummy variable indicating medium-tech industries (see Section 6.6 and Appendix 6.3)	Constructed by the author based on OECD (2011)/Eurostat (2011)
SECmed	+	Interaction term: ***SECedu*medium***	NA
SEChigh	+	Interaction term: ***SECedu*high***	NA
TERTmed	+	Interaction term: ***TERTedu*medium***	NA
TERThigh	+	Interaction term: ***TERTedu*high***	NA
cognitivemed	+	Interaction term: ***congnitive*medium***	NA
cognitivehigh	+	Interaction term: ***cognitive*high***	NA
topmed	+	Interaction term: ***top*medium***	NA
tophigh	+	Interaction term: ***top*high***	NA
wage	-	The average gross wage paid in the host country	WIIW (2011)
gdp	+	Size of the host market as measured by its GDP level (in current USD)	WDI (2010)
gdppc		GDP per capita (in current USD)	WDI (2010)
tradefree	?	Trade freedom component of the Economic Freedom Index	Heritage Foundation (2010)
econfree	+	Economic Freedom Index, excluding the trade freedom component (i.e. the simple average of all other components)	Author's calculations based on data from Heritage Foundation (2010)
ictinfra	+	Sum of the number of telephone lines, broadband subscriptions, and cellular subscriptions, per 100 inhabitants	Author's calculations based on data from WDI (2010)
transition	+	The overall transition score awarded by the EBRD	EBRD (various years)
manprivatisation	+	Dummy variable, equals to 1 in years when FDI-related privatisations of large enterprises took place in the manufacturing sector (see Section 5.2.3)	Constructed by the author based on EBRD (various years), UNCTAD (various years) and Kalotay and Hunya (2000)

indprivatisation	+	Dummy variable, equals to 1 in years when FDI-related privatisations of large enterprises took place in the specific industry (see Section 5.2.3)	Constructed by the author based on EBRD (various years), UNCTAD (various years) and Kalotay and Hunya (2000)
instability	-	Dummy variable, equals to 1 in years when a country is affected by political unrest, either an internal conflict or one in the region (see Section 5.2.3 for explanation)	Constructed by the author

Initially, the baseline Model (6.1) is estimated:

$$\ln manFDIstock_{it} = (1-\alpha)\ln manFDIstock_{i,t-1} + \beta_1 \ln SECedu_{it} +$$
$$+ \beta_2 \ln TERTedu_{it} + \beta_i' \; X_{it} + \delta t_t + z\eta_i + \varepsilon_{it} \qquad \text{..........................(6.1)}$$

Where

manFDIstock is the stock of FDI (in USD) from WIIW (2010);

SECedu (***TERTedu***) is the share of population who have completed secondary (tertiary) education (see Section 5.2 and Table 5.3 for explanations);

$\mathbf{X_{it}}$ are the control variables: average gross wage (***wage***); the size of the host market (***gdp***); trade freedom (***tradefree***); economic freedom (***econfree***); ICT infrastructure (***ictinfra***) progress in transition (***transition***); dummy for major privatisations in manufacturing (***manprivatisation***); dummy for years of political instability (***instability***) (see Table 6.4 above and Section 5.2 for more explanations);

$\boldsymbol{t_t}$ are time dummies;

$\boldsymbol{\eta_i}$ is an unobserved time-invariant individual effect; and

$\boldsymbol{\varepsilon_{it}}$ is an unobserved white noise disturbance.

The baseline Model (6.1) is subsequently augmented with the share of population aged 16-30 in a country's workforce, ***(ln)edutr2***, and the period required for manufacturing firms to fill a vacancy for a skilled worker, ***(ln)manvacancy***, similar to Models (5.16) and (5.17) in Chapter 5:

$$\ln manFDIstock_{it} = (1-\alpha)\ln manFDIstock_{i,t-1} + \beta_1 \ln SECedu_{it} +$$
$$+ \beta_2 \ln TERTedu_{it} + \beta_3 \ln edutr2_{it} + \beta_i' \; X_{it} + \delta t_t + z\eta_i + \varepsilon_{it} \qquad \text{...........................(6.2)}$$

$$\ln manFDIstock_{it} = (1-\alpha)\ln manFDIstock_{i,t-1} + \beta_1 \ln SECedu_{it} +$$
$$+ \beta_2 \ln TERTedu_{it} + \beta_3 \ln manvacancy_{it} + \beta_i' \; X_{it} + \delta t_t + z\eta_i + \varepsilon_{it} \qquad \text{...........................(6.3)}$$

Table 6.5 below presents the results of Models (6.1-6.3) estimated using the dynamic corrected LSDV model, using System GMM as an initial estimator to correct for bias (printouts for these are presented in Appendix 6.2). The variables of interest and the controls in these models are insignificant, with the exception of ***(ln)manvacancy*** which is significant and positive. However, the size of the coefficient on the lagged dependent variable in all these models is above 1, which, as explained in Section 5.5, indicates unstable (explosive) dynamics; in addition, the size of the coefficients is in thousands, which seems peculiar considering that these indicate percentage changes (as this is a log-log model). Therefore, these results are not considered reliable and are not interpreted.

Table 6.5: Models 6.1-6.3 results (dependent variable: lnmanFDIstock)

VARIABLES	(1) Model (6.1)	(2) Model (6.2)	(3) Model (6.3)
L.manfdistock	1.110***	1.088***	1.201***
	(0.0323)	(0.0413)	(0.145)
lnsecedu	-1,594	-3,266	32,803
	(7,602)	(11,491)	(32,124)
lntertedu	-3,575	-1,712	-6,926
	(2,456)	(4,336)	(16,241)
lnwage	-1,430	1,134	-1,880
	(3,519)	(4,977)	(21,846)
lngdp	813.2	-1,190	-5,682
	(3,416)	(6,113)	(20,281)
lntransition	7,920	7,844	-67,395*
	(12,549)	(20,537)	(40,335)
lntradefree	-86.76	211.0	3,943
	(2,289)	(3,910)	(4,908)
lneconfree	-2,989	-4,061	-11,958
	(4,433)	(4,947)	(12,905)
lnictinfra	2,322	2,576	6,223
	(1,713)	(2,359)	(6,383)
manprivatisation	1,064**	1,091*	423.7
	(508.3)	(615.1)	(872.1)
lnedutr2		-13,602	
		(12,139)	
lnmanvacancy			5,871*
			(3,192)
Observations	123	100	42
Number of countryid	12	12	11

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Year dummies included, but not reported. Models estimated using LSDVC.

Considering the problems with these model(s), similar ones using industry-level data are estimated in the beginning of the next section to examine the *average* effect of human capital on FDI in manufacturing industries (i.e. the overall effect *across* industries).

6.6 Evidence from disaggregated industry-level manufacturing data

6.6.1 The empirical model(s)

In Section 6.3 it was argued that the elasticity of FDI inflows to different human capital endowments is likely to differ across different manufacturing industries. This hypothesis is tested in this section using WIIW (2011) manufacturing data disaggregated by industry. The dependent variable in this investigation, ***(ln)indFDIstock***, is the annual level of FDI stock in each manufacturing industry *j* in each country *i*. This analysis includes the whole list of industries in the manufacturing sector disaggregated at 2-digit level according to NACE Rev 1.1 classification (Eurostat, 2008), i.e. industries DA-DN, as listed in Table 6.2 in Section 6.2. The (potential) number of countries is smaller in this sample compared to previous empirical specifications because FDI data at NACE 2-digit level is not available for Bulgaria.

Now that the FDI stock is measured at a more disaggregated level, there are some instances where negative FDI stocks are observed[64]. Negative FDI stocks may seem counter-intuitive and they are encountered more rarely than negative FDI inflows. The reasons for recorded negative FDI stocks may be similar to those for FDI inflows, e.g. when the value of loans or trade credits of the foreign subsidiary extended to its parent company exceed the parent company's direct investment in the subsidiary, or when the subsidiary suffers continuous losses leading to negative reserves. Negative FDI values may be problematic because they cannot be transformed into natural logarithms. Previous studies have approached the problem of zero or negative values by adding a value of one (currency unit) to zeros so that the observation takes the value of zero after the (natural) logarithmic transformation and by taking the natural logarithms of the *absolute* values of the negative observations and subsequently multiplying them by -1 so as to reflect the original

[64] A total of seven negative values are observed. Four of these are in the coke, refined petroleum products and nuclear fuel industry (DF) in Macedonia in 2000, Lithuania in 2000-01, and Hungary in 2003; one is in the textiles and leather industry (DB-DC) in the Czech Republic in 2000; and one is in furniture, manufacturing n.e.c., recycling (DN) in the Slovak Republic in 2007.

sign (Blonigen and Davies, 2004; Neumayer and Spess, 2005; Dalba-Norris et al., 2010; Mina, 2010). A modified version of this approach is applied here motivated on theoretical grounds: negative values are simply changed to the value of 1 USD (rather than to negative values obtained by the transformation explained above). As explained previously in Section 5.2, the purpose of this analysis is to explain the level of advanced direct investment by the foreign investors in their subsidiaries, preferably in *gross* terms, and not the level of trade credits/loans of the latter to their parent companies, the level of their repatriated profits, or losses they may incur (although it is recognised that the last two may themselves be relevant factors in determining the level of the investment that is of interest here). Accordingly, from a theoretical perspective, it is considered that the negative FDI inflows/stocks recorded due to these phenomena are irrelevant for this analysis and therefore this 'interference' with the data is justified. From the perspective of empirical estimation, these transformations are not expected to create any problems because they effect an extremely low proportion of the observations in this sample (i.e. a total of 7 observations out of the total of approximately 1300 that are used in the estimation).

The human capital measures and most control variables used here are the same as the ones used in Models 6.1-6.3 in the previous section; this includes the average number of weeks required to fill a vacancy, ***(ln)manvacancy***, which can only measured at the level of the manufacturing sector as a whole because BEEPS does not disaggregate firms further than the 1-digit NACE classification. The only variable from the previous model that can be further disaggregated at NACE 2-digit classification level is the privatisation dummy, ***indprivatisation***, which now indicates years when privatisations specific to each manufacturing industry took place. As in the previous empirical analyses in this thesis, the continuous variables, including the dependent variable, are transformed into natural logarithms.

In addition to the country- and industry-level explanatory variables, a set of ***country dummies (c2-c14)*** and ***industry dummies (s2-s12)*** are included in the model to account for any remaining country- and sector-specific factors that may affect FDI stocks. Also, as in the previous empirical specifications, a set of ***year dummies (d1996-d2007)*** is included in the model; as explained in Section 5.3, this is expected to (partially) account for the effects of potential cross-sectional dependence that arise due to universal time shocks related to global FDI trends (Roodman, 2006; Sarafidis et al., 2009). Accordingly, the initial industry-level model estimated in this section is:

$$\ln indFDIstock_{ijt} = \beta_1 + (1-\alpha)\ln indFDIstock_{ij,t-1} + \beta_2 \ln SECedu_{it} + \\ + \beta_3 \ln TERTedu_{it} + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \qquad \text{....................(6.4)}$$

Where

i denotes the country dimension i=1, 2, ...,13; ***j*** denotes the industry j=1, 2, ..., 13; and ***t*** denotes the time dimension *t*=1, 2, ..., 13.

manFDIstock is the stock of FDI in country *i* in industry *j* (in USD) from WIIW (2010);

SECedu (***TERTedu***) is the share of population who have completed secondary (tertiary) education (see Section 5.2 and Table 5.3 for explanations);

$\mathbf{X_{it}}$ are the control variables: average gross wage (***wage***); the size of the host market (***gdp***); trade freedom (***tradefree***); economic freedom (***econfree***); ICT infrastructure (***ictinfra***) progress in transition (***transition***); dummy for major privatisations in manufacturing (***manprivatisation***); dummy for years of political instability (***instability***) (see Table 6.4 below and Section 5.2 for more explanations);

t_t are time dummies

c_i are country dummies

s_j are sector (i.e. industry) dummies;

η_{ij} is an unobserved time-invariant individual effect; and

ε_{ijt} is an unobserved white noise disturbance.

This type of model is similar to those previously used in industry-level FDI studies by Bénassy-Quéré et al. (2007) and Bellak et al. (2009). It is analogous to Model (5.15) in Section 5.5 in the sense that it provides an estimate of the *average* effect of the independent variables on FDI stocks *across* different manufacturing industries. Namely, it makes use of a larger number of observations (and the benefits associated with this are discussed later in this section), but does not exploit the industry-level information to shed light on the industries' different levels of sensitivity to different explanatory variables. This can be investigated either through separate estimations by industry or industry group, or by adding dummy variables (and interactions) for them. The latter approach is adopted here because it provides a convenient means to test whether any (potential) observed differences in the estimated coefficients are statistically significant and it makes use of the maximum number of observations available for estimation.

In this particular investigation it is the sensitivity of FDI to human capital endowment that is of interest. In Sections 4.2 and 6.3 it was argued that, to the extent that workforce skills are complementary with technological advancement (embodied in capital), the effect of human capital is expected to be stronger in more technology-intensive industries. Accordingly, industries here are classified on the basis of their technological intensity: low, medium and high. The dummy variables indicating technological intensity were based on the standard industry classification by OECD/Eurostat (OECD, 2011; Eurostat, 2011). OECD and Eurostat classify industries based on direct research and development (R&D) intensity, as initially proposed by Hatzichronoglou (1997). The original classification by OECD/Eurostat is in four categories (low, medium-low, medium-high, and high) based on their R&D relative to value-added and gross production statistics. However since only one of the manufacturing industries falls in the high-technology category, industries in this analysis are classified into three categories: *high-technology industries* (indicated by dummy variable ***high***) in this analysis refer to both medium-high and high categories in the original classification; *medium-technology industries* (indicated by dummy variable ***medium***) refer to the medium-low category in the original classification; and low-technology industries (indicated by dummy variable ***low***) refer to the same category in the original classification. The list of NACE Rev 1.1 2-digit manufacturing industries and their respective technological intensity categories is presented in Appendix 6.3.

To test the hypothesis that FDI in medium and high-technology industries is relatively more sensitive to human capital in the host economy, the technological intensity dummies ***medium*** and ***high*** are interacted with the human capital variables ***SECedu*** and ***TERTedu*** to form ***SECmed***, ***SEChigh***, ***TERTmed*** and ***TERThigh*** (leaving low-technology industries in the reference category). Model (6.4) above is augmented with interactions and with the dummies ***medium*** and ***high*** in Model (6.5) below; although the latter are not of direct interest, they must be included because they are 'constitutive terms' of the interactions (Brambor et al., 2006). Accordingly, the second industry-level specification estimated in this section is:

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ + \beta_3 \ln TERTedu_{it} + \beta_4 medium_j + \beta_5 high_j + \beta_6 \ln SECmed_{ijt} + \beta_7 \ln SEChigh_{ijt} \\ + \beta_8 \ln TERTmed_{ijt} + \beta_9 \ln TERThigh_{ijt} + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ..(6.5)$$

A similar strategy to that applied in Chapter 5 and Section 6.5 above is followed whereby the model is augmented with different variables to test the transition-specific human capital hypotheses developed in the Chapter 5 and the effect of alternative measures of human capital. Accordingly, specifications below are also estimated:

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ + \beta_3 \ln TERTedu_{it} + \beta_4 \ln genvocratio_i + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.6)$$

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ + \beta_3 \ln TERTedu_{it} + \beta_4 \ln edutr1_i + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.7)$$

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ \beta_3 \ln TERTedu_{it} + +\beta_4 \ln edutr2_{it} + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.8)$$

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ \beta_3 \ln TERTedu_{it} + \beta_4 \ln manvacancy_{it} + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.9)$$

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ \beta_3 \ln TERTedu_{it} + \beta_4 \ln cognitive_i + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.10)$$

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ijt-1} + \beta_2 \ln SECedu_{it} + \\ \beta_3 \ln TERTedu_{it} + \beta_4 \ln top_i + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.11)$$

Where:
genvocratio is the initial ratio of general to vocational enrolments in upper-secondary education;
lnedutr1 is the share of population aged 16-30 in a country's working age population in 2008;
lnedutr2 is the share of population who were educated in the communist system only up to age 12 or less in a country's working age population;
manvacancy is the period required to fill a vacancy for a skilled worker by manufacturing firms;
cognitive is the average level of students' cognitive skills

top is the share of top performers in students' cognitive skills tests (see Section 5.2 and Table 6.4 for explanations.)

The next sub-section discusses the alternative estimators that can be used to estimate these models and their suitability, with a special focus on the GMM estimators which can now be used with the increase in the sample.

6.6.2 Generalised Method of Moments (GMM) estimators and their suitability for this particular empirical investigation

As the unit of the analysis is no longer the country, but the country-industry pair, the number of cross-sectional units and total observations available for estimating models (6.4-6.10) increases significantly. The increase in the number of cross-sectional units (N) to a potential of 156 country-industry pairs (13 industries in each of the 12 countries) is particularly important in this context; the Generalised Method of Moments (GMM) estimators which in Chapter 5 and Section 6.5 were ruled out due to the small N dimension can now can now be considered. The rest of this section provides an appraisal of the GMM estimators' merits compared to other available estimators. The properties of GMM estimators and the conditions that must be satisfied in order for these estimators to be consistent are also discussed and it evaluates different GMM estimators and their respective options. However, (arguably) the most important pre-conditions that have to be satisfied for using GMM estimators, large N and small T, are discussed first.

The unavailability of FDI stock data for some of the pairs slightly reduces the number of cross-sectional units[65] available for estimation; this happens either because some countries do not report data for certain industries or because they sometimes report aggregate data for two industries. Further, missing data for some of the independent variables (for whole countries, or just for some time periods) do not allow the exploitation of the total number of cross-sectional units for which FDI stock data is available. Still, the unbalanced dataset of 130 country-industry pairs ultimately available for estimation appears to be sufficiently large for using GMM estimators. Although there are no clear guidelines as to what consists a 'large N' sample (Roodman, 2006), the Monte Carlo simulations based on which Arellano and

[65] The number of available cross-sectional units, however, is a bit lower than 156 because data is missing for some country-industry pairs, either due to missing data for some industry-country pairs, or lack of compatibility due to the level of aggregation (e.g. some countries report aggregated data for Coke, refined petroleum and nuclear fuel, DF, and that for Rubber and plastic products, DH, whilst other report data separately for one or both of these).

Bond (1991) conclude that GMM estimators have 'negligible finite sample biases' (p. 293) are based on a smaller N of 100. For comparison, in terms of the number of cross-sectional units (N) in the sample used here is only slightly smaller than that in the original GMM application by Arellano and Bond (1991) who estimate a dynamic employment equation using an unbalanced dataset of 140 firms; it lies between those of similar GMM applications in industry-level FDI stock models in Bellak et al. (2009) and Riedl (2010) which employ panels of 108 and 155 country-industry pairs, respectively; and it is much larger than the dynamic panel study by Kinoshita (2011) with 12-17 cross-sectional units, which can be safely assumed to be far too small for consistent GMM estimation (Roodman, 2006, p. 35).

The sample used here also seems to be appropriate in terms of the time-dimension (T) size. The number of years available for estimation ranges from 1 to 13, with an average of approximately 10 years per cross-sectional unit. Thus, the number of years in this estimation for some of the country-industry pairs is larger than that of 7 periods which is used in the simulations of Arellano and Bond (1991) and some previous applications of GMM estimators (e.g. Arellano and Bond, 1991; Blundell and Bond, 1999; Mangan et al., 2005; Pugh et al., 2008). However, this should not be a cause for concern since the system GMM estimator has been shown by Hayakawa (2008) to be consistent in a large-N large-T context, with T as large as 20 which is significantly larger than the maximum of 13 periods in the sample used here. A more detailed discussion of this estimator, its suitability for use in this type of sample and a comparison with the previously used estimators is presented next.

As discussed previously in Sections 5.5 and 6.5, accounting for the dynamics in FDI models may be crucial for obtaining consistent estimates in panel models (Bond, 2002). However, the inclusion of lagged dependent variable creates problems in estimation. In OLS estimations (in levels) the lagged dependent variable is positively related to the individual-specific time-invariant component of the error term, giving rise to upward bias which does not vanish with a large T or large N (Bond, 2002, p. 4). On the other hand, as explained in Section 5.5, eliminating the fixed effects through a Within Group (LSDV) estimator introduces another type of downward bias known as 'dynamic panel bias', which decreases as the T approaches infinity, but is a serious problem in small-T sample such as the one used here[66] (Nickell, 1981; Kiviet, 1995). One potential approach for dealing with the problems above, used in the empirical models in Sections 5.5 and 6.5 of this thesis, is to correct the LSDV estimates for this small-T bias. However, as previously noted, this approach has two (potential) disadvantages: the assumption of strictly exogenous regressors and the inability to accommodate time-invariant variables.

The second approach is that of instrumental variable (IV) and Generalised Method of Moments (GMM) estimators which provide consistent estimates in dynamic panels. Anderson and Hsiao (1982) propose estimating a first-difference model where the differenced lagged dependent variable is instrumented by either the level or the first-difference of the second lag of the dependent variable. The differencing eliminates the fixed effects from the error term which, if present, would be correlated with the lagged dependent variable. However, since the error term in the differenced equation would still be correlated with the first difference of the lagged dependent variable ($\Delta y_{i,t-1}$), Anderson and Hsiao propose $\Delta y_{i,t-1}$ to be instrumented by its lag ($\Delta y_{i,t-2}$) or by the second lagged *level* of the dependent variable ($y_{i,t-2}$).

The Anderson-Hsiao IV approach is later extended to a GMM framework which, unlike the IV approach, allows for information to be exploited for more than one instrument per coefficient to be estimated. Accordingly, Arellano and Bond (1991) propose a GMM estimation of the first-differenced model where first-differences of the (predetermined) lagged dependent variable is instrumented by its lagged levels (rather than *only one* level), i.e. $\Delta y_{i,t-1}$ is instrumented by $y_{i,t-2}$ like in the Anderson-Hsiao approach, but also by longer lags like $y_{i,t-3}$, $y_{i,t-4}$, etc. etc. Unlike Anderson and Hsiao (1982), Arellano and Bond (1991) suggest using lagged *levels* specifically (rather than levels *or* differences), based on evidence from experiments in Arellano (1989) and Arellano and Bond (1991), later confirmed by Kiviet (1995), which suggests that the use of levels as instruments yields estimates with relatively smaller variances. The exploitation of more (potentially) valid instruments in a GMM framework means that more information is used in the estimation and thus the coefficients can be estimated more efficiently. Monte Carlo evidence in Arellano and Bond (1991) suggests that estimates obtained by GMM have variances which are up

[66] The time dimension of the industry-level is approximately 10 years, on average, i.e. it is even smaller compared to the ones used for aggregate data in the previous specifications.

to five times smaller compared to those obtained by the simpler version of IV estimators developed by Anderson and Hsiao (1982), discussed above.

Later contributions point out two limitations of the Arellano-Bond (AB) approach, referred to as the *difference* GMM estimator for dynamic panels (Ahn and Schmidt, 1995; Blundell and Bond, 1998). First, it has been argued that the instruments used in this estimator, i.e. the lagged levels of the variables, may be weak in explaining subsequent differences, especially for models where the dependent variable is persistent. Roodman (2006, p. 28) explains: "...if y (i.e. the dependent variable) is close to a random walk, then difference GMM performs poorly, because past levels convey little information about future changes, so that untransformed lags are weak instruments for transformed (i.e. differenced) variables". Accordingly, Blundell and Bond (1998) show that weak instruments can cause large finite-sample biases when the difference GMM estimator is used in models with persistent series. Second, it has been pointed out that difference GMM does not make use of the all the information that is available within the data which, if used, can further increase the efficiency of the estimator (Arellano and Bover, 1995; Blundell and Bond, 1998).

The Arellano-Bond estimator was subsequently augmented by Blundell and Bond (1998) to include another equation in levels in addition to the one in differences. The approach used in 'levels equation', initially outlined in Arellano and Bover (1995), involves transforming the instruments to make them exogenous to the fixed effects, instead of removing the fixed effects by transforming regressors (as in the differenced-equation). Thus, here *levels* of the (predetermined) lagged dependent variable are *instrumented by differences*, i.e., $y_{i,t-1}$ is instrumented by $\Delta y_{i,t-1}$, $\Delta y_{i,t-2}$, etc., under the assumption that the differences are uncorrelated with the fixed effects. The resulting estimator, referred to as *system* GMM estimator, thus allows the exploitation of additional 'moment conditions' from the data in levels, which increases the efficiency of the obtained estimates (Arellano and Bover, 1995). In addition, the system GMM estimator has an advantage over the difference estimator when the dependent variable is persistent, in which case past changes may provide more information on the current levels (Roodman, 2006, p. 28). Blundell and Bond (1998) show that system GMM substantially reduces the biases that arise when such models are estimated using difference GMM estimators. Another advantage of *system* as opposed to *difference*-GMM is that the levels equation which is added in this context allows the estimation of the time-invariant variables which are 'wiped out' in the Arellano-Bond estimator when only a differenced equation is used.

Considering the above, the *GMM estimators* appear to be superior, compared to the corrected LSDV models used in the previous estimations in this thesis, because they allow predetermined and endogenous regressors to be included in the model, which may be the case with some of the variables included in this model (i.e. wage, market size and education variables). Further, the *system GMM estimator*, in particular, appears to be superior in this particular analysis for two reasons. First, the dependent variable, FDI stock, is expected to be persistent; as explained above, difference GMM is expected to perform poorly in these cases. Second, it can be used to estimate the effect of time-invariant variables. The inclusion of time-invariant variables was already an issue in the previous specifications in this thesis for some of the human capital variables such as ***genvocratio*** and ***cognitive***, but it becomes crucial at the industry-level in this specification because it allows the inclusion of technological intensity variables and their interactions with human capital variables, ***SECmed, SEChigh, TERTmed and TERThigh***. This allows testing the hypothesis of a heterogeneous human capital effect depending on the industry. However, the additional moments incorporated in the system estimator are only valid under (additional) assumptions regarding the initial conditions process, discussed later in this section.

Further advantages of GMM estimators are that they do not require assumptions about the distribution and they allow for heteroskedasticity and within-individual autocorrelation can be accounted for using 'robust' estimation (Verbeek, 2000; Greene, 2002; Roodman, 2006). There are two options available in GMM estimation. First, a covariance matrix can be used which is independent of the estimated parameters (Windmeijer, 2005); the SE estimates obtained this way are robust to heteroskedasticity and arbitrary patterns of autocorrelation within individuals can be used in a ***one-step GMM estimator*** (Roodman, 2006, p.38)[67]. Alternatively, a "sandwich" covariance matrix can be obtained based on the initial parameter estimates (i.e. those from the one-step estimation) and the GMM estimation is rerun in the second step, where this matrix is used to reweight the moment conditions

[67] In the *xtabond2*, this is done using option *robust* when option *onestep* (for one-step estimation) is specified (Roodman 2006, p. 38).

(Windmeijer, 2005; Roodman, 2006); the resulting ***efficient two-step GMM estimator*** is robust to "whatever patterns of heteroskedasticity and cross-correlation the sandwich covariance estimator models" (Roodman, 2006, p. 9). On the choice between the two, simulation studies suggest that two-step efficient GMM performs better than one-step GMM, with lower bias and somewhat higher precision (Arellano and Bond, 1991; Blundell and Bond, 1998; Windmeijer, 2005). However, computed standard errors in two-step GMM estimator have been found to be biased downward in smaller samples (Arellano and Bond, 2001; Bond, 2002; Windmeijer, 2005). For these samples Windmeijer (2005) develops a finite-sample correction for the two-step efficient GMM estimator which, simulations suggest, greatly reduces this problem (at least for the difference-GMM estimator for which simulations are carried out). Based on the above considerations, the ***efficient two-step system GMM estimator is used here, applying Windmeijer's (2005) small-sample correction***[68].

Finally, it has been pointed out that the first-differenced equations in the (Difference and System) GMM estimators are inconvenient for application in unbalanced panels because they magnify gaps in the data (Arellano and Bover, 1995; Roodman, 2006), e.g. an observation missing for one period automatically means that the one for the next period is also missing because the difference cannot be taken. For this reason, Arellano and Bover (1995) propose an alternative to first-differencing, i.e. 'forward orthogonal deviations' or 'orthogonal deviations' which involves subtracting the average of all future observations available instead of subtracting the observation of the previous period. Roodman (2006, p. 20) explains that this minimises data losses due to gaps, whilst lagged observations (i.e. levels) remain valid as instruments because they are not involved in the computation of the orthogonal deviations. Accordingly, since the panel used here is an unbalanced panel with gaps, ***orthogonal transformation instead of first-differencing is used in order to preserve sample size,*** as recommended by Roodman (2006, p. 43).

Considering that most of the explanatory variables in this industry-level analysis vary only at country level, observations of FDI stocks coming from each of the countries are likely be correlated which in turn may bias the coefficients' estimated SEs. For this reason, clustering at country level was considered similar to the one undertaken in the empirical estimations in Section 5.4, but this was not applied for

[68] Windmeijer's (2005) correction is applied in *xtabond2* using option *robust* when *twostep* option (for two-step estimation) is specified, where SE's are already robust (Roodman, 2006, p. 38).

the following reasons. First, the number of clusters in these estimations in this thesis is likely to be too small to adjust for clustering effects, as previously explained in Section 5.3 and suggested by the results obtained by the two-way cluster estimator applied in Section 5.4 in which the size of SEs changed very little compared to those obtained using a conventional FE estimator. Second, using the *cluster* option in *xtabond2* overrides the default clustering based on the cross-sectional unit which is likely to be more important than that at country level. However, it can be argued that the potential clustering effects are not likely to be very serious in this analysis because their presence is expected to deteriorate the cross-sectional dependence tests, which does not appear to be the case here, as explained in the next section.

6.6.3 Instruments and specification tests in (System) GMM estimators

The lagged dependent variable in a dynamic panel model is predetermined but not exogenous, in the sense that it is determined within the model, but by *past* values of the other regressors, while being independent of their *present* values. The instrumentation approach adopted in GMM estimators to address the endogeneity of the lagged dependent variable can be used to address the endogeneity of other predetermined and endogenous regressors (with a slight modification in case of the latter, as explained below).

As explained in the previous section, the lagged dependent variable in the first-differenced equation is instrumented by its lagged levels, i.e. $\Delta y_{i,t-1}$ is instrumented by $y_{i,t-2}$ and longer lags (i.e., $y_{i1}, y_{i2}, \ldots, y_{i,t-2}$). Bond (2002, p. 16) explains that this approach is valid ***under the assumption of serially uncorrelated disturbances, an assumption that will be tested through the Arellano-Bond m1/m2 test, explained below.*** Bond further explains that this approach be adopted for any predetermined regressors, i.e. regressors that are not correlated with the contemporaneous disturbance term, but are correlated with previous disturbance terms. Thus, *for any predetermined regressor*, x_{it}, the valid instruments in the differenced equation would be the vector ($x_{i1}, x_{i2}, \ldots, x_{i,t-1}$). *For endogenous regressors*, i.e. those that have contemporaneous correlation with the disturbance term, $x_{i,t-1}$ is no longer a valid instrument, so the above vector would be replaced by the vector ($x_{i1}, x_{i2}, \ldots, x_{i,t-2}$). Alternatively, under an assumption of *strict exogeneity*, i.e. no correlation between the regressor and past, current, or future disturbance terms, then the contemporaneous levels are also valid instruments in the first-differenced equation, making the instrument vector ($x_{i1}, x_{i2},..., x_{iT}$). On the choice between the treatment of variables in GMM estimation, Bond (2002, p. 17) notes that "while the choice between these alternatives may seem a little arbitrary, in most cases these moment conditions will be overidentifying restrictions, so that the validity of a particular assumption may be tested using the standard GMM tests of overidentifying restrictions". Accordingly, the ***Sargan and Hansen tests of overidentifying restrictions, discussed below, will be used to inform the appropriate treatment of variables that are considered as possibly endogenous/predetermined***.

As explained in the previous section, in System GMM additional instruments, i.e. differences, are created to instrument for the levels of the lagged predetermined variable (and suitable lagged differences can be used in a similar manner as above for other predetermined and endogenous variables). However, Bond (2002, p. 17) explains that orthogonality to the disturbance term required for instrument validity in Difference-GMM above is no longer a sufficient condition; namely, the use of these *additional moment conditions* in the levels equation requires an additional assumption of differences in the regressors being uncorrelated with the individual fixed effects. Roodman (2006, p. 30), following Blundell and Bond (1998) explain that two conditions have to be satisfied in order for this assumption to hold. First, the coefficient on the lagged dependent variable "must have an absolute value less than unity, so that the process converges in expectation"; and second, "the deviations of the initial observations, y_{i1}, from these long-term convergent values must not correlate with the fixed effects". ***The "steady-state" assumption and hence the validity of the additional moment conditions for the levels equations will be tested using the Difference-Hansen test,*** as suggested by Bond (2002, p. 22).

The System GMM estimator can create a large number of moment conditions, and hence instruments, which can be used in the estimation: for each variable an instrument can be created for each time period and each lag distance for the corresponding to that period (Roodman, 2006, p. 24). However, caution should be taken because not all the instruments are necessarily valid. Namely, GMM estimators use lags as instruments under the assumption of errors not being autocorrelated which, as explained earlier, would mean they are correlated with the instruments. Arellano and Bond (1991, p. 278) warn that "an estimator that uses lags as instruments under the white noise errors would lose its consistency if in fact errors were serially correlated" and, accordingly, tests of serial correlation must be conducted to ensure instrument validity. For this, Arellano and Bond (1991) propose a ***test of both first- and second-order serial correlation, referred to as m_1 and m_2 test statistics***, respectively. The m_2 statistic tests the hypothesis of no second-order serial correlation in the error term of the first-differenced equation, a condition which must be satisfied in order for values of the dependent variable lagged two periods or to be uncorrelated with the error term, and hence valid instrument to be used in this equation. However, Arellano and Bond (1991, p. 282) note that this condition may be satisfied due to a lack of (second-order) serial correlation in the level equation errors, *or* just due to the errors in this equation following a random walk. In the latter case the m_2 test may become unreliable, i.e. it may wrongly reject the presence of second-order serial correlation, which is why the authors propose the m_1 statistic as a robustness check on this. The m_1 statistic discriminates between situations where lack of second order correlation is 'genuine' vs. those where errors follow a random walk by testing for the presence of first-order serial correlation. Here failure to reject the null of first-order serial correlation indicates that errors do not follow a random walk, thus implying a 'genuine' lack of second-order serial correlation. Thus, the m_1/m_2 test indicates instrument validity if (1) there is first-order serial correlation *and*, (2) there is no second-order serial correlation, in the first-differenced residuals.

The other way of testing for instrument validity is through ***the Sargan/Hansen test of overidentifying restrictions*** which test whether instruments are uncorrelated with the error term. Of the two, the Hansen J statistic has the advantage of being robust to heteroskedasticity and autocorrelation, and can be preferred on these grounds (Roodman, 2007). On the other hand, this test becomes unreliable with a large number of instruments, as discussed below, but Roodman (2006; 2009) provide guidelines as to what the 'acceptable' p-values for the test are and the signs which may indicate the weakening of the test due to instrument count (as discussed further in the next section when the tests from the estimations are interpreted). Whilst the Sargan/Hansen test above tests the validity of all overidentifying restrictions, the ***difference-in-Hansen test*** (or C statistic) is used to test the validity of a subset of instruments by performing two estimations, with and without a subset of suspect instruments (Roodman, 2006, p. 13). Hence, as explained earlier, it can test the "stationarity condition" (and hence the appropriateness of System GMM estimator) by testing the validity of the additional moment conditions in the levels equation.

Another caveat of the System GMM estimators is that the large number of instruments created may create problems in finite samples if there is not sufficient information available for estimation, but also because it can weaken the Hansen test, resulting in failure to reject the null hypothesis of instrument validity with implausibly high p-values of up to 1.00 (Roodman, 2006, p. 14). Unfortunately, the literature does not provide clear guidance as to what is the 'appropriate' number of instruments allowed; a number of instruments lower than that of cross-sectional units is mentioned as a minimal arbitrary rule of thumb, but even this is likely to be too generous (Roodman, 2006, p. 14). Hence, Roodman points out that it is important to report the number of instruments and advises testing the robustness of the Hansen test statistic/p-value by reducing the number of instruments used in the estimation. To reduce the instrument count, Roodman (2006, pp. 22-24) proposes two approaches: limiting the lag ranges that are used to generate instruments and 'collapsing' instruments, i.e. creating instruments for each variable and lag distance only (and not also for each time period). ***Both reducing lag ranges and collapsing instruments are used here to reduce the instrument count, as necessary to reach instrument validity, and results are reported for specifications with different instrument counts for examining robustness***.

As discussed previously, the lagged dependent variable coefficient is biased upward in an OLS regression and downward in a LSDV regression. Bond (2002) argues that estimates from consistent estimators should lie in the range between those obtained by these two estimators and this can be used as a type of check on other estimators. Bond (2002, p. 5) notes that failure of estimates from theoretically superior estimators (in this case system GMM) to follow such a pattern in a seemingly well specified AR(1) model may hint at either inconsistency or severe finite sample bias. Accordingly, ***LSDV and OLS estimates of the lagged dependent variable are estimated and presented here for comparison*** along with other standard specification tests.

Finally, the potential presence of cross-sectional dependence also has to be considered in a dynamic panel context. As explained in Section 5.3, there appears to be a common misconception among applied researchers that the inclusion of time dummies eliminates cross-sectional dependence in the errors. However, Sarafidis et al. (2009) clearly explain that the presence of such dummies is merely expected to mitigate this problem by removing the 'homogeneous' component of the cross-sectional dependence, i.e. that arising from universal time shocks (under the assumption that all cross-sectional units are affected in the same way by these shocks). The remaining 'heterogeneous' cross-sectional dependence may still be substantial and needs to be tested for. Fortunately, simulation evidence in Sarafidis et al. (2009) suggests that low levels of cross-sectional dependence do not cause noticeable bias in the context of GMM estimators. Nevertheless, it is not clear what constitutes 'low' levels of cross-sectional dependence in practice, so ideally ruling out the cross-sectional dependence through the relevant tests would be preferred.

Sarafidis et al. (2009) propose a ***testing procedure for cross-sectional dependence in dynamic linear regression models*** whereby the Arellano and Bond's (1991) m_2 test statistic for second-order serial correlation and the difference-in-Sargan (or Hansen) test which compares the Sargan (or Hansen) test statistic for all over-identifying restrictions and that for the over-identifying restrictions after excluding the instruments on the lagged dependent variable. In the model(s) estimated here, the m_2 test does not indicate the presence of second-order serial correlation which, according to Sarafidis et al. (2009), implies *possibly* no cross-sectional dependence. According to Sarafidis et al. the difference-in-Hansen test statistic provides another means of testing for heterogeneous error cross-sectional dependence. Here, the difference-in-Hansen test fails to reject the null which, Sarafidis et al. argue, *confirms* the lack of heterogeneous error cross-sectional dependence by virtue of failing to reject homogeneous dependence.

6.6.4 Estimation results

Before proceeding with the estimation, unit root tests are conducted to rule out the possibility of a cointegrating relationship between variables which might give rise to a spurious regression. Madala and Wu's (1999) Phillips-Perron type test (Phillips and Perron, 1988) is used here to test the variables for the presence for unit roots on de-meaned data (i.e. subtracting the cross-sectional averages from the series) which, Levin et al. (2002) argue, makes the test more reliable by mitigating the impact of potential cross-sectional dependence. Madala and Wu's test is a Fisher-type test where p-values from individual tests, i.e. unit root tests for each panel's time series here, are combined to obtain an overall test statistic on whether the panels contain a unit root. It should be noted that the consistency of this test relies on large-T asymptotics (Madala and Wu,1999, p. 637), however this was the only available option because the other tests are not suitable for unbalanced panels and/or panels with gaps (StataCorp, 2009), and therefore they could not be implemented in this analysis[69]. Maddala and Wu's (1999) Fisher test strongly rejects the null hypothesis that all panels contain a unit root for the dependent variable, ***(ln)indFDIstock*** and all the independent variables with the exception of ***(ln)TERTedu*** and ***(ln)ictinfra*** (see Appendix 6.4 for printouts). Hence, a cointegrating relationship, which would require for all variables to contain a unit root, can be ruled out.

Because, as explained above, GMM estimators do not rely on assumptions regarding the distribution, no normality testing is necessary. Also, as explained in the previous section, heteroskedasticity is accounted for in the two-step GMM estimator which is used here as the preferred estimator; where estimates from the one-step estimator are provided for comparison, clustering by cross-sectional unit is used so as to account for arbitrary patterns of heteroskedasticiy (as opposed to 'modelling' these patterns in the two-step estimator).

Initially, Model (6.4) is estimated treating all the dependent variables (with the exception of the lagged dependent variable) as exogenous, exploiting the full set of moment conditions available; i.e. for each variable, for each time period and lag. However, this initial specification fails diagnostic tests for instrument validity: the Sargan/Hansen test and the m_1/m_2 test for residual autocorrelation, which is not surprising considering that the number of instruments is larger than the number of cross-sectional units. As a response, the number of instruments is thus reduced because, as Verbeek (2000, p. 138) explains, tests may not be able to determine which of the instruments are invalid. As suggested by Roodman (2006), and explained in the previous section, collapsing instruments and reducing the lag range are used to reduce the instrument count. First, instruments are collapsed, i.e. the creation of instruments for each time period is 'suppressed', but this does not appear to be sufficient because the tests again uniformly reject instrument validity. Accordingly, the lag range is subsequently reduced in addition to collapsing. Initially lags 1-7 are used and then the range is further reduced by excluding farther lags one

[69] The tests/estimations could not be carried out on a balanced sample because the number of observations would be significantly reduced. Data points in this sample are missing due the inconsistence of coverage of variables/years across countries and due to the exclusion of the negative values of FDI stocks, explained in sub-section 6.6.1.

at a time until acceptable specification tests are ultimately obtained when using lags 1 and 2, or lag 1 only (see Appendix 6.4 for printouts). The same instrument count could (theoretically) be obtained whilst using farther lags (e.g. 3 and 4), however the use of more recent lags as is preferred under the assumption that they are likely to convey more (relevant) information (Greene, 2003, p. 309). Between the two specifications for which instrument validity cannot be rejected, i.e. using the first lag or using lags 1 and 2, the one with both lags is preferred because it maximises the use of available information (to an extent that does not jeopardise instrument validity).

Having obtained an 'acceptable' specification, the assumption of endogenous independent variables is relaxed and other alternatives are further explored (see Appendix 6.5 for printouts). Initially, the other 'extreme' is assumed by specifying all the 'suspect' variables, ***(ln)wage***, ***(ln)gdp,*** ***(ln)SECedu*** and ***(ln)TERTedu***, as endogenous, however instrument validity is strongly rejected. Other 'intermediate' scenarios are further explored based on theoretical considerations, as follows.

First, it may be argued that due to the way the education variables are measured, they are expected to be predetermined rather than endogenous. Namely, potential feedback from FDI to the percentage of population who have attained a certain level of education would take at least a few years to take effect (or, more precisely, at least the length of the respective cycle of studies); and a similar argument would apply in case of a (plausible) relationship between the other regressors such as market size (i.e. GDP) and education variable; accordingly, a scenario is estimated where the education variables are treated as predetermined, whilst keeping ***(ln)wage*** and ***(ln)gdp*** endogenous. *Alternatively*, considering that (based on the discussions in Sections 2.3 and 5.3) the education variables are considered the ones least likely to cause endogeneity in this model, another scenario is estimated where these variables are assumed exogenous while ***(ln)wage*** and ***(ln)gdp*** are kept as endogenous. Again, both estimations fail the instrument validity tests.

Second, because the (potential) feedback of FDI on wages, ***(ln)wage***, and on growth (and hence in the ***(ln)gdp*** variable here), would also take effect with a time lag, these variable may be argued to be predetermined in this model. Accordingly, two further specifications are tested where these variables are treated as predetermined, whist

(ln)SECedu and ***(ln)TERTedu*** are treated as exogenous, or predetermined. These specifications are, too, fail instrument validity tests.

Accordingly, all the explanatory variables in the estimations presented in the rest of this chapter are treated as strictly exogenous.

Table 6.6 below summarises the specifications tests and results for the baseline Model (6.4), as estimated with two-step System GMM, Windmeijer-corrected standard errors, orthogonal deviations and small-sample adjustments[70] (see Appendix 6.6 for printouts of specification tests and results). As explained in Section 5.5, in a dynamic model the short-run coefficients represent the effect of the *new* information on the respective regressors, controlling for their (joint) *"historical" effects*, whilst the long-run effects can be obtained by dividing the regressors by (α), i.e. 1 minus the estimated coefficient on the lagged dependent variable (see Section 5.5 for an explanation of the stock adjustment model).The estimated coefficient short-run and long-run coefficients for the baseline Model (6.4) are presented in Columns (1) and (2) of Table 6.6 below. The Arellano-Bond m_1/m_2 test for the differenced residuals fails to reject second-order serial correlation whilst rejecting first-order serial correlation, indicating exogenous, and thus valid, instruments. Instrument validity is also indicated by Hansen's test of over-identifying restrictions[71]. The p-value on the Hansen test is 0.60, which is substantially higher than the (unusually high) threshold of 0.25 which Roodman (2007, p. 10) suggests using for this test as a precautionary measure; on the other hand, it is not "too good", i.e. it does not approach the p-value of 1.00 which would indicate a weakening of the test due to a large number of moments being tested (Roodman, 2007, pp. 9-10). The Difference-in-Hansen test also does not reject the null of instrument validity for the GMM instruments in the levels equation, indicating that the "stationarity" condition is satisfied and System GMM can be used. This is also confirmed by a coefficient on the lagged dependent variable which is below one, indicating a stable dynamic process (Roodman, 2006, p. 19). This coefficient is positive and significant, as expected; and it lies in the 'credible' range, i.e. between the LSDV and OLS estimates (see Appendix 6.6 for printouts), thus not indicating any specification problems and/or lack of consistency

[70] Small-sample adjustments refer to "small-sample corrections to the covariance matrix estimate, resulting in t instead of z test statistics for the coefficients and F instead of Wald chi2 test for overall fit" (Roodman, 2006, p. 38).
[71] The Sargan test is borderline, however this is not considered to be a problem since, as explained in the previous section, this test is expected to over-reject the null in the presence of heteroskedasticity.

in estimation (Bond, 2002; Roodman, 2006). The rejection of first-order serial correlation in the differenced residuals by the m_1 test combined with the failure to reject the null of instrument validity for the 'extra' moment conditions by the difference-in-Hansen test indicates that cross-sectional dependence is not a problem in this model (Sarafidis et al., 2009). The estimated results presented in the rest of this chapter satisfy all the specification tests, unless stated otherwise.

The F-tests for the joint significance of the independent variables soundly rejects the null, indicating that the independent variables collectively have explanatory power with respect to the dependent variable. Similar to the results obtained from FE/FEVD models with aggregate FDI inflows and the LSDV models with aggregate/total manufacturing FDI stocks, this model does not find support for the hypothesis that the percentage of population who have completed secondary/tertiary education, ***(ln)SECedu*** and ***(ln)TERTedu***, have a positive effect on inward FDI. According to the results, controlling for the historical effects of the "independent" regressors, a 1% increase in the level of the economic freedom index by Heritage Foundation, ***(ln)econfree***, is, on average, associated with 1.5% increase in the level of FDI stock in the manufacturing industries, on average. Calculated at the means of the sample, an increase of the economic freedom index from 57.8 to 58.4 is associated with an increase of EUR 8.36 Million in the level of annual FDI stocks in a manufacturing industry. An increase of 1% in host country's progress in transition as measured by the EBRD overall transition indicator, ***(ln)transition*** is, on average, associated with a 2.2% increase in the level of manufacturing FDI stock. Calculated at the means of the sample, an increase of the EBRD transition score from 3.22 to 3.25 is associated with an increase of EUR 12.26 Million in the level of annual FDI stocks in a manufacturing industry. The control for major privatisation (waves) in the specific manufacturing industries, ***indprivatisation***, is marginally significant in the short-run.

The long-run coefficients depict a similar relationship between the stock of FDI and the independent variables in the model, with the exception of the privatisation variable. Again, economic freedom and progress in transition are the only factors that are found to affect manufacturing FDI stocks. In the long-run, an increase of 1% in the level of the economic freedom index is associated with a 2.3% increase (i.e. EUR 12.82 Million) in the level of FDI stock in a manufacturing industry, on average, whilst an increase of the same magnitude in the transition indicator is associated with 3.2% increase (i.e. EUR 17.84 Million).

Table 6.6: Model 6.4 results (dependent variable: lnindFDIstock)

VARIABLES	(1) Short-run	(2) Long-run
L.lnindfdistock	0.321***	
	(0.112)	
lnsecedu	-0.534	-0.785
	(1.040)	(1.577)
lntertedu	-1.015	-1.49
	(0.829)	(1.063)
lnwage	-0.481	-0.708
	(0.429)	(0.647)
lngdp	0.323	0.476
	(0.538)	(0.802)
lntradefree	-0.0157	-0.023
	(0.280)	(0.413)
lneconfree	1.555**	2.289**
	(0.646)	(0.894)
lntransition	2.226**	3.277**
	(1.109)	(1.581)
lnictinfra	0.394*	0.580
	(0.232)	(0.359)
indprivatisation	1.300*	1.914
	(0.692)	(1.189)
Observations	1,283	
Number of id	130	
Number of instruments	47	
F test:	F(42, 129) =	89.93
	Prob > F =	0.00
Arellano-Bond AR(1) test:	z =	-2.13
	Prob > z =	0.03
Arellano-Bond AR(2) test:	z =	-1.06
	Prob > z =	0.29
Sargan test:	chi2(4) =	4.89
	Prof > chi2 =	0.08
Hansen test:	chi2(4) =	0.99
	Prof > chi2 =	0.60
Difference-in-Hansen test:	chi2(2) =	0.73
	Prof > chi2 =	0.39
LSDV-OLS range (lagged dependent var):		0.19-0.47

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Year dummies included, but not reported. Models estimated using two-step System GMM.

As a robustness check, Model (6.4) was estimated using the *one-step* System GMM estimator (as opposed to the *two-step* estimator) and/or using *first-differences* (as opposed to orthogonal deviations) in the differenced equation; and with the Difference GMM estimator using all these combinations of options. Whilst the results of these different specifications differ to some extent with regard to the magnitude and/or significance of the other regressors, the results with regard to the human capital variables remain largely unchanged, with the exception of the two-step estimator with first differences in which tertiary education is found to be statistically significant, though with a negative sign (see Appendix 6.7 for printouts). In addition, as suggested by Roodman (2006), the "robustness" of the Hansen test was tested, and approved, by checking for any major changes in its value when the instrument count is continuously reduced by: using only one lag, dropping year dummies, dropping sector dummies, and dropping country dummies (See Appendix 6.8 for printouts). The preferred specification remains with two lags, because it utilises more information in the estimation without causing deterioration of the specification tests; and with all dummies included because they are found to be jointly significant (See Appendix 6.8 for printouts of the joint significance tests).

Next, the baseline model above is augmented with technological intensity dummies, ***medium*** and ***high***, and their respective interactions with the education variables: ***(ln)SECmed***, ***(ln)SEChigh***, ***(ln)TERTmed*** and ***(ln)TERThigh***. This enables to test for the hypotheses that FDI in technology-intensive industries is relatively more sensitive to human capital availability[72]. Also, it should be able to shed light on any potential relationship between human capital and FDI that may exist only in these specific groups of manufacturing industries and therefore could be "hidden" by estimating the average effect when data for all industries (or all sectors) are pooled together. The estimator and the options used in this model are the same as in the previous model. The specification tests and results of the augmented Model (6.5) are presented in Table 6.7 below, whilst the printouts for these are presented in Appendix 6.9.

[72] This hypothesis can also be tested by estimating and comparing individual regressions for different groups of industries. The results of this approach were not any different from the ones reported here, but they are not reported because of problems with the specification tests, likely resulting from the smaller sample size.

Similar to the previous model, this model appears to have no problems in terms of specification. In the short-run, the education variables remain insignificant, as are the technological intensity dummies and the interactions between these sets of variables. The insignificance of these variables indicated by their individual t-statistic was also confirmed by F tests for joint significance to ensure that this result was not obtained merely due to collinearity between the interactions and the variables themselves (see Appendix 6.9 for the joint tests). Contrary to expectations, ***(ln)TERTmed*** is found to be (marginally) significant with a negative sign in the long-run, indicating that the effect of the percentage of population who have attained secondary education is lower in medium technology manufacturing industries compared to low technology ones. In terms of control variables, economic freedom and progress in transition remain significant, with almost identical coefficients as in the baseline model.

Table 6.7: Model 6.5 results (dependent variable: lnindFDIstock)

VARIABLES	(1) Short-run	(2) Long-run
L.lnindfdistock	0.319***	
	(0.116)	
lnsecedu	-0.708	-1.038
	(0.996)	(1.511)
lntertedu	-0.669	-0.982
	(0.761)	(1.024)
medium	-0.268	-0.39
	(1.223)	(1.793)
high	-0.0317	-0.046
	(1.116)	(1.637)
lnsecmed	0.330	0.484
	(0.372)	(0.520)
lnsechigh	0.0870	0.127
	(0.345)	(0.500)
lntertmed	-0.739	-1.084*
	(0.453)	(0.571)
lnterthigh	-0.375	-0.550
	(0.342)	(0.469)
lnwage	-0.481	-0.705
	(0.429)	(0.646)
lngdp	0.323	0.474
	(0.541)	(0.805)
lntradefree	-0.0110	-0.016
	(0.283)	(0.416)
lneconfree	1.532**	2.248**
	(0.656)	(0.912)

lntransition	2.218**	3.254**
	(1.113)	(1.588)
lnictinfra	0.392	0.574
	(0.237)	(0.370)
indprivatisation	1.300*	1.908
	(0.702)	(1.210)
Observations	1,283	
Number of id	130	
Number of instruments	51	
F test:	F(48, 129) =	95.50
	Prob > F =	0.00
Arellano-Bond AR(1) test:	z =	-2.11
	Prob > z =	0.03
Arellano-Bond AR(2) test:	z =	-1.07
	Prob > z =	0.29
Sargan test:	chi2(4) =	4.69
	Prof > chi2 =	0.10
Hansen test:	chi2(4) =	0.94
	Prof > chi2 =	0.62
Difference-in-Hansen test:	chi2(2) =	0.68
	Prof > chi2 =	0.41
LSDV-OLS range (lagged dependent var):		0.17-0.46

Notes:
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Results with Windmeijer-corrected standard errors, small-sample adjustments and orthogonal deviations.
Instruments are collapsed and lag range is restricted to lags 1 and 2.
lagged (ln)indfdistock is treated as predetermined, and other regressors as exogenous.
Country, year and sector dummies included, but not reported.

Table 6.8 below presents the results for the transition-specific hypothesis which were tested in Models (6.6-6.8). (Printouts of the results, specification tests, and long-run coefficients for Models (6.6-6.8) are presented in Appendices 6.10-6.12, respectively.) The estimated results do not seem to lend support to the hypothesis that foreign investors are attracted by countries that have emphasised general (rather than vocational) upper-secondary education, or by a relatively younger workforce which is educated in post-communist education system. Contrary to expectations, the initial general- to vocational- ratio of enrolments at the outset of transition, ***(ln)genvocratio***, i.e. the level of emphasis on general education, is found to have a significant negative effect on FDI. The share of population aged 16-30 in 2008, ***(ln)edutr1***, is also found to have an insignificant effect on FDI inflows, both in the short- and long-run. The second proxy for the share of population educated after the communist period, ***(ln)edutr2***, is found to be insignificant, however, this model has problem with the Arellano-Bond *m1* test for residual correlation, and therefore it is not clear that the results of Model (6.8) are reliable.

Table 6.8: Models (6.6-6.8) results (dependent variable: lnindFDIstock)

	(1)	(2)	(3)
VARIABLES	Model (6.6)	Model (6.7)	Model (6.8)
L.lnindfdistock	0.321***	0.255**	0.247*
	(0.112)	(0.100)	(0.134)
lnsecedu	-0.534	-0.683	0.532
	(1.040)	(3.491)	(3.940)
lntertedu	-1.015	0.236	-0.289
	(0.829)	(1.482)	(1.690)
lngenvocratio	-2.355**		
	(1.038)		
lnedutr1		-3.224	
		(3.169)	
lnedutr2			-2.033
			(2.538)
lnwage	-0.481	0.0504	-0.177
	(0.429)	(0.770)	(0.784)
lngdp	0.323	-0.302	0.239
	(0.538)	(1.099)	(1.150)
lntradefree	-0.0157	-0.560	-0.395
	(0.280)	(0.382)	(0.419)
lneconfree	1.555**	1.247*	1.131*
	(0.646)	(0.672)	(0.612)
lntransition	2.226**	3.906	2.576
	(1.109)	(2.387)	(2.958)
lnictinfra	0.394*	0.000282	0.235
	(0.232)	(0.544)	(0.632)
indprivatisation	1.300*	1.467***	1.093
	(0.692)	(0.459)	(0.682)
Observations		1,283	1,017
Number of id		130	129
Number of instruments		51	51

Notes:

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results with Windmeijer-corrected standard errors, small-sample adjustments and orthogonal deviations.

Instruments are collapsed and lag range is restricted to lags 1 and 2.

lagged (ln)indfdistock is treated as predetermined, and other regressors as exogenous.

Country, year and sector dummies included, but not reported.

Table 6.9 below presents the results of the baseline model augmented with the measures of human capital availability/cognitive skills. The country-average of number of weeks it takes firms in the manufacturing sector to fill a vacancy for a skilled worker in manufacturing, (ln)manvacancy, is found to be insignificant, though Model (6.9) appears to have problems with instrument validity and therefore cannot be considered reliable (see Appendix 6.13 for printouts). However, contrary to the previous results for human capital measures obtained in this research, the average level of cognitive skills in science and math measured in primary/secondary school in International Student Achievement Tests, ***(ln)cognitive***, as well as the share of top-performers in these tests ***(ln)top***, are found to have a significant positive effect on manufacturing FDI stocks (see Appendices 6.13 and 6.14 for Model 6.10 and 6.11 printouts, respectively). The size of these effects and the long-run coefficients are discussed later in this section.

Table 6.9: Model (6.9-6.11) results (dependent variable: lnindFDIstock)

VARIABLES	(1) Model (6.9)	(2) Model (6.10)	(3) Model (6.11)
L.lnindfdistock	0.162**	0.273*	0.273*
	(0.0644)	(0.138)	(0.138)
lnsecedu	-5.270	-0.630	-0.630
	(3.904)	(1.050)	(1.050)
lntertedu	2.806	-1.150	-1.150
	(2.042)	(0.896)	(0.896)
lnmanvacancy	0.243		
	(0.480)		
lncognitive		9.368**	
		(3.824)	
lntop			1.679**
			(0.685)
lnwage	-1.283	-0.344	-0.344
	(2.259)	(0.497)	(0.497)
lngdp	2.474	0.264	0.264
	(2.157)	(0.561)	(0.561)
lntradefree	-1.477*	-0.101	-0.101
	(0.795)	(0.278)	(0.278)
lneconfree	0.412	1.667**	1.667**
	(1.531)	(0.638)	(0.638)
lntransition	1.482	1.936*	1.936*
	(4.645)	(1.117)	(1.117)

lnictinfra	-1.458*	0.339	0.339
	(0.866)	(0.253)	(0.253)
indprivatisation	1.241	1.285	1.285
	(0.820)	(0.849)	(0.849)
Observations	474	1,190	1,190
Number of id	129	118	118
Number of instruments	39	46	46

Notes:
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Results with Windmeijer-corrected standard errors, small-sample adjustments and orthogonal deviations.
Instruments are collapsed and lag range is restricted to lags 1 and 2.
lagged (ln)indfdistock is treated as predetermined, and other regressors as exogenous.
Country, year and sector dummies included, but not reported.

Having found a positive effect of ***(ln)cognitive*** and ***(ln)top***, interactions of these variables were added to test the hypothesis that a higher level of cognitive skills and top performer in cognitive tests have a stronger effect on higher-technology manufacturing industries. Accordingly, Models (6.10) and (6.11) are augmented with technology level dummies, ***medium*** and ***high***, and their interactions with the respective cognitive skill measures:

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ij,t-1} + \beta_2 \ln SECedu_{it} + \\ + \beta_3 \ln TERTedu_{it} + \beta_4 \ln cognitive_i + \beta_5 medium_j + \beta_6 high_j + \\ + \beta_7 \ln cognitivemed_{ij} + \beta_7 \ln cognitivehigh_{ij} + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ......(6.12)$$

$$\ln indFDIstock_{ijt} = \beta_0 + (1-\alpha)\ln indFDIstock_{ij,t-1} + \beta_2 \ln SECedu_{it} + \\ + \beta_3 \ln TERTedu_{it} + \beta_4 \ln top_i + \beta_5 medium_j + \beta_6 high_j + \beta_7 \ln topmed_{ij} + \\ + \beta_7 \ln tophigh_{ij} + \gamma X_{it} + \delta t_t + \xi c_i + \theta s_j + \eta_{ij} + \varepsilon_{ijt} \quad ....(6.13)$$

Table 6.10 below presents the estimated short- and long- run coefficients for Models (6.10) and (6.12), the printouts of which are presented in Appendices 6.14 and 6.16, respectively. The average level of cognitive skills, ***(ln)cognitive***, remains significant in the long-run, with an even higher significance level and size of coefficient (Column 2). According to the results, a 1% increase in the standardised measure of cognitive skills is, on average, associated with a 9.3% increase in manufacturing FDI stock in the short-run and a 12.8% increase in the long-run. Calculated at the sample means, the results suggest that an increase of the standardised cognitive score measure from 4.75 to 4.8 (note that the maximum in the sample is 5.19) is associated with an increase of a manufacturing industry's annual FDI stock by EUR 51.8 and 71.3 Million in the short- and long-run, respectively.

The inclusion of dummies for industry groups according to technological intensity suggests that, in accordance with the hypothesis developed earlier in this chapter, the positive effect of cognitive skills is larger in high-tech industries compared to that in low-tech industries, as indicated by the significant and positive interaction term ***(ln)cognitivehigh***. The size of the effects of both ***(ln)cognitive*** and its interaction with the high-tech industry dummy remain very large. The estimated effect for low-tech industries is a bit smaller, with a 1% increase in ***(ln)cognitive*** being associated with a 7.1% and 9.7%, i.e. EUR 39.6 and 54.1 Million, increase in a manufacturing industry's FDI stock in the short-run and the long-run, respectively[73]. For high-tech industries this effect is larger: a 1% increase in ***(ln)cognitive*** is associated with a 13.1% increase in manufacturing FDI stocks in the short-run and an 17.9% increase in the long-run, which at the mean of the sample translates into an increase of EUR 73 and 99.9 Million, respectively.

Table 6.10: Model (6.10) and (6.12) (dependent variable: lnindFDIstock)

	(1)	(2)	(3)	(4)
	Model (6.10)		Model (6.12)	
VARIABLES	short-run	long-run	short-run	long-run
L.lnindfdistock	0.273*		0.274**	
	(0.138)		(0.138)	
lnsecedu	-0.630	-0.857	-0.619	-0.852
	(1.050)	(1.470)	(1.053)	(1.474)
lntertedu	-1.150	-1.582	-1.147	-1.579
	(0.896)	(1.024)	(0.896)	(1.026)
lncognitive	9.368**	12.893***	7.106*	9.788**
	(3.824)	(3.853)	(3.727)	(4.250)
medium			-4.394	-6.053
			(3.517)	(4.610)
high			-9.844**	-13.560***
			(3.942)	(4.586)
lncognitivemed			2.427	3.343
			(2.193)	(2.895)
lncognitivehigh			5.928**	8.166***
			(2.452)	(2.874)
lnwage	-0.344	-0.473	-0.351	-0.483
	(0.497)	(0.722)	(0.496)	(0.722)

[73] The effect for the high-tech industries is calculated by summing the coefficients on ***lncognitive*** and ***lncognitivehigh***, e.g. in Column 3 the effect is 7.106 + 5.928 = 13.134.

lngdp	0.264	0.363	0.270	0.037
	(0.561)	(0.790)	(0.562)	0.7927
lntradefree	-0.101	-0.138	-0.100	-0.138
	(0.278)	(0.394)	(0.278)	(0.396)
lneconfree	1.667**	2.294***	1.668**	2.297***
	(0.638)	(0.825)	(0.641)	(0.828)
lntransition	1.936*	2.664*	1.922*	2.647
	(1.117)	(1.452)	(1.117)	(1.457)*
lnictinfra	0.339	0.467	0.342	0.470
	(0.253)	(0.385)	(0.253)	(0.385)
indprivatisation	1.285	1.768	1.274	1.755
	(0.849)	(1.387)	(0.851)	(1.388)
Observations	1,190		1,190	
Number of id	118		118	
Number of instruments	46		48	

Notes:

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results with Windmeijer-corrected standard errors, small-sample adjustments and orthogonal deviations.

Instruments are collapsed and lag range is restricted to lags 1 and 2.

lagged (ln)indfdistock is treated as predetermined, and other regressors as exogenous.

Country, year and sector dummies included, but not reported.

Table 6.11 below presents the estimated short- and long- run coefficients for Models (6.11) and (6.13), the printouts of which are presented in Appendices 6.15 and 6.17, respectively. Similar to the results for ***(ln)cognitive*** above, the short-run and long-run coefficients on the share of top-performers in cognitive tests ***(ln)top*** are significant and positive. According to the results, an increase of the share of top performers in cognitive tests by 1% (i.e. at the mean of the sample from 7.01 to 7.08 percent) is, on average, associated with an increase in manufacturing FDI stock by 1.6% (or EUR 6.7 Million) in the short-run and 2.3% (or EUR 12.8 Million) in the long-run.

As expected, the effect of ***(ln)top*** is found to be significantly larger in medium-tech industries and high-tech industries compared to the base category of low-tech industries, as indicated by the significant and positive interactions ***(ln)topmed*** and ***(ln)tophigh***. An increase of ***(ln)top*** by 1% is, on average associated with an increase of 1.8% or EUR 10 Million (2.5% or EUR 13.9 Million) in the FDI stock of medium industries in the short-run (long-run), and an increase of 2% or EUR 11.2 Million (2.7% or EUR 15 Million) in the FDI stock of high-tech industries in the short-run (long-run).

Table 6.11: Model (6.11) and (6.13) (dependent variable: lnindFDIstock)

	(1)	(2)	(3)	(4)
	Model (6.11)		Model (6.13)	
VARIABLES	short-run	long-run	short-run	long-run
L.lnindfdistock	0.273*		0.275**	
	(0.138)		(0.137)	
lnsecedu	-0.630	-0.867	-0.619	-0.853
	(1.050)	(1.470)	(1.056)	(1.480)
lntertedu	-1.150	-1.582	-1.141	-1.572
	(0.896)	(1.024)	(0.895)	(1.027)
lntop	1.679**	2.310***	1.353**	1.865**
	(0.685)	0.690	(0.659)	(0.721)
medium			0.887	1.223
			(0.644)	(0.832)
high			1.375**	1.896
			(0.685)	(0.852)
lntopmed			0.534**	0.736**
			(0.249)	(0.304)
lntophigh			0.670***	0.924***
			(0.256)	(0.300)
lnwage	-0.344	-1.473	-0.352	-0.485
	(0.497)	(0.722)	(0.496)	(0.721)
lngdp	0.264	0.363	0.272	0.374
	(0.561)	(0.790)	(0.563)	(0.794)
lntradefree	-0.101	-0.138	-0.104	-0.143
	(0.278)	(0.394)	(0.278)	(0.396)
lneconfree	1.667**	2.294***	1.665**	2.296***
	(0.638)	(0.825)	(0.643)	(0.829)
lntransition	1.936*	2.664*	1.915*	2.641*
	(1.117)	(1.452)	(1.115)	(1.458)
lnictinfra	0.339	0.467	0.341	0.470
	(0.253)	(0.385)	(0.252)	(0.384)
indprivatisation	1.285	1.768	1.263	1.741
	(0.849)	(1.387)	(0.857)	(1.396)
Observations	1,190		1,190	
Number of id	118		118	
Number of instruments	46		48	

Notes:

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results with Windmeijer-corrected standard errors, small-sample adjustments and orthogonal deviations.

Instruments are collapsed and lag range is restricted to lags 1 and 2.

lagged (ln)indfdistock is treated as predetermined, and other regressors as exogenous.

Country, year and sector dummies included, but not reported.

Models (6.10) and (6.11) above were estimated adding the level of development (as measured by GDP per capita, ***gdppc***) as a control variable in an attempt to control for possible omitted variable bias. The inclusion of this variable does not appear to reduce the size of the coefficients on ***(ln)cognitive*** and ***(ln)top*** (printouts for these regressions are presented in Appendix 6.19).

6.7 Conclusion

In previous chapters it was argued that not being able to discriminate between different economic sectors is a major weakness of FDI studies, particularly when the effect of human capital is being investigated. This chapter first looked at the sectoral composition of the FDI in European transition economies. An overview of the data suggests that nearly one-third of FDI stocks in these economies was in manufacturing; the rest is strongly dominated by services, of which financial intermediation is the largest industry, whilst the primary sector accounts for a negligible share of FDI. Of three sectors, it was argued that FDI in the manufacturing sector is most likely to be attracted by the availability (and cost) of human capital and therefore any potential relationship between human capital and the determinants of FDI are more likely to be identified by restricting the latter measure to *FDI in manufacturing*. Accordingly, a dynamic LSDV model similar to that used in the previous chapter was estimated using aggregate manufacturing FDI stocks as a dependent variable. Similar to the empirical investigation in the previous chapter and the meta-regression analysis in Chapter 3, no significant effect of education variables on FDI was found; similarly, no support is found for the transition-specific human capital hypotheses developed in Chapter 5.

It was further argued previously (in Section 4.2) that FDI in some industries is likely to be more sensitive to the availability of human capital, depending on their level of technological intensity. To test the hypothesis, the independent variable was measured at a further disaggregated level (2-digit NACE classification) and dummy variables indicating the level of technological intensity were entered, together with their interactions with the human capital variables. The (System) GMM results of the stock adjustment model with country-industry pairs of FDI stocks as a dependent variable do not suggest that there is a positive relationship between the percentage of population who have completed secondary/tertiary education and FDI, regardless of the level of technological intensity. The results of this model also do not support the transition-specific hypotheses developed in this research. However, contrary to the results obtained for the education measures, and in the previous chapter, the level of cognitive skills measured in International Student Achievement Tests, as well as the share of top-performers in these tests, are found to have a significant positive effect on FDI stocks. Moreover, in accordance with the hypothesis developed in this research, the positive effect of these variables is found to be stronger for FDI in (medium- and) high-tech industries. Except for the previous level of FDI stocks and the cognitive skills measure, FDI stocks in European transition economies appear to be primarily driven by the level of economic freedom and progress achieved in the transition process.

The empirical analyses presented in this thesis have consistently suggested no significant effect of traditional, non quality-adjusted, human capital measures on inwards FDI, accordingly the following chapter explores some potential explanations for these findings. However, there was empirical evidence indicating that the quality dimension of human capital has a positive effect on inwards manufacturing FDI in European transition economies, so Chapter 7 also presents a discussion of the implications of these results for further macro-level economic research focusing on the effects of human capital.

Chapter 7

CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Contents

7.1 Introduction

This aim of this thesis was to empirically investigate the effect of human capital on inwards FDI in European transition economies. Having found no consensus after a review of previous studies that empirically investigate this relationship, the first research questions in this research programme were ***whether an 'authentic' effect of human capital can be identified (and quantified) in previous research*** and ***whether the heterogeneity of results can be explained by specific characteristics of previous studies***. These research questions were addressed using a meta-regression analysis (MRA) in Chapter 3. Following a critical review of alternative measures of human capital, the next research question addressed concerned ***whether economies with relatively abundant human capital attract more inwards FDI***. This research question was investigated in Chapter 5 using panel data on aggregate FDI inflows and stocks of European transition economies. After a review of different types of FDI, the further research questions addressed in this research were ***whether economies that are relatively human capital abundant attract more inwards FDI into their manufacturing sector,*** and ***whether the effect of human capital is stronger in more technologically-intensive manufacturing industries***. These research questions were addressed in Chapter 6 using panel data on manufacturing FDI stocks of European transition economies. This chapter will synthesise and analyse the findings of the thesis to provide explanations and implications of the findings for future research, and it will list its main contributions to knowledge and limitations. The rest of this chapter is organised as follows. Section 7.2 syntheses the findings of this research with regard to the research questions introduced above. Section 7.3 appraises the contributions to knowledge and the limitations of this thesis. Section 7.4 provides potential explanations for the findings of the empirical investigation and explores some of their implications. In addition, this section points to further research that can be undertaken in this field. A separate section on policy implications is not provided in this chapter considering the lack of significant effects found for traditional human capital measures and the need for further empirical work to explore the significance of the cognitive skills measures. Section 7.5 concludes by looking at the wider implications of this research for future empirical research using aggregate measures of human capital.

7.2 Main findings

7.2.1 Analysing the results of the previous empirical literature

The simple bivariate meta-regression model estimated in Chapter 3 suggested that there is no "genuine effect" of human capital on FDI in the previous literature. As this lack of a genuine effect may arise due to a large unexplained heterogeneity, the bivariate meta-regression model was subsequently augmented with a range of variables indicating characteristics of the original studies with regard to the data, estimation techniques and model specifications they use. However, in this meta-regression analysis (MRA) this finding does not seem to be attributed to unexplained heterogeneity, as the results of the multivariate model confirm the ***lack of a "genuine effect" of human capital on FDI***. This finding was argued to be consistent, among other explanations, with human capital not necessarily being a relevant attractor for all types of FDI, or in all economic activities; e.g. being of little importance in resource-seeking FDI in primary sector activities or in market-seeking tertiary sector activities compared to manufacturing activities. The fact that over half of the world inward FDI stock is estimated to be market- or resource-seeking (UNCTAD, 2010a), and therefore is expected to be (relatively) little affected by human capital, makes it difficult for studies using aggregate FDI measures to identify any relationship that may exist between human capital and FDI in the rest of the economic activities. Therefore, the empirical analyses in Chapters 6 restricts the measure of FDI stock to that in manufacturing activities where such a relationship is more likely to be found.

Controlling for different study characteristics related to FDI and human capital measures used, methodology, model specification and sample of countries covered in the sample, the results of the MRA suggests that there is ***also no publication bias in the previous literature***. This finding in not surprising considering that the only a small fraction of the studies actually have the relationship between human capital and FDI as a focus of their investigation. Rather, human capital tends to be included merely as one of many FDI determinants in a "kitchen sink" approach, or simply as a control variable in empirical studies that focus on the effect of other locational factors on FDI. Under these circumstances, if the researchers are prone to "search" for significant results, they are likely to pay (relatively) little attention to the human capital variable compared both to their variable(s) of interest and other determinants which are more "established" in FDI theory, as explained in Chapter 2 (e.g. market size, trade costs, etc.).

The results of the MRA suggest that the size of the estimated effect of human capital on FDI does not depend on the choice of FDI measure (flow vs. stock) or data/estimation technique (cross-section OLS, limited dependent variable model, time-series, static panel or dynamic panel). Similarly, the estimated effect of human capital does not appear to depend on indicators of "reliability" of the results: the quality of data and/or econometric techniques (as proxied by recentness of publication), the number of periods covered in the study, the number variables of controlled for in the model and whether or not endogeneity was (tentatively) controlled for. The estimated ***effect of human capital on FDI*** is found to be significantly lower if a simple labour cost measure in included the model, but it is ***significantly larger in models where productivity or unit labour costs are controlled for***. Consistent with the view that human capital is becoming more important for (foreign) firms over time (Noorbakhsh et al., 2002; Machin, 2004), ***studies using more recent data find a significantly larger effect of human capital on FDI***.

Contrary to expectations, the estimated effect of human capital is not larger when stock measures of human capital are used (as opposed to flow measures such as enrolment rates), or when output measures are used (as opposed to input measures such as spending on education). However, ***the estimated effect of secondary education measures on FDI is lower compared to that of measures referring to other levels of education or not specifying the level of education***. There does not seem to be a theoretical rationale for secondary education being less important to foreign investors, but this finding could be partly explained by fact that secondary education attainment (to a greater extent than other levels) may actually measure different things in different countries because of the differences in education systems with regard to length of secondary education or the mix of general-vocational education. Compared to primary education, in particular, there may also be more pronounced differences in the quality of provision at the secondary level.

The sample of countries for which the relationship between human capital and FDI is estimated also appears to affect the estimated results. The ***estimated effect of human***

capital is found to be, on average, larger in mixed samples and regional data from China relative to samples of developing or developed economies. In contrast, the size of this effect is estimated to be ***smaller, on average, in samples of transition economies***. One potential explanation for this finding was argued to be the inferiority of the communist education systems in developing skills and traits that are valued by (foreign) firms in a market economy, due partly to their curricular content, instruction methods and over-emphasis on 'traditional' vocational education. Accordingly, the level of emphasis on vocational education and the share of population educated in a post-communist education system were used in the empirical investigations reported in Chapters 5 and 6 in an attempt to investigate the extent to which these potential effects may cause foreign investors to value human capital developed in transition economies less than that in other countries.

7.2.2 Does human capital affect total inwards FDI in European transition economies?

Consistent with the results of the meta-regression, the empirical investigations in Chapters 5 and 6 do not find support for the hypothesis that volume measures of human capital positively affect the level of FDI received in European transition economies. This result is consistent across different specifications, regardless of the type of the human capital measure, FDI measure or estimator used. ***In a fixed effects (FE) estimation, the share of working age population who have completed secondary or tertiary education (Barro and Lee, 2010) are both found to have an insignificant effect on net FDI inflows,*** regardless of whether they enter the model separately or simultaneously. These results of the conventional (panel-robust) FE estimator are ***confirmed by the Driscoll-Kraay- and the two-way cluster-robust estimators*** which account for the effects of autocorrelation, cross-sectional dependence and group-wise heteroskedasticity. However, since these stock measures of education are both variables that change slowly over time, i.e. they have low within variation, the FE estimator which utilises only within variation in the estimation was argued to be less able to identify any potential relationship that may exist between these and FDI inflows. Accordingly, the fixed effect vector decomposition (FEVD) estimator was used in an attempt to improve the efficiency (i.e. precision) of estimation in order to ensure that the obtained results are not merely caused by low within variation in the data. ***The results of the FEVD***

estimator also suggest that the share of the working age population who have completed secondary/tertiary education do not have a significant effect on FDI inflows. Finally, FDI stocks are used as an independent variable instead of net FDI inflows and a stock adjustment model is estimated as a robustness check. ***The stock adjustment model estimated using the corrected dynamic least squares dummy variable (LSDVC) estimator confirms the insignificant effect of these variables on FDI stocks.***

In addition to the more conventional educational attainment measures above, three new measures of human capital were used in this investigation: the level of cognitive skills as derived by Hanushek and Woessmann (2009a) based on international standardised test scores at primary and/or secondary education level; the share of top-performing students in these tests (2009a); and the availability of skilled labour as measured by the country-average number of weeks it took firms currently operating in the economy to fill a vacancy for a skilled worker (BEEPS, 2002, 2005). As there is only one observation per country available for the measures of cognitive skills, these have to be assumed as time-invariant and, in a FE context, they can only be estimated using the FEVD estimator. The availability of skilled workers is available for a total of four years but, similar to the education measures above, it has low within variation and therefore the FEVD estimator is preferred. However, in the case of this variable, a stock adjustment model can also be estimated for using the corrected dynamic LSDV estimator. Similar to the human capital measures above, ***the level of cognitive skills, the share of top performers in cognitive tests and the availability of skilled workers in the economy are not found to affect the level of FDI inflows/stocks.***

7.2.3 Does human capital affect inwards FDI in manufacturing activities in European transition economies?

In Chapter 6 it has been argued that human capital may not necessarily be a relevant factor for all types of FDI. If FDI is disaggregated according to economic sectors, it has been argued that FDI in primary sector activities such as agriculture or mining is driven by the availability of natural resources which are location-bound and therefore (relatively) less likely to be affected by the host countries' human capital availability. Similarly, FDI in the tertiary sector activities such as the provision of financial or telecommunication services is likely to be primarily driven by the size of the host country market. FDI in the manufacturing activities, on the other hand, was argued to be (largely) efficiency-seeking and therefore more likely to be driven by the availability and cost of factors of production such as human capital. If aggregate FDI data is used, as in most of the previous literature included in the MRA or in the estimations in Chapter 5, these sectoral differences may therefore "blur" any relationship between human capital and FDI in manufacturing.

Accordingly, the hypothesis of a positive relationship between human capital and FDI was tested in a stock adjustment model restricting the independent variable to *stocks of FDI in the manufacturing sector only*. This hypothesis was initially tested using total manufacturing FDI stocks in a corrected dynamic LSDV context, and insignificant effects of the share of population who have completed secondary/tertiary education and the availability of skilled workers as reported by the firms operating in the economy were found. Further, a dynamic panel model with country-industry pairs of FDI stocks in manufacturing industries as an independent variable was estimated using the two-step System Generalised Method of Moments (GMM) estimator; this way, the *average* effect of human capital *across manufacturing sectors* is estimated, although more disaggregated data is used. Similar to previous specifications using ***aggregate FDI as an independent variable, the results of the System GMM estimator suggest that neither the share of working age population who have completed secondary/tertiary education nor the availability of skilled workers in the economy have a significant effects on manufacturing FDI stocks in European transition economies.*** These findings appear are confirmed by both short-run and long-run coefficients and they appear to be robust to different specifications and GMM estimators.

However, in contrast to the measures of available quantity of human capital above, the measures of cognitive skills are found to be significantly and positively associated with inwards FDI stocks in European transition economies. Positive effects are found, of a feasible magnitude, for both the average level of cognitive skill as measured by the scores of primary/secondary students in International Student Achievement Tests and the percentage of top performers in these tests. The level of development (as measured by GDP per capita) was controlled for in these regressions because it was considered a potential source of omitted variable bias which could have affected the results, but the inclusion of this variable did not reduce the level of statistical significance or size of the coefficient of the cognitive skill measure. The effect of top performers' share was also found to be robust to the inclusion of the development variable.

7.2.4 Does the effect of human capital vary according to the level of technological intensity of inwards FDI?

After having found no relationship between quantity measures and aggregate FDI or manufacturing FDI, the hypothesis that the effect of human capital varies in different (manufacturing) industries depending on their level of technological intensity was tested. This also provides a means of testing whether such a relationship exists only in some specific industries, which would potentially explain why insignificant effects of human capital on aggregate or manufacturing FDI were found. Manufacturing industries were classified into three groups according to their level of technological intensity (based on the standard OECD/Eurostat classification) and the potential differences on the effect of human capital on these different groups were investigated using interaction terms. As in the previous specifications, no effect of volume measures of human capital on FDI was found, nor were there any statistically significant differences between the industry groups, indicating that human capital does not attract FDI regardless of the level of technological intensity. The effect of the level of cognitive skills and that of the share of top performers in cognitive tests, on the other hand, was found to vary with the level of industries' technological intensity. In accordance with the hypothesis proposed, the effect of the average level of cognitive skills is found to be significantly larger in high-tech industries compared to that in low-tech industries, whilst the effect of the share of top performers is significantly larger in both medium- and high-tech industries compared to that in low-tech industries.

7.2.5 Can the largely insignificant results be (partly) attributed to transition-specific factors?

It was argued that one potential explanation for the MRA finding that the estimated effect of human capital is smaller in samples of transition economies compared to other samples could (partly) be due to the inferiority of the communist (education) system in developing skills and traits that are relevant in a market economy, discussed in Sections 1.3 and 4.3. Accordingly, an attempt was made to control for features of these education systems that may have caused the development of 'lower-quality' human capital in transition economies by including proxies for the percentage of population who have completed education after the fall of communism. ***The results are mixed and, overall, they do not lend support to the hypothesis that foreign investors are attracted by a younger workforce (educated during the transition period).*** The first proxy of age structure is found to have an insignificant effect when a model of aggregate FDI data is estimated using the FEVD estimator, and negative in an industry-level FDI model estimated using the System GMM estimator. The second proxy for age structure, on the other hand, is found to be positive in models using aggregate FDI, though insignificant in models using sector- and industry-level manufacturing data.

Further, one specific feature of the communist education systems which may have restricted the development of skills sought by firms in a market economy is their stronger emphasis on 'traditional' vocational education compared to developed economies. This (potential) effect was tested using the ratio of general-to-vocational upper-secondary enrolments at the outset of transition. Similar to the results regarding the age structure, ***the evidence is mixed and does not appear to support the hypothesis that countries with a stronger emphasis on general education manage to attract more FDI.*** Results of the System GMM estimator suggest that there is no significant effect of the initial general-to-vocational ratio in FDI in manufacturing industries, whilst the results of the FEVD estimator suggest that, contrary to expectations, a higher initial general-to-vocational ratio at the outset of transition is associated with lower net FDI inflows.

7.3 Contributions to knowledge

7.3.1 Establishing the underlying theoretical rationale for a human capital-FDI relationship and choosing appropriate measures of human capital

An initial review revealed many theoretical approaches to the determinants of FDI. However, the review of FDI theory shows that the few approaches that make reference to human capital as a potential determinant of FDI do not provide an underlying theoretical rationale for such a relationship. This research fills this gap by ***addressing the reasons why countries with relatively abundant human capital may be expected to attract more FDI.*** However, the initial attempt to provide this rationale proved to be problematic, largely because of the failure of economic research to unpick the meaning of 'relatively abundant human capital' and hence identify how it is best measured. Therefore, ***based on previous micro-level studies, this research sought to identify the actual skills and traits that 'human capital' consists of and how these are developed.***

First, human capital theory and growth theory were reviewed to identify the mechanisms through which European transition countries with a relative advantage in human capital are expected to attract disproportionate amounts of FDI (Section 2.3). ***Three main potential channels were identified from growth theory: increased productivity, increased ability to adopt new technology and facilitation of innovation***, of which technology adoption was argued to be likely to be the most important because of the type of activities that tend to be undertaken by foreign investors in transition economies. Further, the discussion presented in Section 4.2 looked more closely at what employee characteristics (foreign) firms are expected to value in a new market economy and has identified some 'productivity-enhancing' skills/traits. First, foreign investors are expected to be attracted by relatively abundant human capital because it enables, on average, a given worker to perform tasks more productively than those in countries with inferior stocks of human capital, which is ***the 'conventional' role of human capital as identified in orthodox human capital theory.*** Second***, cognitive skills such as the ability to think critically and ability to perceive and solve new problems*** appear to be linked, in particular, to the facilitation of innovation and technology adoption. However, contrary to the (implicit) assumption usually made in economic research that human capital consists of only cognitive skills, non-cognitive skills and behavioural traits were also identified as relevant from the (foreign) employers' perspective. For instance, ***behavioural traits such as self-determination, efficacy and low time-discount rate are also expected to be 'productivity-enhancing'*** because, ceteris paribus, they make employees supply more effort and reduce the need for monitoring.

These insights further complicate the problem of measuring human capital in economic research and appear to require a ***re-assessment of the conventional measures utilised in empirical studies***. The question of both how and where these skills and traits are developed appears to be crucial, both to inform the choice of appropriate human capital measures in applied economic research and from a policy perspective. A review of relevant research has suggested that ***formal education is an important channel through which these skills and traits are reinforced/developed by exposing students to problems with generalisable properties and a system of values similar to those that they will face in the workplace.*** Therefore, measures of educational attainment were used as primary human capital measures in this research: the share of the working age population who have completed secondary education and the share of working age population who have completed tertiary education. The higher levels of formal schooling were used under the assumption that higher-level skills are predominantly developed in upper-secondary and tertiary levels, and considering that there is more variation in this measure in this sample across countries and across time.

Compared to a significant portion of previous literature which uses enrolment rates in education as a proxy for human capital, it has been argued here that ***stock measures of human capital such as the ones above are more appropriate because they represent the whole of human capital available in the workforce***. Enrolment rates, on the other hand, only represent a portion of the capital being developed currently and they may even be misleading in a 'catch-up' scenario if enrolment rates are higher in countries that have lower shares of educated individuals have higher and/or faster growing enrolments.

Further, when stock measures are used, careful consideration should be given to the way these measures of education are defined and what they actually represent. Measures of the share of population who have completed a certain level of education defined in terms of the highest level of education completed by an individual (as in the Barro-Lee database, for instance) may be inappropriate measures of human capital stock. It was argued the percentage of population who have completed primary education, or even secondary education, can be highly misleading measure of the country's quantity of human capital. Namely, if a higher share of the population have primary education as their highest level attained, this automatically implies that a *lower* share of the population have attained secondary and/or tertiary education. In this case, higher values of the human capital measure actually represent lower levels of human capital endowment. By the same token, in this context a higher level of secondary education attainment could actually be at the expense of tertiary attainment. Therefore, in this research the share of working age population who have completed secondary education attainment was defined so as to include the share of those who have continued to complete tertiary education (i.e. the original value reported in Barro and Lee (2010) plus the share who have completed tertiary education and above).

In the previous literature, a measure referring to a certain level of education is (arbitrarily) chosen to represent human capital endowments; or, in a few cases, different levels are used as a robustness check, but separately (i.e. in different specifications). ***In this research it has been argued that, theoretically, there it appears to be inappropriate to limit the representation of human capital to only one measure/level of educational attainment. Also, the use of more than one measure could shed light into the specific levels of education that may be (relatively more) sought by foreign investors.*** Upon examination it was established that the inclusion of more than one human capital measure did not appear to cause any econometric problems (i.e. in terms of multicollinearity), and therefore both the share of working age population who have completed secondary education and the share of working age population who have completed tertiary education were included in the model simultaneously.

However, it was argued in this research that there are likely to be differences in the quality and/or market value of skills offered by different education systems across countries which measures of educational attainment alone cannot convey information on. ***A measure of cognitive skills based on standardised test scores was argued to provide more accurate information on the quality of (the cognitive component of) human capital because: it measures cognitive skills regardless of where and how they are formed; it reflects, in part, the quality of education provision; and, in addition to knowledge, it seeks to measure the ability to apply this to solve real-life problems, which is a more general competence that has been argued to be relevant in a dynamic market economy, and particularly during the process of transition.***

Further, as explained in Section 1.3, PISA tests provide information on the share of students reaching the highest proficiency level, i.e. those who can thoroughly analyse and evaluate information, a category which has been argued to be particularly valued in knowledge-based economies where innovation and decisions-making based on all available evidence is needed. It was further argued in Section 5.2 that ***foreign investors are likely to be particularly interested in the share of the workforce at the top of the distribution of (cognitive) skills, as they can attract the most able individuals by paying higher wages compared to their local counterparts. Accordingly, the share of top-performers in International Student Achievement Tests was used as a proxy for the share of individuals at the top of the distribution in the workforce.***

Finally, it was argued that, contrary to the conventional approach of measuring the 'supply' of human capital by the number of educated individuals, an additional appropriate measure would be one which indicates the availability of skilled labour in an economy as reported by the private sector itself. Accordingly, a country-average of the number of weeks it took firms to fill a vacancy for a skilled worked from survey data was calculated and used as a measure of skilled labour availability.

7.3.2 Synthesising the results from the previous empirical literature

This research has provided the first systematic review of empirical studies that estimate the effect of human capital on FDI inflows, in doing so it sought to search for any consensus that may prevail in previous research. However, an examination of the literature showed extremely diverse results, with no apparent patterns according to the particular characteristics of studies which could be used to summarise, classify, or explain, them. A meta-regression analysis was found to be a valuable tool in both identifying any average 'authentic' effect in the literature and explaining part of the heterogeneity in results that could be attributed to different study characteristics. Accordingly, ***the first meta-regression analysis of the empirical literature that estimates the effect of human capital on inwards FDI was conducted (Chapter 3)***.

7.3.3 Modelling the relationship between human capital and inwards FDI in European transition economies

Having identified the potential mechanisms behind the human capital-FDI relationship and what appear to be the most appropriate measures available, this research then analysed the extent to which the relationship between these measures and FDI are likely to apply in the specific context of (European) transition economies. This research has presented some specific characteristics of the labour markets and education systems of these economies (Sections 1.3-1.4) and examined the type of 'human capital' developed in transition economies and its likely value in a market economy (Sections 4.2-4.3). ***It was argued that communist education systems, but also societies more generally, neglected or even actively discouraged the development of the 'productivity-enhancing' skills and traits identified above. By emphasising the memorising of factual knowledge, an authoritarian style of instruction and conformity to authority in general, they are likely to have inhibited creativity, critical thinking and self-directedness and instead fostered the development of the opposite traits such as docility, adherence to rules and dependence. Based on these considerations, two transition-specific human capital hypotheses were developed. First,*** since the differences between the level of skill-development in developed economies and (European) transition economies were argued to be partially attributable to differences between general and vocational education, ***the ratio of general-to-vocational enrolments at the outset of transition was controlled for. Second, proxies were developed based on the age structure of the population as a means of controlling for the 'vintage' of human capital by discriminating between the age-groups who were educated during communism and those educated in the transition period.***

7.3.4 Estimating the effect of human capital on inwards FDI in European transition economies

Based on the theoretical insights above, an empirical model was developed to estimate the effect of human capital on FDI for a sample of 12 European transition economies for the period 1995-2008. ***The empirical analysis presented in Chapters 5 and 6 is the first to focus on the relationship between human capital and FDI in a sample of transition economies.*** Although there are studies for transition economies that include human capital in the model as a control variable, like most of previous research, they tend not to pay too much attention to the measures used. With the exception of one study, they use human capital measures which were argued in Section 5.2 to be inappropriate for transition economies, i.e. enrolment rates (Tondel, 2001; Gorg and Greeneway, 2002; Kinoshita and Campos, 2003; Carstensen and Toubal, 2004) or illiteracy rates (Fung et al., 2008). The only study of European transition economies that uses a similar stock measure, the economically active population with tertiary education, is Serbu (2005) but this study covers bilateral inward FDI stocks for only 3 economies.

This research has pointed out that human capital measures, in particular stock measures used here, change slowly over time and this may cause difficulties in identifying their effect in empirical estimations based on only within-variation of the variable. Accordingly, the ***Fixed Effect Vector Decomposition (FEVD) technique has been used for the first time in this type of research***.

It has been argued in this research that controlling for the type and sector/industry of FDI is likely to be important in 'disentangling' the determinants of FDI, especially when human capital is concerned. In Chapter 6 this thesis presents ***the first empirical analysis which used sector- and industry-level data to estimate the relationship between human capital and FDI***. The few sector- or industry-level studies that exist (for transition economies and beyond) do not include human capital measures at all. Further, they do not exploit this level of disaggregation to test for potential sectoral differences in the sensitivity of FDI to different determinants. ***Initially, FDI in the manufacturing sector was identified as most likely to be affected by human capital compared to the primary and services sector***, so the effect of human capital on manufacturing sector FDI was estimated. ***In addition, it was hypothesised that, within manufacturing industries, the more technologically-intensive ones are likely to be more sensitive to human capital availability.*** This hypothesis was tested by checking for differences in the estimated human capital effects between three groups of industries classified according to technological intensity.

Finally, this empirical research has considered and (tentatively) addressed potential problems in the estimations undertaken. Most empirical research in this area tends not to report any diagnostic tests or robustness checks, which makes it difficult to assess the reliability of their results. ***In this research, multiple robustness checks were conducted using different human capital and FDI measures and different estimators. Different remedies for diagnostic problems, or approaches to accounting for their consequences in estimation, were considered and those which were assessed to be most appropriate were used in the estimations.*** In contrast to previous FDI studies which do not test/address this issue, ***cross-sectional dependence*** was argued to be likely to be found in this type of research. This suspicion was confirmed by the diagnostic test and suitable estimators were used to address the potential consequences of cross-sectional dependence. ***Finally, this research was the first empirical analysis to discussthe potential endogeneity of human capital measures in FDI models.***

7.3.5 Limitations of this research

This research has addressed some major limitations of previous research in terms of the measures and empirical approach used. However, some limitations remain which could not be addressed, mainly due to the availability and/or quality of human capital measures.

First, with the exception of one measure, all human capital measures used here are economy- or sector-wide measures, whereas it is not clear that foreign investors are interested in the characteristics of the whole workforce. Rather, they may be interested only in the quantity/quality of skills and other characteristics of the individuals at the top of the skill distribution, which these measures do not necessarily convey information on.

Second, as discussed in Section 5.2, the productivity-enhancing skills and traits that are valued in the labour market are not only developed in formal education: they are also developed during early childhood (e.g. by the family) and after formal education (e.g. through work experience and formal or informal training). In this research, three innovative proxies were used which can be argued to partly account for these limitations. The measures of cognitive skills based upon International Student Achievement Test scores at primary/secondary education level also incorporate the skills formed during early childhood, regardless of where and how they were formed. However, the available data did not allow to control explicitly for the effects of pre-school learning which appear to be crucial for the development of cognitive, and especially non-cognitive, skills, partly due to the presence of multiplicative effects in skill formation (Heckman, 2000; Cunha et al., 2006). Similarly, lack of data did not allow to control for skill formation that occurs after formal schooling, which is likely to be a major limitation considering that this is estimated to account for "as much as one third to one half of all skill formation in a modern economy" (Heckman, 2000, p. 5). The measure of availability of skilled labour as reported by firms used here can be argued to include all the market-relevant skills and traits, including those developed after schooling, however this is limited in that it is determined by the number and/or characteristics of the firms currently in the market and does not necessarily represent foreign investors' demand for skilled labour.

Third, the use of measures of the quantity of educational attainment implicitly assumes that education is homogeneous across countries and across time, whereas in reality there are likely to be significant differences with regard to quality and/or length of education. In this research, the quality of education is partially accounted for by the level of cognitive skills; however, this measure, too, has some limitations, as explained above.

Fourth, historically the education systems in transition economies appear to have been inferior in developing the type of cognitive and non-cognitive skills that are valued in a market economy. However, the extent to which this could be accounted for in this research is limited. Namely, the measure of cognitive skills utilised can partly account for cross-country differences in endowments in one type of cognitive skills, problem-solving skills, but this is only measured at primary/secondary level education and there is no data for variation across time. Vocational education was argued to be more associated with the types of skills/traits fostered in communist (education) systems, but controlling for the relative importance of vocational education, again, only partly controls for these effects. Finally, an attempt was made to control for the communism-specific characteristics of human capital through a measure of the vintage of human capital, as indicated by the age structure of the population. However, the effect of this proxy may be argued to reflect merely the potential effect of age structure, and it assumes that there has been an instantaneous reform in European transition economies' education systems.

Finally, it has been argued that the (relative) wage of skilled workers, in particular, should be controlled for in this type of research. Based on the assumption that income inequality in European transition economies is primarily driven by an increasing education premium during transition, the distribution of earnings as measured by the Gini coefficient was initially considered as a proxy for the level of skilled workers' wages. However, upon careful consideration it was decided that the effect of this variable is, a priori, ambiguous because it is affected by both the level of wages of the highly skilled and the share of the highly skilled in the economy.

7.4 Implications of the findings for further research: challenging conventional thinking?

As explained in Section 7.2, the hypothesis that a country's relative quantity of human capital is positively related to the amount of foreign direct investment it attracts does not seem to be supported empirically by this empirical investigation. Some potential reasons for the insignificant results in the previous literature, e.g. the use of inappropriate measures of the level of human capital in the country or failure to discriminate between FDI in different sectors, have been initially advanced and accordingly addressed in this thesis. However, despite these and other methodological improvements, no significant effect of the quantity measures of human capital endowment on FDI could be identified in European transition economies. This finding and the lack of a "genuine" effect found by the MRA can potentially be explained on theoretical grounds and/or in terms of (the limitations of) empirical specification. The rest of this section explores some potential explanations for the insignificant effect of quantity measures of human capital on European transition economies' inward FDI, and then investigates the implications of the significant effect found for quality measures and potential extensions of this research programme.

7.4.1 Do foreign investors necessarily require/prefer highly-skilled labour?

Foreign investors may not necessarily be attracted by higher-level skills if the activities they (intend to) carry out in the host country are not skill-intensive in nature. Namely, if foreign investors turn to producing in European transition economies only at the later stages of the product cycle, i.e. mass production of a product rather than product development, as maintained by the product cycle theory (Section 2.2), then relative human capital endowment is not a relevant factor in their FDI location decision. This argument is consistent with evidence presented in Smarzynska (2002) according to which inwards FDI in transition economies are concentrated in low technology production activities, whilst foreign investors with relatively higher R&D intensity tend to merely open representative offices rather than engage in production in these economies.

However, even in these 'imitation' stages of production, foreign investors may have choices of different technologies they can adopt, and the choice of technology is not necessarily exogenously determined. In Section 1.2 it was argued that foreign investors may choose the technology they adopt in the host country based on the quality and price of labour in the host country, or other characteristics such as the level of protection of intellectual property rights. This argument appears to be in line with models discussed in Section 2.3 according to which countries may choose their technology based on their human capital endowments. Namely, skill-complementary technologies developed in advanced economies may be relatively less profitable compared to a labour-intensive technology in a host country that is well endowed with (cheap) lower-skilled labour. Theoretically, the potential endogeneity of the choice of technology may "blur" the relationship between the level of skills in the host country and the level of FDI it receives: in this scenario a lower level of skills may be associated with a lower *"quality"* of FDI in terms of technological content, but not necessarily a smaller *amount* of FDI attracted. This is consistent with the arguments of UNCTAD (1999, pp. 205-6) that a lower level technology is transferred to affiliates in "host countries with low capabilities and weak learning systems", and the example of affiliates of foreign electronics firms in Indonesia which, according to Pangestu (1997, cited in Ritchie, 2002, p. 17), limit their technology to a medium level due to lack of highly educated workforce (engineers, scientists, and technicians). The ability of foreign firms to adapt the level of technology to the host country's workforce skills in turn would imply that foreign investors do not necessarily seek production locations with high-skill endowments and any relationship between human capital and FDI that may exist should be specified in terms of the technological level of FDI or similar measures, rather than merely a financial measure of FDI as is conventional practice in empirical literature.

Finally, the availability of highly-skilled employees may only translate into higher profitability for foreign investors, and hence be preferred by them, to the extent that they do not have to be (fully) remunerated for their skills. In this case, controlling for the cost of highly-skilled labour would be crucial for identifying any relationship between the availability of highly-skilled workers and inward FDI in an empirical investigation. However, finding data, or even proxies, for (relative) wages of skilled-labour appears to be very difficult in practice, as explained in the empirical investigations in Chapters 5 and 6.

7.4.2 How much of a location-bound factor is a highly-skilled workforce?

Even assuming that foreign investors do require (a portion of) their staff to be highly-skilled, this does not necessarily imply that the host countries' human capital endowments are a (major) factor in investors' location decisions.

First, the parent company has the option of transferring highly-skilled staff, including managerial staff, to the foreign subsidiary. Micro-level research economies reviewed in Section 4.3.1 suggests that this is indeed the case for many managerial positions in foreign subsidiaries in European transition economies.

Second, highly-skilled staff can be argued to be more mobile compared other 'conventional' location factors such as cheap low-skilled labour or natural resources. Compared to low-skilled labour, in particular, high-skilled labour is argued to be generally more mobile because of two reasons. First, assuming that skill-complementary technologies are likely to require a smaller number of employees, the transaction cost of transferring the highly-skilled to the MNE's parent country (or other foreign countries) is lower. Second, which is probably more relevant in the case of developing/transition economies, the immigration policies of developed economies tend to be selective, i.e. they aim to decrease the quantity, and increase the "quality", of immigration and thus are less stringent (or least impose lower transaction costs) for the highly-skilled workers (Checci et al., 2007; Kugler and Rapoport, 2011). The potential for highly-skilled employees to migrate from the parent company to the host country, and the *relative* ease with which such employees can emigrate to developed economies, makes a skilled workforce less of a location-bound factor, contrary to what appears to be the assumption in previous FDI research. As such, a skilled workforce is likely to be attached less weight by foreign investors when choosing their foreign production destination.

7.4.3 Do the human capital measures used accurately reflect the workforce skills/characteristics most relevant to foreign investors?

In empirical research in general, and to some extent in this thesis, it is usually assumed that a high level of technical skills is associated with high educational attainment and this is what increases the productivity of the workforce. Some limitations of this approach have been recognised and discussed in detail in Section 4.2. It can be further argued that in reality ***there are likely to be other skills and traits which are not necessarily related to formal schooling, but which may be even more important than technical skills. Examples of these may be the ability of the local workforce to communicate in a major business language or familiarity with, and ability to adapt to, the culture and work norms of the investor's home country.*** This would be consistent with the research reviewed in Chapter 4 which suggests that employers value workers' communication skills and attitudes in addition to technical skills.

Further, to the extent that foreign investors evaluate different locations based on the availability of workers with the relevant technical skills, they would be interested only in the segment of the workforce with the qualifications and experience relevant to their line of business. For instance, a foreign company who will employ chemical engineers would only be interested in the economy's quantity and quality of the workforce with the relevant qualification, whilst it is unlikely to be interested in the labour market for doctors or economists. The quality of this relevant segment of the workforce in turn is not necessarily related to the quality of the workforce overall, in which case the economy-wide measures used in empirical research do not convey the relevant information. Further problems with using economy-wide measures are discussed next.

7.4.4 Are foreign investors interested in the characteristics of the *whole* workforce?

Assuming that foreign investors do seek highly-skilled labour when choosing among potential production locations, it is not clear that this relationship can be tested using the conventional approach whereby FDI is related to country-level human capital measures. ***Since each foreign investor is expected to employ merely a small fraction of the host country's workforce and the total share of foreign companies'***

employment is likely to be relatively low[74], it is not clear that the average/overall level of skills in the host country is relevant to them. Instead, they can simply 'cream-skim' the local labour markets by offering higher wages compared to their local competitors. Consistent with this is evidence that foreign investors do pay higher wages, on average, as explained in Sections 1.2 and 2.3, and the persistence of a foreign ownership premium even after controlling for firm- and employee-characteristics (Andrews et al., 2009). If foreign investors indeed cream-skim, they would only be interested in the top of the 'skill distribution'; this in turn implies that to the extent that most able/qualified individuals are randomly distributed across countries, foreign investors would be indifferent to the overall level of skills in the workforce when choosing their production location.

7.4.5 Are foreign investors attracted by (only) the quality of human capital?

Empirical evidence presented here appears to suggest that the only measures of human capital that are positively associated with inward FDI in the manufacturing sector are those of cognitive skills: the proxy for the average level of cognitive skills in the workforce and that for the share of the workforce at the top of the skill distribution. Moreover, the higher estimated effect of these measures on (medium- and) high-tech groups of industries compared to the low-tech group appears to be consistent with the hypothesis that the quality workforce skills affects also the level of technology employed by foreign investors and/or the sectoral composition of inward FDI. The findings of this thesis appear to stress the importance of controlling for direct measures of cognitive skills, which (partly) reflect the quality of schooling (in addition to conventional measures of human capital quantity)

7.4.6 Possible extensions of this research

This research has empirically investigated the effect of volume and quality measures of human capital on FDI at the macro-, sector- and industry-level in European transition economies. The potentially most interesting and important finding of this

[74] Although in Czech Republic, where the inwards FDI relative to the economy is among the highest in the sample, as explained in Section 1.2, the share of employees the employment in foreign-controlled affiliates is as high as 45.5 percent in manufacturing and 18.7 percent in services, the share of employment relative to total employment is likely to be lower. This indicator does not appear to be available for European transition economies, but globally it is estimated to be around 2.2%, as calculated using data from (UNCTAD, 2011, p. 24) on foreign investment-enterprise employees and from ILO (2011) on world employment.

research has been the positive effect of cognitive skill measures on inward FDI, in contrast to consistent findings of insignificant effects of traditional human capital measures, both in this research and the previous literature. ***The findings of this research point to the importance of distinguishing between the dimensions of volume and quality of human capital in future FDI studies and warrant further research on the size and robustness of the effect of cognitive skills measures on FDI***.

A similar approach could be used to test the same hypotheses in different samples of countries. Considering that the estimated effect of human capital measures on FDI in previous literature is found by the MRA to be smaller for samples of transition economies compared to other countries, it would be interesting to investigate whether the similar results are found for other economies. ***The estimation of similar industry- level models in developed economies would, in particular, be interesting*** for several reasons. First, such research has not been previously undertaken. Second, the technological level and human capital intensity of activities is likely to be significantly higher (on average) in developed economies, providing a reason to believe that a (stronger) effect of human capital on FDI would be found. Finally, the availability and quality of human capital (and FDI) data for developed economies is likely to allow for at least some of the limitations of this research to be overcome.

This research could be further improved ***by controlling for the level of wages of skilled workers and using/developing alternative measures of human capital which provide information on the actual skills of the workforce rather than merely the average quantity of education attained.*** The latter would, in particular, be useful because it would overcome the limitations of differences in quality of formal education and ensure that individuals' skills/traits are accounted for, regardless of whether and how they were formed. Existing studies that could be considered for this purpose would be the International Adult Literacy Survey (IALS), Adult Literacy and Lifeskills Survey (ALL) and OECD's Programme for the International Assessment of Adult Competencies (PIAAC) which provide information on the literacy of working-age population could be used. Or, ideally, similar but more inclusive surveys which would provide information on the skills and traits that are relevant in a market economy could be used.

Considering the complex relationship between human capital availability and FDI level/quality and difficulties in measuring human capital, c***omplementing macro-level research with micro-level quantitative and qualitative research could provide a useful means of disentangling this relationship.*** This type of study could be used, first of all, to identify the skills and traits that foreign investors value and, if they evaluate investment locations by availability of human capital, what indicators they use to inform their decision. ***Finally, related issues that would be interesting to research are whether and how the availability (and cost) of skilled labour affects the foreign investors' decisions to choose the type of activity that is undertaken in the host country (e.g. mass production vs. product development) and the level/recentness of technology they employ in the host country.***

7.5 Conclusion

This chapter has summarised the main findings of this research and provided potential explanations for the failure of both this research and previous literature to find empirical support in favour of a positive relationship between an investment location's volume measures of human capital and its level of inward FDI. This chapter has also pointed out the importance of this thesis' finding of a positive relationship between the cognitive skill measures and inward FDI in European transition economies which indicates the importance of taking into account the quality dimension of human capital in addition to traditional educational attainment measures usually used in economic research.

However, the criticism and refinement of human capital and FDI measures in this research have wider implications for future economic research. First, the use of disaggregated measures of FDI flows/stocks at sector level or industry level (and classified according to technological intensity) appears to be more appropriate for disentangling the effect of different locational determinants of FDI. Second, the use of quality-adjusted measures of human capital appears to be a necessary, and potentially crucial, refinement to the use of traditional measures of the quantity of human capital when investigating the relationship between human capital endowments and FDI. This in turn appears to point to still wider implications for other economic research which empirically investigates the effects of aggregate measures of human capital, for example in the study of economic growth or income inequality, both in European transition economies and beyond.

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Note: ** (i.e. asterisk) indicates the study is included in the meta-regression analysis.*

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Appendix 1: Professional development

Conferences

Presented the following papers at the following conferences:

"The effect of human capital on FDI: A meta-regression analysis", in:

“The Adriatic-Balkan Area from Transition to Integration", May 21-22, 2010. Università Politecnica delle Marche. Ancona, Italy.

“Activating Sources of Economic Growth in Kosovo”, May 13-14, 2010. Riinvest Institute/AAB-Riinvest University. Prishtina, Kosovo.

“Human capital and the attraction of inwards FDI in European transition economies”, in:

“26th MET-EACES Network Seminar”, April 16, 2012. Managing Economic Transition and European Association for Comparative Economic Studies. Brunel University, London, UK.

Attended the following conferences:

"Regional and Global Integration: Quo Vadis?", January 16-18, 2010. The Global Development Network. Prague, Czech Republic.

“International Trade: A Global Perspective for the 21st Century”. 5-6 December 2008. Staffordshire University. Stoke-on-Trent, UK.

Seminars/trainings

Completed the following seminars/courses:

“EU Project Manager.” European Certification Qualification Association and (ECQA). April 2010.

“Foreign Direct Investment Policies Seminar”. Joint Vienna Institute. Vienna, Austria. 23-27 November 2009.

“Research Methods Course”. Staffordshire University. November 2008.

Publications

Rizvanolli, A., forthcoming. The effect of human capital on FDI: A meta-regression analysis. In Canullo, G., Chiapparino, F., & Cingolani, G., eds. *The Adriatic-Balkan Area from Transition to Integration.* Napoli: Edizioni Scientifiche Italiane.

Teaching

Worked as a ***teaching assistant/lecturer*** (Riinvest/AAB-Riinvest University, Prishtina) in the following subjects:

Basic Macroeconomics. (September 2007-present)

Statistics. (January 2008-present)

Research projects

Participated in/managed the following research projects (Riinvest Institute, Prishtina):

"Kosovo Human Development Report 2011", 2011, UNDP. *(Researcher and co-author)*

"Feasibility study for a VET centre in Kosovo", 2011, UNDP. *(Project manager, author)*

"Private Sector Development", 2011, Friedrich Ebert Stiftung. *(Researcher and author)*

"Assessment of the Demand for Student Financing Schemes in Kosovo", 2011, Finance in Motion. *(Researcher)*

"Economic challenges 2011+", 2011, Friedrich Ebert Stiftung. *(Researcher and co-author)*

"Anti-corruption and the Rule of Law", 2010, CIPE. *(Researcher)*

"Market Research of the Multi-family Housing Market in Prishtina", 2010, Private Investor. *(Project manager, co-author, editor)*

"Strategy for Industry in Kosova", 2009-2010, Ministry of Trade and Industry, Government of the Republic of Kosova. *(Researcher and co-author*)

"Extensive Evaluation of the Employment Assistance Services (EAS) Programme", 2009, Swiss Cooperation Organisation. (*Project coordinator and co-author of the evaluation report*).

"Non-formal Education in Kosovo: Survey and analysis of the drop-outs from compulsory and upper secondary education in Kosovo", 2008-2009, supported by GTZ *(Researcher)*

"Privatization and Post-privatization in Kosova", 2008, supported by The Netherlands Embassy in Prishtina, Friedrich Ebert Stiftung Foundation and Open Society Institute. *(Project manager, co-author, editor)*

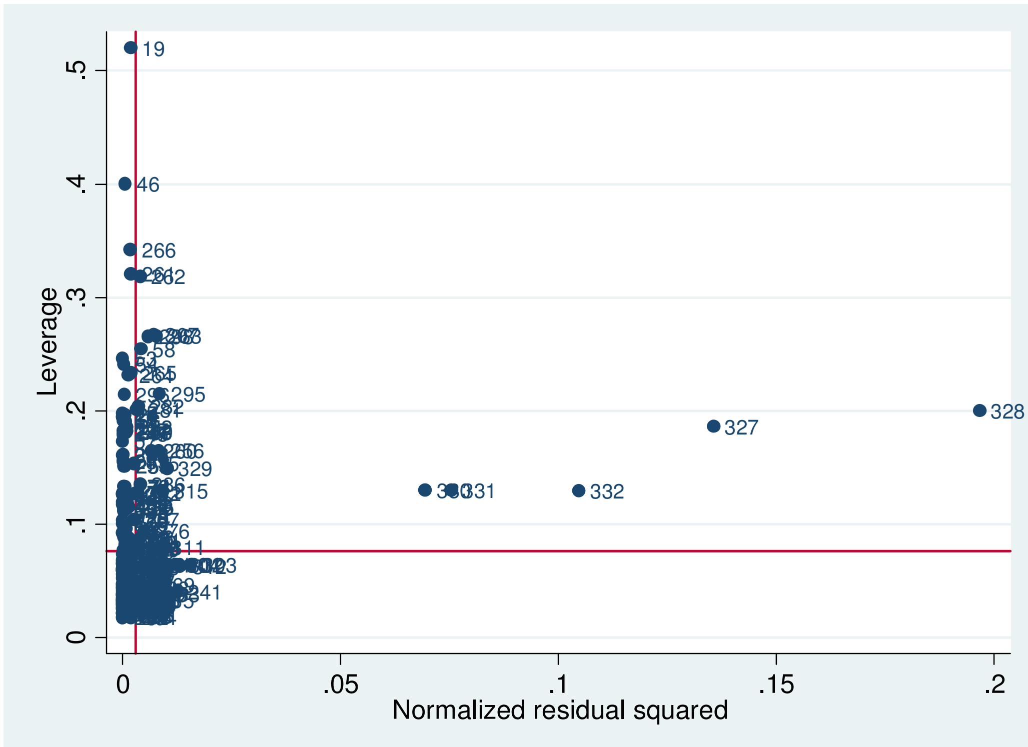
Appendix 3

Contents

Appendix 3.1 Initial sensitivity analysis

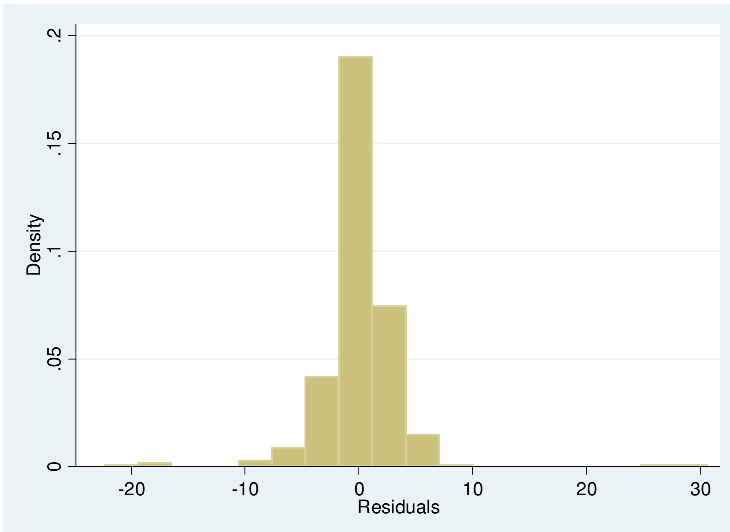
```
. **Start with full model, full sample
. regress tstat invsepcc dynamic qualdv timeseries crosssection mixed developed
transition china fdistock fdirel h
> cstock hcinput  secondary tertiary sectert avgyred labcost labprod endogeneity
lnpubyr lnmedianyr lnperiod lntno
> exp published[pweight = weight], vce(cluster study)
(sum of wgt is   5.6000e+01)

Linear regression                                      Number of obs =     341
                                                       F( 25,    55) =    9.49
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.5727
                                                       Root MSE      =  3.8321

                                  (Std. Err. adjusted for 56 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .5552002   .2124286     2.61   0.012      .1294836    .9809167
     dynamic |   .0468112   .0577505     0.81   0.421     -.0689234    .1625458
      qualdv |  -.1390898    .093568    -1.49   0.143     -.3266043    .0484247
  timeseries |   .2394262   .2549799     0.94   0.352      -.271565    .7504174
crosssection |  -.0133662   .0792541    -0.17   0.867      -.172195    .1454626
       mixed |   .0678314   .0863475     0.79   0.435     -.1052128    .2408756
   developed |   .0911523   .0660963     1.38   0.173     -.0413076    .2236122
  transition |  -.0602446    .095401    -0.63   0.530     -.2514326    .1309433
       china |   .0809153   .0584476     1.38   0.172     -.0362164     .198047
   fdistock |    .019603    .053429     0.37   0.715     -.0874711    .1266771
      fdirel |  -.0477379   .0463183    -1.03   0.307     -.1405618    .0450859
     hcstock |   .1654176   .0582348     2.84   0.006      .0487125    .2821227
     hcinput |  -.0632204   .0882109    -0.72   0.477     -.2399991    .1135582
   secondary |  -.0863616   .0594305    -1.45   0.152      -.205463    .0327398
    tertiary |  -.1013375    .050529    -2.01   0.050     -.2025999   -.0000752
     sectert |   .0288001    .063227     0.46   0.651     -.0979096    .1555098
     avgyred |  -.2290467   .1030877    -2.22   0.030     -.4356391   -.0224542
     labcost |  -.1701654   .0519395    -3.28   0.002     -.2742546   -.0660762
     labprod |   .0046908   .0445042     0.11   0.916     -.0844976    .0938791
 endogeneity |  -.1301086    .053418    -2.44   0.018     -.2371606   -.0230566
     lnpubyr |   .0609884   .6408281     0.10   0.925      -1.22326    1.345237
  lnmedianyr |  -.0950141   .5062518    -0.19   0.852     -1.109565    .9195372
    lnperiod |  -.7163985   .3932153    -1.82   0.074      -1.50442    .0716226
    lntnoexp |  -1.805099   .9826589    -1.84   0.072     -3.774392    .1641932
   published |  -.1570831   .0402468    -3.90   0.000     -.2377394   -.0764268
       _cons |   8.390642   5.306001     1.58   0.120     -2.242821    19.02411
------------------------------------------------------------------------------

. **Linearity test
. estat ovtest

Ramsey RESET test using powers of the fitted values of tstat
       Ho:  model has no omitted variables
                 F(3, 312) =     80.55
                  Prob > F =      0.0000

. *fails linearity
.
```

```
. **Investigation of outliers
. qui regress tstat invsepcc dynamic qualdv timeseries crosssection mixed developed
transition china fdistock fdir
> el hcstock hcinput  secondary tertiary sectert avgyred labcost labprod endogeneity
lnpubyr lnmedianyr lnperiod l
> ntnoexp published

. lvr2plot, ml(obs)
```




```
*regressions from Kang and Lee (2007) with large normalised squared residuals
.
.
. **Further investigation of outliers (cooksd, dfits)
. predict cooksd, cooksd

. predict dfits, dfits

. *regressions from Kang and Lee (2007) have the largest values of cooksd and dfits,
well above conventional cut-o
> ff points
>
.
```

```
. **Histogram of residuals
. predict resid, res

. histogram resid
(bin=18, start=-22.362078, width=2.9453735)
```




```
. *histogram indicates normality problems, probably due to outliers
.
. **Multicollinearity check
. estat vif

    Variable |       VIF       1/VIF
-------------+----------------------
    invsepcc |    265.67    0.003764
      qualdv |     66.36    0.015068
       mixed |     64.27    0.015560
   published |     40.76    0.024534
    tertiary |     35.71    0.028000
     labcost |     31.14    0.032112
     hcstock |     17.03    0.058718
       china |     16.07    0.062247
     sectert |     13.32    0.075077
     lnpubyr |      5.82    0.171899
    lnperiod |      5.45    0.183320
     hcinput |      5.17    0.193445
crosssection |      4.52    0.221028
   developed |      4.41    0.226987
  lnmedianyr |      3.68    0.271382
 endogeneity |      3.22    0.310360
     labprod |      3.11    0.321297
    lntnoexp |      2.86    0.350024
     avgyred |      2.80    0.356914
   secondary |      2.64    0.378648
  transition |      2.59    0.386278
    fdistock |      2.49    0.401864
     dynamic |      2.21    0.452695
      fdirel |      2.08    0.480107
  timeseries |      1.24    0.809423
-------------+----------------------
    Mean VIF |     24.18

. *very high collinearity
.
. *regressions from Kang and Lee (2005) are excluded from the analysis based on the
above.
```

Appendix 3.2: Summary statistics and correlations

Variable*	Obs	Mean	Std. Dev.	Min	Max
tstat	335	1.194449	2.714776	-8.58	11.98
invsepcc	335	17.53262	24.52421	2.3585	216.316
lnpubyr	335	5.106788	0.71529	3.13813	7.67933
lnmedianyr	335	5.222382	0.77193	2.4666	7.86165
lntnoexp	335	4.853073	0.978714	2.04056	7.94315
lnperiod	335	4.536439	1.159802	1.66186	8.08479

*Note: Variables are multiplied by ***invsepcc***

Dummy variable		Value
dynamic		
	Zero	268
	Positive	67
	Total	335
qualdv		
	Zero	292
	Positive	43
	Total	335
panel		
	Zero	179
	Positive	156
	Total	335
timeseries		
	Zero	329
	Positive	6
	Total	335
crosssection		
	Zero	272
	Positive	63
mixed		
	Zero	281
	Positive	54
	Total	335
developed		
	Zero	303
	Positive	32
	Total	335
developing		
	Zero	233
	Positive	102
	Total	335

transition		
	Zero	270
	Positive	65
	Total	335
china		
	Zero	253
	Positive	82
	Total	335
fdiflow		
	Zero	79
	Positive	256
	Total	335
fdistock		
	Zero	256
	Positive	79
	Total	335
fdirel		
	Zero	218
	Positive	117
	Total	335
fdiabs		
	Zero	117
	Positive	218
	Total	335
hcflow		
	Zero	238
	Positive	97
	Total	335
hcstock		
	Zero	103
	Positive	232
	Total	335
hcinput		
	Zero	319
	Positive	16
	Total	335
primary		
	Zero	283
	Positive	52
	Total	335
secondary		
	Zero	245
	Positive	90
	Total	335
tertiary		
	Zero	230

	Positive	105
	Total	335
sectert		
	Zero	291
	Positive	44
	Total	335
avgyred		
	Zero	303
	Positive	32
	Total	335
labcost		
	Zero	153
	Positive	182
	Total	335
labprod		
	Zero	288
	Positive	47
	Total	335
endogeneity		
	Zero	279
	Positive	56
	Total	335
published		
	Zero	136
	Positive	199
	Total	335

```
. corr  published lnperiod lnmedianyr lnpubyr lntnoexp endogeneity labprod labcost avgyred sectert tertiary second
> ary primary hcinput hcstock hcflow fdiabs fdirel fdistock fdiflow china transition developing developed mixed cr
> osssection timeseries panel qualdv dynamic invsepcc tstat
(obs=335)
```

	publis~d	lnperiod	lnmedi~r	lnpubyr	lntnoexp	endoge~y	labprod	labcost	avgyred	sectert	tertiary
published	1.0000										
lnperiod	0.5856	1.0000									
lnmedianyr	0.6166	0.4664	1.0000								
lnpubyr	0.6653	0.6483	0.6864	1.0000							
lntnoexp	0.5071	0.5688	0.5473	0.6343	1.0000						
endogeneity	0.0021	0.2048	0.2027	0.2747	0.2301	1.0000					
labprod	0.0897	0.2094	-0.0366	0.1403	0.1483	0.0282	1.0000				
labcost	0.9544	0.5512	0.6177	0.6171	0.5349	-0.0028	-0.0247	1.0000			
avgyred	-0.0569	-0.1265	0.0378	0.0277	0.0218	0.3245	-0.1055	-0.0844	1.0000		
sectert	0.1028	0.1324	0.2941	0.2236	0.2135	0.2255	0.1892	0.0960	-0.0977	1.0000	
tertiary	0.9065	0.5121	0.5631	0.5528	0.4581	-0.0784	-0.1074	0.9271	-0.0960	-0.1043	1.0000
secondary	-0.0689	0.0527	0.0086	0.0506	-0.1405	0.2803	-0.1360	-0.0876	-0.1596	-0.1045	-0.1332
primary	-0.0406	-0.0452	-0.0543	0.1201	0.0792	-0.0425	0.0407	-0.0234	-0.1110	-0.1206	-0.1185
hcinput	0.0636	0.2476	0.0371	0.0811	0.1194	-0.0812	0.5780	0.0197	-0.0624	-0.0139	-0.0448
hcstock	-0.0136	0.0289	0.3039	0.2774	0.3220	0.4003	-0.0599	-0.0075	0.2109	0.3918	-0.1675
hcflow	0.9209	0.5704	0.5232	0.5938	0.4265	-0.0842	0.0637	0.9047	-0.0929	-0.0532	0.9342
fdiabs	0.9441	0.5906	0.6378	0.6154	0.5489	0.0007	0.0059	0.9537	-0.0395	0.1206	0.9226
fdirel	-0.0826	-0.0022	-0.0212	0.1987	-0.0490	0.1449	0.1282	-0.1479	0.0380	-0.1505	-0.1185
fdistock	-0.0762	0.0440	0.0843	-0.1082	0.0486	0.4548	0.0068	-0.0247	0.2186	0.2373	-0.1009
fdiflow	0.9533	0.5892	0.6228	0.7040	0.5329	-0.0624	0.0397	0.9335	-0.0791	0.0275	0.9273
china	0.1015	0.1802	0.2346	0.1611	0.2406	0.1385	-0.0890	0.1406	-0.1350	0.3584	-0.0086
transition	-0.1564	-0.2529	-0.0171	-0.1245	-0.0013	-0.0853	0.1095	-0.1186	-0.1323	0.1847	-0.1045
developing	-0.1210	-0.0767	-0.1052	0.0075	-0.1505	-0.1057	-0.1490	-0.1780	0.2297	-0.1446	-0.1487
developed	0.0446	0.2867	0.0191	0.1521	0.1418	0.1706	0.5860	-0.0396	0.2553	-0.0827	-0.0750
mixed	0.9203	0.5177	0.5727	0.5949	0.4550	-0.0071	-0.0482	0.9254	-0.0727	-0.0124	0.9491
crosssection	0.0598	-0.0626	0.0259	0.0549	-0.1151	-0.0837	0.5144	-0.0561	0.2362	-0.1088	-0.1048
timeseries	-0.0477	-0.0106	-0.2571	-0.1677	-0.1534	-0.0173	-0.0158	-0.0510	0.0159	-0.0418	-0.0339
panel	-0.0911	0.1510	0.1052	0.2358	0.2274	0.3010	-0.0526	-0.0613	-0.1111	0.1437	-0.0693
qualdv	0.9435	0.5011	0.5849	0.5867	0.4706	-0.0959	-0.0675	0.9496	-0.0703	0.0510	0.9395
dynamic	-0.1155	0.2340	0.0263	-0.0309	0.0913	0.3203	0.0319	-0.0984	0.0964	0.0545	-0.0969
invsepcc	0.9725	0.6224	0.6668	0.7059	0.5651	0.0421	0.0428	0.9640	-0.0308	0.0843	0.9396
tstat	-0.2192	-0.0067	0.1088	0.0581	0.1143	0.1382	0.1852	-0.2311	0.1082	0.1458	-0.2874

	second~y	primary	hcinput	hcstock	hcflow	fdiabs	fdirel	fdistock	fdiflow	china	transi~n
secondary	1.0000										
primary	-0.1970	1.0000									

hcinput	-0.1107	-0.0770	1.0000								
hcstock	-0.0331	0.2527	-0.2262	1.0000							
hcflow	-0.0544	-0.1147	0.0966	-0.3371	1.0000						
fdiabs	-0.1646	-0.0728	0.0211	-0.0466	0.9154	1.0000					
fdirel	0.3413	0.1269	0.1624	0.0622	-0.0646	-0.3232	1.0000				
fdistock	-0.0519	-0.1090	0.0658	0.1933	-0.1365	0.0115	-0.2228	1.0000			
fdiflow	-0.0618	-0.0145	0.0511	-0.0740	0.9427	0.9243	-0.0035	-0.2756	1.0000		
china	0.0983	0.1372	0.0116	0.5657	-0.1388	0.0663	-0.0241	0.0087	0.0587	1.0000	
transition	-0.1324	0.0147	-0.0918	-0.1678	-0.0563	-0.0407	-0.2818	0.0396	-0.1275	-0.2194	1.0000
developing	0.1795	-0.0974	-0.0906	0.0402	-0.1270	-0.1983	0.3019	-0.1834	-0.0771	-0.3014	-0.2676
developed	-0.1241	-0.1083	0.6526	-0.0623	0.0707	0.0099	0.1399	0.0247	0.0428	-0.1455	-0.1292
mixed	-0.0930	-0.0385	-0.0527	-0.1771	0.9527	0.9292	-0.0981	-0.0234	0.9220	-0.1259	-0.1118
crosssection	-0.1256	-0.0358	0.6194	-0.1203	0.0379	-0.0804	0.2764	-0.0950	0.0157	-0.1155	-0.1777
timeseries	-0.0684	-0.0475	0.0150	-0.1129	-0.0244	-0.0407	-0.0820	-0.0608	-0.0501	-0.0638	-0.0567
panel	0.2918	-0.0379	-0.1655	0.3238	-0.1509	-0.1207	0.2346	0.0274	-0.0644	0.1510	-0.1894
qualdv	-0.1285	-0.0169	-0.0445	-0.0839	0.9316	0.9553	-0.1567	-0.1033	0.9505	0.0275	-0.0779
dynamic	0.0130	-0.0037	0.0765	-0.0455	-0.0668	-0.0229	-0.1149	0.3368	-0.1310	0.0715	0.2853
invsepcc	-0.0764	-0.0407	0.0685	-0.0315	0.9473	0.9629	-0.0560	-0.0514	0.9742	0.0630	-0.1232
tstat	-0.1027	0.2030	0.0803	0.2800	-0.2655	-0.1999	0.0672	0.0882	-0.2045	0.0544	-0.0258

	develo~g	develo~d	mixed	crosss~n	timese~s	panel	qualdv	dynamic	invsepcc	tstat
developing	1.0000									
developed	-0.1774	1.0000								
mixed	-0.1536	-0.0741	1.0000							
crosssection	0.0098	0.5952	-0.0781	1.0000						
timeseries	0.0347	-0.0376	-0.0325	-0.0517	1.0000					
panel	0.1952	-0.2242	-0.0670	-0.3204	-0.1022	1.0000				
qualdv	-0.1406	-0.0511	0.9487	-0.0988	-0.0315	-0.1954	1.0000			
dynamic	-0.1613	0.1404	-0.1164	-0.1849	-0.0590	-0.3655	-0.1127	1.0000		
invsepcc	-0.1232	0.0503	0.9524	-0.0060	-0.0664	-0.0605	0.9632	-0.0570	1.0000	
tstat	-0.0528	0.1610	-0.2182	0.1111	-0.0534	0.0837	-0.2598	0.1582	-0.1918	1.0000

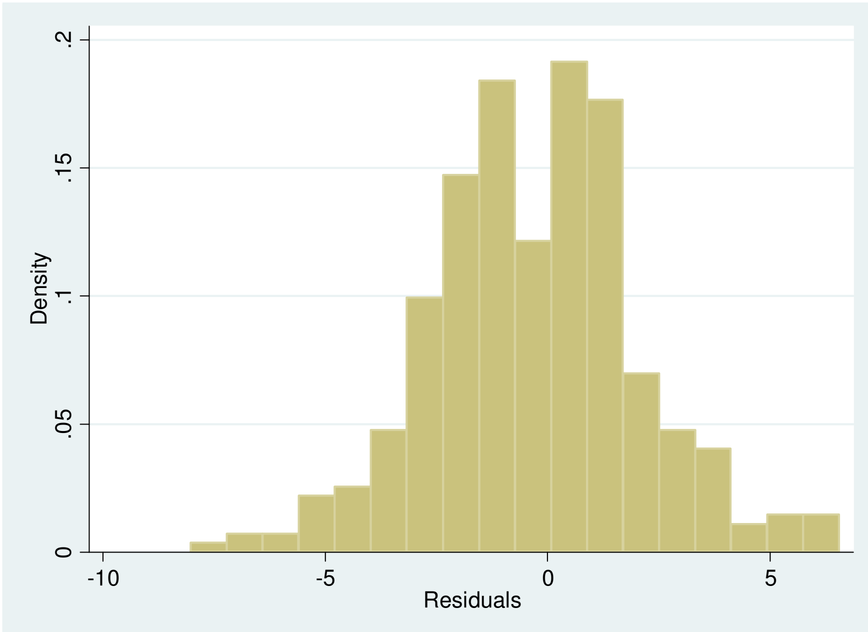
Appendix 3.3: Bivariate MRA (Model 3.2) results and diagnostics

```
. **Bivariate MRA model, sample excluding Kang and Lee (2007)
. regress tstat invsepcc [pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F(  1,    54) =    2.12
                                                       Prob > F      =  0.1509
                                                       R-squared     =  0.0228
                                                       Root MSE      =  2.4799

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |  -.0201938   .0138601    -1.46   0.151    -.0479817     .007594
       _cons |   2.066277   .4036785     5.12   0.000     1.256951    2.875604
------------------------------------------------------------------------------


. estat ovtest

Ramsey RESET test using powers of the fitted values of tstat
       Ho:  model has no omitted variables
                 F(3, 330) =      7.22
                  Prob > F =      0.0001
```

Appendix 3.4: Full multivariate MRA (Model 3.3) results and diagnostics

```
. **Start with full model, sample excluding Kang and Lee (2007)
. regress tstat invsepcc dynamic qualdv timeseries crosssection mixed developed transition
china fdistock fdirel h
> cstock hcinput  secondary tertiary sectert avgyred labcost labprod endogeneity lnpubyr
lnmedianyr lnperiod lntno
> exp published [pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 25,    54) =   19.60
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3801
                                                       Root MSE      =  2.0503

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .1750783   .1002161     1.75   0.086    -.0258429    .3759996
     dynamic |   .0611628   .0456958     1.34   0.186    -.0304519    .1527774
      qualdv |  -.0470682   .0502894    -0.94   0.353    -.1478924    .0537559
  timeseries |   .2182407   .2574841     0.85   0.400    -.2979838    .7344652
crosssection |  -.0027922   .0634367    -0.04   0.965    -.1299752    .1243907
       mixed |    .090753   .0879819     1.03   0.307    -.0856402    .2671462
   developed |   .0232758   .0610291     0.38   0.704    -.0990802    .1456319
  transition |  -.1129344   .0705296    -1.60   0.115    -.2543377    .0284688
       china |    .069092   .0520508     1.33   0.190    -.0352637    .1734476
    fdistock |   .0237482   .0529818     0.45   0.656    -.0824739    .1299703
      fdirel |   -.019491   .0420386    -0.46   0.645    -.1037733    .0647912
     hcstock |   .0453959   .0557678     0.81   0.419    -.0664118    .1572035
     hcinput |  -.0733057   .0713894    -1.03   0.309    -.2164328    .0698214
   secondary |  -.1215634   .0582944    -2.09   0.042    -.2384366   -.0046902
    tertiary |  -.0550672   .0388507    -1.42   0.162    -.1329581    .0228237
     sectert |  -.0332482   .0376136    -0.88   0.381    -.1086589    .0421626
     avgyred |  -.1176622   .0633563    -1.86   0.069    -.2446839    .0093596
     labcost |  -.1224047   .0457973    -2.67   0.010    -.2142227   -.0305867
     labprod |   .0955991   .0425048     2.25   0.029     .0103821    .1808162
 endogeneity |  -.0599005   .0562347    -1.07   0.292    -.1726442    .0528432
     lnpubyr |   .3292858   .4486779     0.73   0.466    -.5702592    1.228831
  lnmedianyr |   .8875675   .3427648     2.59   0.012     .2003655     1.57477
    lnperiod |  -.3733034    .222675    -1.68   0.099      -.81974    .0731331
    lntnoexp |  -.3661083   .4424019    -0.83   0.412    -1.253071    .5208541
   published |  -.0730546   .0380131    -1.92   0.060    -.1492663    .0031571
       _cons |  -1.885811   2.090304    -0.90   0.371    -6.076618    2.304996
------------------------------------------------------------------------------

.
. **Linearity test
. estat ovtest

Ramsey RESET test using powers of the fitted values of tstat
       Ho:  model has no omitted variables
                 F(3, 306) =     14.89
                  Prob > F =      0.0000

. *still fails linearity test, but F-statistic has decreased to 14.89 from over 95 in the full
sample
.
```

```
. **Investigating normality
. predict resid, res

. histogram resid
(bin=18, start=-8.0269508, width=.81036038)
```




```
. *The distribution of residuals is basically bell-shaped
.

. **Multicollinearity check
. estat vif

    Variable |       VIF       1/VIF  
-------------+----------------------
    invsepcc |    108.43    0.009223
       mixed |     31.85    0.031396
      qualdv |     25.64    0.039000
    tertiary |     14.92    0.067028
   published |     14.72    0.067923
     labcost |     14.12    0.070820
     hcstock |      5.38    0.185821
 endogeneity |      5.14    0.194506
       china |      5.00    0.199937
    lntnoexp |      4.93    0.202986
     avgyred |      4.58    0.218194
     lnpubyr |      3.95    0.253437
   developed |      3.86    0.259167
  lnmedianyr |      3.69    0.270828
     sectert |      3.46    0.289170
crosssection |      3.44    0.290412
    lnperiod |      3.33    0.300197
     hcinput |      3.02    0.330713
   secondary |      2.62    0.382006
  transition |      2.62    0.382265
    fdistock |      2.53    0.394735
     labprod |      2.51    0.397706
      fdirel |      2.43    0.411623
     dynamic |      2.10    0.475339
  timeseries |      1.55    0.646038
-------------+----------------------
    Mean VIF |     11.03

. *very high VIF in the case of some variables
```

Appendix 3.5: Testing down procedure

```
. **Testing down procedure
. regress tstat invsepcc dynamic qualdv timeseries crosssection mixed developed transition
china fdistock fdirel h
> cstock hcinput  secondary tertiary sectert avgyred labcost labprod endogeneity lnpubyr
lnmedianyr lnperiod lntno
> exp published[pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 25,    54) =   19.60
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3801
                                                       Root MSE      =  2.0503

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .1750783   .1002161     1.75   0.086    -.0258429    .3759996
     dynamic |   .0611628   .0456958     1.34   0.186    -.0304519    .1527774
      qualdv |  -.0470682   .0502894    -0.94   0.353    -.1478924    .0537559
  timeseries |   .2182407   .2574841     0.85   0.400    -.2979838    .7344652
crosssection |  -.0027922   .0634367    -0.04   0.965    -.1299752    .1243907
       mixed |    .090753   .0879819     1.03   0.307    -.0856402    .2671462
   developed |   .0232758   .0610291     0.38   0.704    -.0990802    .1456319
  transition |  -.1129344   .0705296    -1.60   0.115    -.2543377    .0284688
       china |    .069092   .0520508     1.33   0.190    -.0352637    .1734476
    fdistock |   .0237482   .0529818     0.45   0.656    -.0824739    .1299703
      fdirel |   -.019491   .0420386    -0.46   0.645    -.1037733    .0647912
     hcstock |   .0453959   .0557678     0.81   0.419    -.0664118    .1572035
     hcinput |  -.0733057   .0713894    -1.03   0.309    -.2164328    .0698214
   secondary |  -.1215634   .0582944    -2.09   0.042    -.2384366   -.0046902
    tertiary |  -.0550672   .0388507    -1.42   0.162    -.1329581    .0228237
     sectert |  -.0332482   .0376136    -0.88   0.381    -.1086589    .0421626
     avgyred |  -.1176622   .0633563    -1.86   0.069    -.2446839    .0093596
     labcost |  -.1224047   .0457973    -2.67   0.010    -.2142227   -.0305867
     labprod |   .0955991   .0425048     2.25   0.029     .0103821    .1808162
 endogeneity |  -.0599005   .0562347    -1.07   0.292    -.1726442    .0528432
     lnpubyr |   .3292858   .4486779     0.73   0.466    -.5702592    1.228831
  lnmedianyr |   .8875675   .3427648     2.59   0.012     .2003655     1.57477
    lnperiod |  -.3733034    .222675    -1.68   0.099      -.81974    .0731331
    lntnoexp |  -.3661083   .4424019    -0.83   0.412    -1.253071    .5208541
   published |  -.0730546   .0380131    -1.92   0.060    -.1492663    .0031571
       _cons |  -1.885811   2.090304    -0.90   0.371    -6.076618    2.304996
------------------------------------------------------------------------------

. test crosssection=fdistock=0

 ( 1)  crosssection - fdistock = 0
 ( 2)  crosssection = 0

       F(  2,    54) =    0.11
            Prob > F =    0.8956

. *drop
.
```

```
. regress tstat invsepcc dynamic qualdv timeseries mixed developed transition china fdirel
hcstock hcinput  second
> ary tertiary sectert avgyred labcost labprod endogeneity lnpubyr lnmedianyr lnperiod
lntnoexp published[pweight
> = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 23,    54) =   19.31
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3788
                                                       Root MSE      =  2.0459

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .1578144   .0881094     1.79   0.079    -.0188343    .3344632
     dynamic |   .0691701   .0365632     1.89   0.064    -.0041347     .142475
      qualdv |  -.0467879   .0395976    -1.18   0.243    -.1261762    .0326005
  timeseries |   .1973442   .2762592     0.71   0.478    -.3565221    .7512106
       mixed |   .1012093   .0731363     1.38   0.172    -.0454201    .2478387
   developed |   .0191505   .0489713     0.39   0.697    -.0790311     .117332
  transition |   -.109668   .0643321    -1.70   0.094     -.238646      .01931
       china |   .0687228   .0498103     1.38   0.173    -.0311407    .1685864
      fdirel |  -.0194871   .0418807    -0.47   0.644    -.1034529    .0644786
     hcstock |   .0531121   .0476449     1.11   0.270    -.0424102    .1486343
     hcinput |  -.0593672   .0515716    -1.15   0.255    -.1627619    .0440275
   secondary |  -.1226703   .0572398    -2.14   0.037    -.2374293   -.0079113
    tertiary |  -.0543681   .0380699    -1.43   0.159    -.1306937    .0219575
     sectert |  -.0293673   .0371341    -0.79   0.432    -.1038167    .0450821
     avgyred |   -.113034   .0622294    -1.82   0.075    -.2377964    .0117284
     labcost |   -.116887   .0413537    -2.83   0.007    -.1997962   -.0339777
     labprod |   .0954643   .0416386     2.29   0.026      .011984    .1789447
 endogeneity |   -.052746   .0524212    -1.01   0.319    -.1578442    .0523521
     lnpubyr |   .2751165   .4263913     0.65   0.522    -.5797465     1.12998
  lnmedianyr |   .8931452   .3377408     2.64   0.011     .2160157    1.570275
    lnperiod |  -.3483453   .2322207    -1.50   0.139    -.8139198    .1172293
    lntnoexp |  -.3838825   .4075914    -0.94   0.350    -1.201054    .4332892
   published |  -.0728445   .0375287    -1.94   0.057     -.148085    .0023961
       _cons |  -1.573993   2.126415    -0.74   0.462    -5.837199    2.689213
------------------------------------------------------------------------------

. test developed=fdirel=0

 ( 1)  developed - fdirel = 0
 ( 2)  developed = 0

       F(  2,    54) =    0.18
            Prob > F =    0.8345

. *drop
.
```

```
. regress tstat invsepcc dynamic qualdv timeseries mixed transition china hcstock hcinput
secondary tertiary sect
> ert avgyred labcost labprod endogeneity lnpubyr lnmedianyr lnperiod lntnoexp
published[pweight = weight], vce(cl
> uster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 21,    54) =   21.39
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3764
                                                       Root MSE      =  2.0433

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .1351214    .081142     1.67   0.102    -.0275586    .2978013
     dynamic |   .0738996   .0367192     2.01   0.049      .000282    .1475172
      qualdv |  -.0343522   .0362018    -0.95   0.347    -.1069325    .0382281
  timeseries |   .1989821   .2709733     0.73   0.466    -.3442867    .7422509
       mixed |   .0973706   .0582319     1.67   0.100    -.0193774    .2141186
  transition |  -.1159383   .0468613    -2.47   0.017    -.2098895   -.0219871
       china |   .0658125   .0386481     1.70   0.094    -.0116723    .1432972
     hcstock |   .0476042   .0453359     1.05   0.298    -.0432888    .1384971
     hcinput |  -.0559966   .0514875    -1.09   0.282    -.1592229    .0472296
   secondary |   -.127655   .0557704    -2.29   0.026    -.2394679   -.0158421
    tertiary |  -.0513456   .0375122    -1.37   0.177    -.1265531    .0238619
     sectert |    -.02702   .0381287    -0.71   0.482    -.1034633    .0494233
     avgyred |  -.0973897   .0541737    -1.80   0.078    -.2060014     .011222
     labcost |  -.1119337   .0396787    -2.82   0.007    -.1914846   -.0323827
     labprod |   .1082472   .0355361     3.05   0.004     .0370016    .1794928
 endogeneity |  -.0469758   .0497553    -0.94   0.349    -.1467292    .0527776
     lnpubyr |   .2365647   .4230445     0.56   0.578    -.6115885    1.084718
  lnmedianyr |   .9839192   .3121545     3.15   0.003     .3580872    1.609751
    lnperiod |  -.3269056    .216472    -1.51   0.137    -.7609059    .1070946
    lntnoexp |  -.3699038   .4119247    -0.90   0.373    -1.195763    .4559555
   published |  -.0693669    .036779    -1.89   0.065    -.1431044    .0043707
       _cons |  -1.851455   2.139526    -0.87   0.391    -6.140945    2.438036
------------------------------------------------------------------------------

. test lnpubyr=timeseries=0

 ( 1)  - timeseries + lnpubyr = 0
 ( 2)  lnpubyr = 0

       F(  2,    54) =    0.47
            Prob > F =    0.6245

. *drop
.
```

```
. regress tstat invsepcc dynamic qualdv mixed transition china hcstock hcinput  secondary
tertiary sectert avgyred
>  labcost labprod endogeneity  lnmedianyr lnperiod lntnoexp published[pweight = weight],
vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 19,    54) =   25.63
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3687
                                                       Root MSE      =  2.0493

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .1364476   .0820727     1.66   0.102    -.0280983    .3009936
     dynamic |   .0657264   .0398886     1.65   0.105    -.0142455    .1456982
      qualdv |  -.0350106   .0338011    -1.04   0.305    -.1027778    .0327566
       mixed |   .0997246    .060265     1.65   0.104    -.0210995    .2205487
  transition |  -.1074779   .0453495    -2.37   0.021    -.1983982   -.0165575
       china |   .0688293   .0379048     1.82   0.075    -.0071652    .1448238
     hcstock |    .048911   .0453869     1.08   0.286    -.0420843    .1399063
     hcinput |  -.0507865   .0600646    -0.85   0.402    -.1712088    .0696358
   secondary |  -.1299933   .0553888    -2.35   0.023    -.2410411   -.0189454
    tertiary |  -.0510921   .0376769    -1.36   0.181    -.1266297    .0244455
     sectert |  -.0259614    .037101    -0.70   0.487    -.1003445    .0484217
      avgyred |  -.0945595   .0548767    -1.72   0.091    -.2045806    .0154616
     labcost |   -.116154   .0400159    -2.90   0.005    -.1963811   -.0359268
     labprod |   .1015916   .0319196     3.18   0.002     .0375966    .1655866
 endogeneity |  -.0421202   .0508901    -0.83   0.411    -.1441487    .0599083
  lnmedianyr |   .9002566   .3375269     2.67   0.010     .2235558    1.576957
    lnperiod |  -.2340325    .222707    -1.05   0.298    -.6805331    .2124681
    lntnoexp |  -.3662773   .3993773    -0.92   0.363    -1.166981    .4344259
   published |  -.0653665   .0372577    -1.75   0.085    -.1400638    .0093307
       _cons |  -.6671542   1.720411    -0.39   0.700    -4.116371    2.782062
------------------------------------------------------------------------------

. test endogeneity=hcinput=0

 ( 1)  - hcinput + endogeneity = 0
 ( 2)  endogeneity = 0

       F(  2,    54) =    0.73
            Prob > F =    0.4853

. *drop
.
```

```
. regress tstat invsepcc dynamic qualdv mixed transition china hcstock  secondary tertiary
sectert avgyred labcost
>  labprod  lnmedianyr lnperiod lntnoexp published[pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 17,    54) =   19.88
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3575
                                                       Root MSE      =  2.0609

                                 (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .0950867   .0711625     1.34   0.187    -.0475855    .2377589
     dynamic |   .0554318   .0369301     1.50   0.139    -.0186085    .1294722
      qualdv |  -.0185974   .0239687    -0.78   0.441    -.0666517    .0294569
       mixed |   .1038222   .0522858     1.99   0.052    -.0010045    .2086489
  transition |   -.079651   .0414857    -1.92   0.060    -.1628247    .0035228
       china |   .0699294   .0374916     1.87   0.068    -.0052367    .1450956
     hcstock |   .0529456   .0359559     1.47   0.147    -.0191417    .1250329
   secondary |  -.1390807   .0625101    -2.22   0.030    -.2644059   -.0137555
    tertiary |  -.0467081   .0392329    -1.19   0.239    -.1253653    .0319491
     sectert |  -.0290207   .0404334    -0.72   0.476    -.1100848    .0520434
     avgyred |  -.1046169   .0614913    -1.70   0.095    -.2278995    .0186657
     labcost |  -.1072095   .0358078    -2.99   0.004    -.1789998   -.0354191
     labprod |   .0916028   .0302899     3.02   0.004     .0308753    .1523304
  lnmedianyr |   .8759674   .3291901     2.66   0.010      .215981    1.535954
    lnperiod |  -.1710445   .2250857    -0.76   0.451    -.6223142    .2802252
    lntnoexp |  -.3950188   .4083242    -0.97   0.338     -1.21366    .4236218
   published |  -.0601837   .0372814    -1.61   0.112    -.1349283    .0145609
       _cons |  -.5025598   1.635373    -0.31   0.760    -3.781286    2.776166
------------------------------------------------------------------------------

. test sectert=lnperiod=0

 ( 1)  sectert - lnperiod = 0
 ( 2)  sectert = 0

       F(  2,    54) =    0.65
            Prob > F =    0.5276

. *drop
.
```

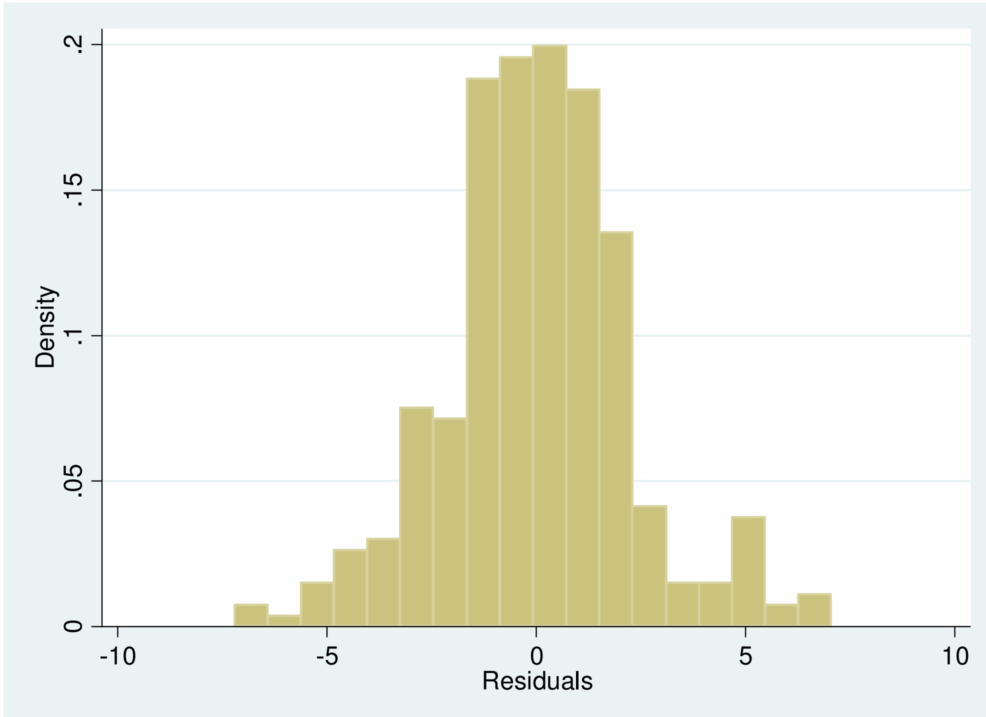
```
. regress tstat invsepcc dynamic qualdv mixed transition china hcstock  secondary tertiary
avgyred labcost labprod
>   lnmedianyr  lntnoexp published[pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 15,    54) =   19.62
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3505
                                                       Root MSE      =  2.0657

                                 (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .0631281   .0676104     0.93   0.355    -.0724226    .1986788
     dynamic |   .0512156   .0346013     1.48   0.145    -.0181558    .1205871
      qualdv |  -.0089414   .0221887    -0.40   0.689    -.0534271    .0355442
       mixed |    .098465   .0442419     2.23   0.030     .0097653    .1871647
  transition |  -.0917751   .0375842    -2.44   0.018    -.1671268   -.0164233
       china |   .0573115   .0316608     1.81   0.076    -.0061645    .1207874
     hcstock |   .0514491   .0370359     1.39   0.170    -.0228034    .1257015
   secondary |  -.1231097   .0502565    -2.45   0.018    -.2238679   -.0223515
    tertiary |  -.0301877   .0250203    -1.21   0.233    -.0803505    .0199751
     avgyred |  -.0841859   .0595683    -1.41   0.163    -.2036131    .0352413
     labcost |  -.1048476    .036155    -2.90   0.005    -.1773339   -.0323612
     labprod |    .092567   .0311243     2.97   0.004     .0301666    .1549674
  lnmedianyr |   .8952305   .3146477     2.85   0.006     .2643999    1.526061
    lntnoexp |  -.3905211   .3660201    -1.07   0.291    -1.124347     .343305
   published |  -.0574519   .0375567    -1.53   0.132    -.1327485    .0178448
       _cons |  -1.139737   1.876688    -0.61   0.546    -4.902269    2.622796
------------------------------------------------------------------------------

. test qualdv=lntnoexp=0

 ( 1)  qualdv - lntnoexp = 0
 ( 2)  qualdv = 0

       F(  2,    54) =    0.59
            Prob > F =    0.5568

. *drop
.
```

```
. regress tstat invsepcc dynamic mixed transition china hcstock  secondary tertiary avgyred
labcost labprod  lnmed
> ianyr  published[pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 13,    54) =   16.55
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3443
                                                       Root MSE      =   2.069

                                 (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .0158606    .045626     0.35   0.729     -.075614    .1073352
     dynamic |   .0554106   .0342959     1.62   0.112    -.0133484    .1241697
       mixed |   .1032192   .0461793     2.24   0.030     .0106352    .1958031
  transition |   -.098037    .039346    -2.49   0.016    -.1769211   -.0191529
       china |   .0619786   .0331083     1.87   0.067    -.0043995    .1283567
     hcstock |   .0394269   .0341541     1.15   0.253     -.029048    .1079018
   secondary |  -.1233779   .0522618    -2.36   0.022    -.2281565   -.0185993
    tertiary |  -.0224771   .0227184    -0.99   0.327    -.0680247    .0230706
     avgyred |  -.0706794   .0551799    -1.28   0.206    -.1813084    .0399497
     labcost |   -.102212   .0352625    -2.90   0.005    -.1729091   -.0315149
     labprod |   .0958277   .0307249     3.12   0.003     .0342279    .1574275
  lnmedianyr |   .8716855   .3133429     2.78   0.007     .2434709      1.4999
   published |  -.0442774    .037605    -1.18   0.244    -.1196709    .0311161
       _cons |   -2.37849   1.474975    -1.61   0.113    -5.335636    .5786567
------------------------------------------------------------------------------

. *final parsimonious model
```

Appendix 3.6: Parsimonious multivariate MRA (Model 3.3) results and diagnostics

```
. do "C:\Users\popli\Desktop\PhD final pieces\ch 3 final reported revisions 26apr12\viva 5
final multivariate MRA
> minus52.do"

. **Final parsimonious model, sample excluding Kang and Lee (2007)
. regress tstat invsepcc dynamic mixed transition china hcstock  secondary tertiary avgyred
labcost labprod  lnmed
> ianyr  published[pweight = weight], vce(cluster study)
(sum of wgt is   5.5000e+01)

Linear regression                                      Number of obs =     335
                                                       F( 13,    54) =   16.55
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.3443
                                                       Root MSE      =   2.069

                                  (Std. Err. adjusted for 55 clusters in study)
------------------------------------------------------------------------------
             |               Robust
       tstat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    invsepcc |   .0158606    .045626     0.35   0.729     -.075614    .1073352
     dynamic |   .0554106   .0342959     1.62   0.112    -.0133484    .1241697
       mixed |   .1032192   .0461793     2.24   0.030     .0106352    .1958031
  transition |   -.098037    .039346    -2.49   0.016    -.1769211   -.0191529
       china |   .0619786   .0331083     1.87   0.067    -.0043995    .1283567
     hcstock |   .0394269   .0341541     1.15   0.253     -.029048    .1079018
   secondary |  -.1233779   .0522618    -2.36   0.022    -.2281565   -.0185993
    tertiary |  -.0224771   .0227184    -0.99   0.327    -.0680247    .0230706
     avgyred |  -.0706794   .0551799    -1.28   0.206    -.1813084    .0399497
     labcost |   -.102212   .0352625    -2.90   0.005    -.1729091   -.0315149
     labprod |   .0958277   .0307249     3.12   0.003     .0342279    .1574275
 lnmedianyr |   .8716855   .3133429     2.78   0.007     .2434709      1.4999
   published |  -.0442774    .037605    -1.18   0.244    -.1196709    .0311161
       _cons |   -2.37849   1.474975    -1.61   0.113    -5.335636    .5786567
------------------------------------------------------------------------------

.
. **Linearity test
. estat ovtest

Ramsey RESET test using powers of the fitted values of tstat
       Ho:  model has no omitted variables
                 F(3, 318) =      3.41
                  Prob > F =      0.0179

. *linearity can be rejected at 5% significance level but not at the 1%.
.
. **Investigating normality
. qui regress tstat invsepcc dynamic mixed transition china hcstock  secondary tertiary
avgyred labcost labprod  l
> nmedianyr  published

. estat imtest

Cameron & Trivedi's decomposition of IM-test

---------------------------------------------------
              Source |       chi2     df      p
---------------------+-----------------------------
  Heteroskedasticity |     198.58     82    0.0000
            Skewness |      54.22     13    0.0000
            Kurtosis |      12.32      1    0.0004
---------------------+-----------------------------
               Total |     265.12     96    0.0000
---------------------------------------------------

. *normality problem
. predict resid2, res
```

```
. histogram resid2
(bin=18, start=-7.2053146, width=.79268736)
```




```
. *bell-shaped
.
. **Multicollinearity check
. qui regress tstat invsepcc dynamic mixed transition china hcstock  secondary tertiary
avgyred labcost labprod  l
> nmedianyr  published [pweight = weight], vce(cluster study)

. estat vif

    Variable |       VIF       1/VIF  
-------------+----------------------
    invsepcc |     24.30    0.041146
       mixed |     12.99    0.076975
     labcost |      9.84    0.101595
   published |      9.42    0.106122
    tertiary |      7.83    0.127752
       china |      2.70    0.370059
     hcstock |      2.41    0.414391
  lnmedianyr |      2.25    0.444760
     avgyred |      2.12    0.470621
     labprod |      1.49    0.670293
   secondary |      1.41    0.709513
  transition |      1.32    0.759418
     dynamic |      1.28    0.780215
-------------+----------------------
    Mean VIF |      6.11

. *multicillinearity significantly reduced
```

Appendix 5

Contents

Appendix 5.1: Descriptive statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
fdiflow	overall	3217.308	7549.187	9.49	71484.99	N = 193
	between		4040.673	238.0998	14038.79	n = 14
	within		6451.402	-8684.083	60663.51	T-bar = 13.7857
fdistock	overall	18978.49	35450.15	86.58867	251951.6	N = 194
	between		22709.32	830.7806	65544.95	n = 14
	within		27804.99	-38126.87	205385.1	T-bar = 13.8571
primedu	overall	91.84012	6.694157	72.5	99.8	N = 168
	between		6.63157	77.12	98.88714	n = 12
	within		2.063354	87.21154	96.16012	T = 14
secedu	overall	45.50548	15.62276	22	80.7	N = 168
	between		15.64613	22.68429	68.08286	n = 12
	within		4.280841	32.22262	58.12262	T = 14
tertedu	overall	7.353095	3.173817	3.3	15.2	N = 168
	between		3.130256	3.471428	13.7	n = 12
	within		1.018513	4.553095	11.17738	T = 14
genvoc~o	overall	0.4394899	0.4419921	0.1466837	1.780488	N = 196
	between		0.4575053	0.1466837	1.780488	n = 14
	within		0	0.4394899	0.4394899	T = 14
cognit~e	overall	4.75875	0.3990634	3.785	5.192	N = 168
	between		0.4155658	3.785	5.192	n = 12
	within		0	4.75875	4.75875	T = 14
top	overall	0.0701667	0.0352971	0.013	0.122	N = 168
	between		0.0367568	0.013	0.122	n = 12
	within		0	0.0701667	0.0701667	T = 14
vacancy	overall	3.893044	1.362624	1.68085	7.23077	N = 56
	between		1.277325	2.07614	5.463493	n = 14
	within		0.5605182	2.023689	5.762399	T = 4
transi~n	overall	3.226143	0.4962871	1.111111	3.962222	N = 193
	between		0.4319198	2.182619	3.816508	n = 14
	within		0.2681852	2.154635	3.821301	T-bar = 13.7857
tradef~e	overall	73.04396	9.87613	46.8	87.8	N = 182
	between		5.907103	62	82.58571	n = 14
	within		8.02428	49.85934	94.21538	T-bar = 13

econfree	overall	57.88642	9.169961	24.42891	77.00185	N = 182
	between		8.099609	39.65407	72.5352	n = 14
	within		4.924805	42.29225	71.63622	T-bar = 13
ictinfra	overall	77.19616	52.2034	1.34503	249.1646	N = 196
	between		22.51218	35.22544	109.7186	n = 14
	within		47.45717	-1.754916	216.6421	T = 14
gdp	overall	4.89E+10	7.23E+10	1.87E+09	5.28E+11	N = 196
	between		6.36E+10	5.02E+09	2.44E+11	n = 14
	within		3.82E+10	-5.65E+10	3.33E+11	T = 14
primex~t	overall	0.1169967	0.0682481	0.0277404	0.3343436	N = 196
	between		0.058766	0.0464846	0.2150174	n = 14
	within		0.037876	-0.0043659	0.2389431	T = 14
forbank	overall	0.5317708	0.2209783	0	1	N = 192
	between		0.1485024	0.2535714	0.7792857	n = 14
	within		0.166837	0.0303423	0.9224851	T-bar = 13.7143
wage	overall	489.474	353.8258	60.8529	2038.203	N = 188
	between		247.6512	149.9469	1070.345	n = 14
	within		256.326	-82.96173	1457.333	T-bar = 13.4286
gini	overall	0.3263255	0.0424144	0.243	0.406	N = 106
	between		0.0393852	0.267	0.377	n = 10
	within		0.0210108	0.2445398	0.3770398	T = 10.6
privat~n	overall	0.4081633	0.4927523	0	1	N = 196
	between		0.1846303	0.2142857	0.7857143	n = 14
	within		0.4593354	-0.377551	1.193878	T = 14
instab~y	overall	0.0255102	0.1580725	0	1	N = 196
	between		0.0663416	0	0.2142857	n = 14
	within		0.1444961	-0.1887755	0.8826531	T = 14

Appendix 5.2: Between-to-within ratios

Variable		Mean	Std. Dev.	Between-to-within ratio*
lnprim~u	overall	4.517257	0.0760378	3.25
	between		0.0754002	
	within		0.0232191	
lnsecedu	overall	3.757556	0.3524169	4.42
	between		0.3572097	
	within		0.080819	
lntert~u	overall	1.904314	0.4283678	3.63
	between		0.4288173	
	within		0.1180212	
lngenv~o	overall	-1.160987	0.760616	Time-invariant
	between		0.7873124	
	within		0	
lncogn~e	overall	1.556188	0.0892752	Time-invariant
	between		0.092967	
	within		0	
lntop	overall	-2.83484	0.6635057	Time-invariant
	between		0.6909435	
	within		0	
lnvaca~y	overall	1.295273	0.3678036	2.50
	between		0.3499025	
	within		0.1397346	
lntran~n	overall	1.156979	0.1799261	1.47
	between		0.1521118	
	within		0.1034439	
lntrad~e	overall	4.281385	0.1418565	0.74
	between		0.0848653	
	within		0.1153051	
lnecon~e	overall	4.044214	0.1767746	1.54
	between		0.1546549	
	within		0.1001181	
lnicti~a	overall	4.038468	0.9081815	0.63
	between		0.4868857	
	within		0.7768782	

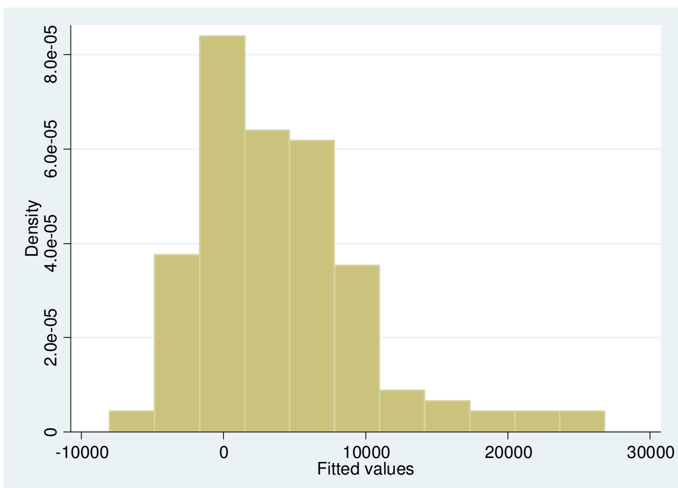
lngdp	overall	23.86489	1.234269	2.37
	between		1.170495	
	within		0.4946693	
lnprim~t	overall	-2.305377	0.5699126	1.72
	between		0.5057387	
	within		0.2933943	
lnforb~k	overall	-0.755124	0.6050269	0.75
	between		0.3673489	
	within		0.4867113	
lnwage	overall	5.941384	0.7370654	1.21
	between		0.5736379	
	within		0.4723268	
lngini	overall	-1.128338	0.1313726	1.89
	between		0.1219636	
	within		0.0644616	
lnedutr1	overall	-1.089152	0.1438554	Time-invariant
	between		0.1489045	
	within		0	
lnedutr2	overall	-1.690939	0.3105992	0.46
	between		0.1304231	
	within		0.2838955	
privat~n	overall	0.4081633	0.4927523	0.40
	between		0.1846303	
	within		0.4593354	
instab~y	overall	0.0255102	0.1580725	0.46
	between		0.0663416	
	within		0.1444961	

*Ratio calculated by dividing between S.D. of the variable by its within S.D

Appendix 5.3: Diagnostic tests and raw correlations

```
------------------------------------------------------------------------------------------
--------------------
. **full model 5.1, in levels
. xtreg fdiflow secedu tertedu wage l1wage l2wage gdp l1gdp l2gdp  transition tradefree
econfree ictinfra primexpo
> rt l1primexport l2primexport forbank privatisation instability d2008 d2007 d2006 d2005 d2004
d2003 d2002 d2001 d
> 2000 d1999 d1998 d1997 d1996 d1995, fe
note: d2008 omitted because of collinearity
note: d1996 omitted because of collinearity
note: d1995 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       143
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.4612                         Obs per group: min =        11
       between = 0.1098                                        avg =      11.9
       overall = 0.1302                                        max =        12

                                                F(29,102)          =      3.01
corr(u_i, Xb)  = -0.8857                        Prob > F           =    0.0000

------------------------------------------------------------------------------
     fdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      secedu |   643.9913   366.2689     1.76   0.082    -82.50134    1370.484
     tertedu |   111.3773   1033.206     0.11   0.914    -1937.981    2160.736
        wage |   12.94399   21.80005     0.59   0.554    -30.29631    56.18428
      l1wage |   -43.1405   36.72932    -1.17   0.243    -115.9929    29.71193
      l2wage |   14.95244   24.14391     0.62   0.537    -32.93688    62.84176
         gdp |  -3.62e-07   1.48e-07    -2.45   0.016    -6.55e-07   -6.93e-08
       l1gdp |   7.19e-08   2.26e-07     0.32   0.751    -3.77e-07    5.20e-07
       l2gdp |   6.93e-07   1.99e-07     3.49   0.001     2.99e-07    1.09e-06
  transition |   -39131.9   12394.22    -3.16   0.002    -63715.78   -14548.01
   tradefree |  -78.23926   113.6188    -0.69   0.493    -303.6016    147.1231
    econfree |   217.0831   236.8552     0.92   0.362    -252.7181    686.8842
    ictinfra |  -11.89955   54.00112    -0.22   0.826    -119.0105    95.21142
  primexport |   16567.55   28082.53     0.59   0.557    -39134.01    72269.12
l1primexport |   1058.366    31609.2     0.03   0.973    -61638.33    63755.06
l2primexport |   14143.96   32810.09     0.43   0.667    -50934.69    79222.62
     forbank |  -2254.634   7402.109    -0.30   0.761    -16936.68    12427.41
privatisat~n |  -687.6849    1354.29    -0.51   0.613    -3373.914    1998.544
 instability |  -1641.946   5963.029    -0.28   0.784    -13469.59    10185.69
       d2008 |  (omitted)
       d2007 |   -1424.24   3828.139    -0.37   0.711    -9017.336    6168.857
       d2006 |  -8120.683   4654.311    -1.74   0.084    -17352.49    1111.121
       d2005 |  -6744.756   5811.406    -1.16   0.249    -18271.65     4782.14
       d2004 |  -7145.187    6899.48    -1.04   0.303    -20830.27    6539.899
       d2003 |  -12845.82   8079.754    -1.59   0.115    -28871.98     3180.33
       d2002 |  -13701.33   8922.475    -1.54   0.128    -31399.01    3996.361
       d2001 |  -17626.69   9641.028    -1.83   0.070    -36749.62    1496.243
       d2000 |  -19584.02   10403.27    -1.88   0.063    -40218.85    1050.812
       d1999 |  -20918.63   11426.23    -1.83   0.070    -43582.51    1745.252
       d1998 |  -23700.48   11992.49    -1.98   0.051    -47487.53    86.57441
       d1997 |  -25965.11   12637.75    -2.05   0.042    -51032.02   -898.2038
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   105144.1   47198.76     2.23   0.028     11525.63    198762.7
-------------+----------------------------------------------------------------
     sigma_u |  13340.737
     sigma_e |  6324.4792
         rho |  .81649655   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(11, 102) =     2.99             Prob > F = 0.0018

. pantest2 year


Test for serial correlation in residuals
Null hypothesis is either that rho=0 if residuals are AR(1)
or that lamda=0 if residuals are MA(1)
Following tests only approximate for unbalanced panels
LM= 26.218339
which is asy. distributed as chisq(1) under null, so:
```

```
Probability of value greater than LM is 3.049e-07
LM5= 5.1203847
which is asy. distributed as N(0,1) under null, so:
Probability of value greater than abs(LM5) is 1.525e-07


Test for significance of fixed effects
F= 2.9872844
Probability>F= .00176597


Test for normality of residuals

                    Skewness/Kurtosis tests for Normality
                                                         ------- joint ------
    Variable |    Obs   Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)    Prob>chi2
-------------+---------------------------------------------------------------
    __00000B |    143      0.0000         0.0000            .         0.0000


. predict residlev
(option xb assumed; fitted values)
(53 missing values generated)

. histogram residlev
(bin=11, start=-8018.5571, width=3168.8532)
```




```
. *there is a normality problem, therefore fdiflow is transformed
.
```

```
. corr lnfdiflow lnfdistock lntransition lntradefree lneconfree  lnictinfra lngdp lnl1gdp lnl2gdp lnprimexport l1l
> nprimexport l2lnprimexport lnforbank lnl1forbank lnl2forbank lnwage  l1lnwage l2lnwage lnprimedu lnsecedu lntert
> edu lngenvocratio lnedutr1 lnedutr2 lnvacancy lncognitive lntop
(obs=44)
```

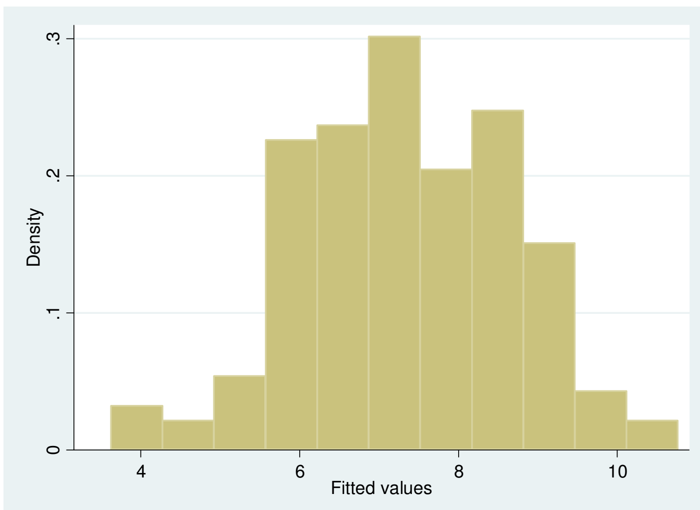
	lnfdif~w	lnfdis~k	lntran~n	lntrad~e	lnecon~e	lnicti~a	lngdp	lnl1gdp	lnl2gdp	lnprim~t	l1lnpr~t
lnfdiflow	1.0000										
lnfdistock	0.8816	1.0000									
lntransition	0.5064	0.6909	1.0000								
lntradefree	0.0755	0.2607	0.6917	1.0000							
lneconfree	-0.1476	-0.0057	0.6054	0.6484	1.0000						
lnictinfra	0.3820	0.5073	0.7736	0.5031	0.5589	1.0000					
lngdp	0.8455	0.9326	0.4835	0.0613	-0.2342	0.3193	1.0000				
lnl1gdp	0.8420	0.9263	0.4848	0.0719	-0.2301	0.3196	0.9983	1.0000			
lnl2gdp	0.8334	0.9163	0.4776	0.0717	-0.2414	0.2985	0.9951	0.9978	1.0000		
lnprimexport	-0.0557	-0.1626	-0.2113	0.0753	-0.0618	-0.1455	-0.1659	-0.1652	-0.1745	1.0000	
l1lnprimex~t	-0.0320	-0.1060	-0.1615	0.0775	-0.0734	-0.1600	-0.1040	-0.1042	-0.1033	0.9496	1.0000
l2lnprimex~t	-0.0540	-0.1016	-0.1388	0.0825	-0.0759	-0.2233	-0.1151	-0.1183	-0.1116	0.8965	0.9485
lnforbank	0.3564	0.2067	-0.1141	-0.1873	-0.1579	-0.3981	0.2332	0.2269	0.2174	0.0065	0.0189
lnl1forbank	0.3171	0.1922	-0.1294	-0.2209	-0.1511	-0.4084	0.2094	0.1992	0.1877	0.0306	0.0295
lnl2forbank	0.2944	0.1523	-0.1244	-0.2012	-0.1196	-0.4151	0.1559	0.1479	0.1344	0.0372	0.0260
lnwage	0.3256	0.5200	0.6643	0.3730	0.3261	0.7890	0.4834	0.4893	0.4806	-0.4391	-0.4281
l1lnwage	0.3249	0.5112	0.6611	0.3902	0.3270	0.7792	0.4829	0.4941	0.4863	-0.4133	-0.4073
l2lnwage	0.3181	0.5019	0.6616	0.4028	0.3167	0.7556	0.4826	0.4961	0.4948	-0.4071	-0.3855
lnprimedu	0.0565	0.1268	0.5307	0.5261	0.7438	0.2583	-0.0206	-0.0174	-0.0266	-0.1678	-0.1894
lnsecedu	-0.0180	0.0928	0.3905	0.4686	0.5500	0.3919	-0.1762	-0.1901	-0.2092	-0.0125	-0.0155
lntertedu	0.0076	0.1611	0.6562	0.6207	0.6386	0.5558	-0.1029	-0.1028	-0.1091	0.2247	0.2251
lngenvocra~o	-0.3367	-0.3290	0.2174	0.4523	0.7244	0.1145	-0.5435	-0.5439	-0.5503	0.3692	0.3417
lnedutr1	-0.5610	-0.6945	-0.5936	-0.2072	-0.0049	-0.6800	-0.6005	-0.5998	-0.6020	0.2150	0.1323
lnedutr2	-0.1639	-0.2750	-0.1743	-0.0144	0.1714	-0.0822	-0.2140	-0.2092	-0.2412	0.2615	0.1145
lnvacancy	-0.2293	-0.0336	0.4217	0.4742	0.5291	0.4411	-0.1589	-0.1569	-0.1525	-0.1803	-0.1555
lncognitive	0.4711	0.6453	0.8675	0.5852	0.4476	0.7907	0.4292	0.4286	0.4300	-0.1487	-0.0635
lntop	0.6964	0.7805	0.7879	0.3730	0.2474	0.6231	0.6146	0.6144	0.6167	-0.2751	-0.1843

	l2lnpr~t	lnforb~k	lnl1fo~k	lnl2fo~k	lnwage	l1lnwage	l2lnwage	lnprim~u	lnsecedu	lntert~u	lngenv~o
l2lnprimex~t	1.0000										
lnforbank	0.0367	1.0000									
lnl1forbank	0.0462	0.9681	1.0000								
lnl2forbank	0.0333	0.9276	0.9632	1.0000							
lnwage	-0.4682	-0.4365	-0.4846	-0.5318	1.0000						
l1lnwage	-0.4529	-0.4357	-0.4882	-0.5322	0.9949	1.0000					
l2lnwage	-0.4262	-0.4541	-0.5098	-0.5551	0.9857	0.9941	1.0000				
lnprimedu	-0.1973	0.3158	0.3445	0.3980	0.0569	0.0665	0.0592	1.0000			
lnsecedu	0.0018	-0.0163	0.0224	0.0622	0.0266	0.0010	-0.0258	0.4399	1.0000		
lntertedu	0.2480	-0.3196	-0.2955	-0.2551	0.2111	0.2119	0.2134	0.4066	0.4175	1.0000	
lngenvocra~o	0.3528	0.0542	0.0683	0.1072	-0.2588	-0.2513	-0.2513	0.6008	0.4152	0.6974	1.0000
lnedutr1	0.0987	0.3448	0.3607	0.3899	-0.6075	-0.5932	-0.5964	0.1894	-0.1721	-0.2854	0.3773
lnedutr2	-0.0324	0.2450	0.2712	0.2852	-0.0843	-0.0592	-0.0937	0.3188	-0.1555	-0.1154	0.2893
lnvacancy	-0.1514	-0.6337	-0.6445	-0.6403	0.5299	0.5222	0.5321	0.0876	0.3595	0.3017	0.1181
lncognitive	-0.0081	-0.3248	-0.3565	-0.3816	0.6669	0.6564	0.6665	0.1577	0.3571	0.5976	0.0600
lntop	-0.1205	0.0287	-0.0098	-0.0478	0.5404	0.5327	0.5397	0.1829	0.1419	0.3543	-0.1143

	lnedutr1	lnedutr2	lnvaca~y	lncogn~e	lntop
lnedutr1	1.0000				
lnedutr2	0.6700	1.0000			
lnvacancy	-0.2257	-0.1793	1.0000		
lncognitive	-0.8159	-0.4836	0.5005	1.0000	
lntop	-0.7781	-0.4538	0.1807	0.8817	1.0000

```
. **full model 5.1, log-log
. xtreg lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree lnec
> onfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007 d20
> 06 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe robust
note: d1997 omitted because of collinearity
note: d1996 omitted because of collinearity
note: d1995 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       143
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.7717                         Obs per group: min =        11
       between = 0.5551                                        avg =      11.9
       overall = 0.0494                                        max =        12

                                                F(11,11)           =         .
corr(u_i, Xb)  = -0.3698                        Prob > F           =         .

                                (Std. Err. adjusted for 12 clusters in country)
------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.4633169   2.128209    -0.22   0.832    -5.147474     4.22084
   lntertedu |  -.7689391   1.211899    -0.63   0.539     -3.43631    1.898432
      lnwage |   .0142601   1.544155     0.01   0.993    -3.384401    3.412921
    l1lnwage |   .5475273   .5299172     1.03   0.324    -.6188127    1.713867
    l2lnwage |  -.3932786   .9403425    -0.42   0.684    -2.462958    1.676401
       lngdp |   .3805829   1.836163     0.21   0.840    -3.660785    4.421951
     l1lngdp |  -.5564767   1.379886    -0.40   0.694    -3.593586    2.480632
     l2lngdp |   -.229746   1.448211    -0.16   0.877    -3.417238    2.957746
lntransition |    1.55692   3.053853     0.51   0.620    -5.164565    8.278404
 lntradefree |  -.4707713   .6344151    -0.74   0.474    -1.867109    .9255669
  lneconfree |   1.155114   1.523858     0.76   0.464    -2.198876    4.509104
  lnictinfra |  -.0536539   .3963855    -0.14   0.895    -.9260924    .8187846
lnprimexport |   .2395144   .2997981     0.80   0.441    -.4203367    .8993655
l1lnprimex~t |   .0042075    .318612     0.01   0.990    -.6970527    .7054677
l2lnprimex~t |  -.1572141   .3176584    -0.49   0.630    -.8563755    .5419472
   lnforbank |   .2231828   .2380808     0.94   0.369    -.3008294    .7471951
privatisat~n |   .4472416   .1284495     3.48   0.005     .1645261    .7299571
 instability |  -.6138362   .7838364    -0.78   0.450    -2.339049    1.111376
       d2008 |   2.118311   1.824904     1.16   0.270    -1.898275    6.134898
       d2007 |   2.124796   1.675585     1.27   0.231    -1.563142    5.812734
       d2006 |   1.554211   1.375633     1.13   0.283    -1.473536    4.581959
       d2005 |   1.146123   1.296192     0.88   0.395    -1.706776    3.999023
       d2004 |   .6854929   1.064224     0.64   0.533    -1.656849    3.027835
       d2003 |    .323199   .7889698     0.41   0.690    -1.413312     2.05971
       d2002 |   .4044573   .7250545     0.56   0.588    -1.191377    2.000291
       d2001 |   .2401294   .5693881     0.42   0.681    -1.013085    1.493344
       d2000 |   .0186956   .3719085     0.05   0.961    -.7998694    .8372605
       d1999 |  -.0507387    .302621    -0.17   0.870     -.716803    .6153256
       d1998 |   .1567807   .2256905     0.69   0.502    -.3399609    .6535222
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   14.24458   36.72955     0.39   0.706    -66.59662    95.08579
-------------+----------------------------------------------------------------
     sigma_u |  1.4985071
     sigma_e |   .4922461
         rho |  .90260337   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. pantest2 year


Test for serial correlation in residuals
Null hypothesis is either that rho=0 if residuals are AR(1)
or that lamda=0 if residuals are MA(1)
Following tests only approximate for unbalanced panels
LM= 12.164785
which is asy. distributed as chisq(1) under null, so:
Probability of value greater than LM is .000487
LM5= 3.4878051
which is asy. distributed as N(0,1) under null, so:
```

```
Probability of value greater than abs(LM5) is .0002435


Test for significance of fixed effects
F= 2.8622156
Probability>F= .00228797


Test for normality of residuals

                    Skewness/Kurtosis tests for Normality
                                                        ------- joint ------
    Variable |    Obs   Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)    Prob>chi2
-------------+---------------------------------------------------------------
    __00000B |    143      0.0561         0.1181         5.88         0.0529



. predict residln
(option xb assumed; fitted values)
(53 missing values generated)

. histogram residln
(bin=11, start=3.6209955, width=.6493669)
```




```
.
. **variance inflation factor (VIF)
. qui reg fdiflow secedu tertedu wage l1wage l2wage gdp l1gdp l2gdp  transition tradefree
econfree ictinfra primex
> port l1primexport l2primexport forbank privatisation instability d2008 d2007 d2006 d2005
d2004 d2003 d2002 d2001
>  d2000 d1999 d1998 d1997 d1996 d1995

. estat vif

    Variable |       VIF       1/VIF
-------------+----------------------
       l1gdp |    777.28    0.001287
      l1wage |    477.33    0.002095
         gdp |    288.21    0.003470
       l2gdp |    245.43    0.004074
        wage |    196.04    0.005101
      l2wage |    160.30    0.006238
    ictinfra |     16.87    0.059271
l1primexport |     12.87    0.077707
       d1997 |      9.50    0.105267
       d1998 |      9.31    0.107446
  primexport |      8.75    0.114298
       d1999 |      8.20    0.121886
l2primexport |      7.95    0.125832
       d2000 |      7.63    0.130998
       d2001 |      7.27    0.137618
  transition |      6.91    0.144673
       d2002 |      5.30    0.188619
```

```
       d2003 |      4.77    0.209444
       d2004 |      4.14    0.241686
       d2005 |      3.89    0.257060
       d2006 |      3.58    0.279662
    econfree |      3.54    0.282476
      secedu |      3.48    0.287106
       d2007 |      3.36    0.297843
     forbank |      3.06    0.326492
     tertedu |      2.95    0.338893
   tradefree |      2.86    0.349426
privatisat~n |      1.50    0.667569
 instability |      1.49    0.669974
-------------+----------------------
    Mean VIF |     78.75

. *there is high multicollinearity
.
. **cross-sectional dependence tests
. qui xtreg lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree
> lneconfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007
>  d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

. xtcsd, frees abs

  Frees' test of cross sectional independence =     0.313
|--------------------------------------------------------|
  Critical values from Frees' Q distribution
                    alpha = 0.10 :   0.2333
                    alpha = 0.05 :   0.3103
                    alpha = 0.01 :   0.4649

Average absolute value of the off-diagonal elements =     0.270

. xtcsd, pesaran abs

Pesaran's test of cross sectional independence =    -2.280, Pr = 0.0226

Average absolute value of the off-diagonal elements =     0.255

. *there is a cross-sectional dependence problem
.
. **heteroskedasticity test
. qui xtreg lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree
> lneconfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007
>  d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (12)  =      67.48
Prob>chi2 =      0.0000


. *there is a heteroskedasticity problem
.
. **serial correlation test
. xtserial lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree l
> neconfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007
> d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      11) =      9.463
           Prob > F =      0.0105

. *there is a serial correlation problem
```

```
. *therefore, Driscoll-Kraay SE's (robust to heteroskedasticity, serial correlation and cross-
sectional dependence
> )
.
. **Hausman test
. *FE estimation
. qui xtreg lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree
> lneconfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007
>  d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

. est store fe1i

. *RE estimation
. qui xtreg lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree
> lneconfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007
>  d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, re

. est store re1i

. *Conventional Hausman test
. hausman fe1i re1i

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe1i         re1i        Difference          S.E.
-------------+----------------------------------------------------------------
    lnsecedu |   -.4633169      .163096       -.6264129        1.826122
   lntertedu |   -.7689391    -.1598311        -.609108        .8236482
      lnwage |    .0142601     -1.34973         1.36399        .7247764
    l1lnwage |    .5475273     .3128669        .2346604               .
    l2lnwage |   -.3932786     .6015357       -.9948143        .3371823
       lngdp |    .3805829     1.347262       -.9666789        .5975451
     l1lngdp |   -.5564767     .4989155       -1.055392               .
     l2lngdp |    -.229746    -1.060782        .8310358        .3292609
lntransition |     1.55692     6.309532       -4.752613        2.601833
 lntradefree |   -.4707713    -.7577396        .2869683        .2981251
  lneconfree |    1.155114    -1.440415        2.595529         .788465
  lnictinfra |   -.0536539     .2619887       -.3156426        .2171724
lnprimexport |    .2395144      .350609       -.1110946        .0915035
l1lnprimex~t |    .0042075    -.0571217        .0613292               .
l2lnprimex~t |   -.1572141    -.3325908        .1753766        .1473407
   lnforbank |    .2231828     .4476344       -.2244516        .1584315
privatisat~n |    .4472416     .5381635       -.0909219         .012263
 instability |   -.6138362    -.0451347       -.5687016         .215062
       d2008 |    2.118311     .2455641        1.872747        1.083027
       d2007 |    2.124796     .3693831        1.755413        .9869644
       d2006 |    1.554211    -.1551574        1.709369        .8777765
       d2005 |    1.146123    -.4729852        1.619109        .7835802
       d2004 |    .6854929    -.6407246        1.326217        .6471892
       d2003 |     .323199    -.6209917        .9441907        .5293624
       d2002 |    .4044573    -.4120101        .8164674        .4321286
       d2001 |    .2401294    -.4360164        .6761458        .3613012
       d2000 |    .0186956    -.5976556        .6163512        .2701818
       d1999 |   -.0507387    -.3333133        .2825747        .1402556
       d1998 |    .1567807     .1148545        .0419262        .0430835
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                 chi2(29) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        7.97
                Prob>chi2 =      1.0000
                (V_b-V_B is not positive definite)

. *Panel-robust Hausman test (Wooldridge, 2002)
. hausman fe1i re1i, sigmamore

Note: the rank of the differenced variance matrix (11) does not equal the number of
coefficients being tested
        (29); be sure this is what you expect, or there may be problems computing the test.
Examine the output of
```

```
        your estimators for anything unexpected and possibly consider scaling your variables
so that the
        coefficients are on a similar scale.

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe1i         re1i        Difference          S.E.
-------------+----------------------------------------------------------------
    lnsecedu |   -.4633169      .163096       -.6264129        1.950793
   lntertedu |   -.7689391    -.1598311        -.609108        .8829069
      lnwage |    .0142601     -1.34973         1.36399        .8853712
    l1lnwage |    .5475273     .3128669        .2346604        .3345801
    l2lnwage |   -.3932786     .6015357       -.9948143        .5258773
       lngdp |    .3805829     1.347262       -.9666789        .8204679
     l1lngdp |   -.5564767     .4989155       -1.055392        .5518417
     l2lngdp |    -.229746    -1.060782        .8310358         .613776
lntransition |     1.55692     6.309532       -4.752613        2.847253
 lntradefree |   -.4707713    -.7577396        .2869683        .3708358
  lneconfree |    1.155114    -1.440415        2.595529        .8756891
  lnictinfra |   -.0536539     .2619887       -.3156426        .2522345
lnprimexport |    .2395144      .350609       -.1110946         .142992
l1lnprimex~t |    .0042075    -.0571217        .0613292        .0626374
l2lnprimex~t |   -.1572141    -.3325908        .1753766        .1887065
   lnforbank |    .2231828     .4476344       -.2244516        .1834441
privatisat~n |    .4472416     .5381635       -.0909219        .0415424
 instability |   -.6138362    -.0451347       -.5687016        .3016885
       d2008 |    2.118311     .2455641        1.872747        1.173015
       d2007 |    2.124796     .3693831        1.755413         1.06905
       d2006 |    1.554211    -.1551574        1.709369        .9516056
       d2005 |    1.146123    -.4729852        1.619109        .8529012
       d2004 |    .6854929    -.6407246        1.326217        .7124953
       d2003 |     .323199    -.6209917        .9441907        .5858145
       d2002 |    .4044573    -.4120101        .8164674         .481669
       d2001 |    .2401294    -.4360164        .6761458        .4031172
       d2000 |    .0186956    -.5976556        .6163512        .3061226
       d1999 |   -.0507387    -.3333133        .2825747         .179233
       d1998 |    .1567807     .1148545        .0419262        .1029484
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                 chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       23.49
                Prob>chi2 =      0.0151
                (V_b-V_B is not positive definite)

. *Spatial and temporal dependence robust Hausman test (Hoechle 2007)
. * Generate the variables for the auxiliary regression proposed by Hausman (1978).
. scalar lambda_hat = 1 - sqrt(e(sigma_e)^2/(e(g_avg)*e(sigma_u)^2+e(sigma_e)^2))

. gen in_sample = e(sample)

. sort country year

. qui foreach X of varlist lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp
l2lngdp  lntransiti
> on lntradefree lneconfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank
privatisation instabil
> ity d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995{

. *Hoechle's (2007) auxilary regression robust to general forms of spatial and temporal
dependence, based on Woold
> ridge's(2002)panel-robust auxilary regression
. qui xtscc lnfdiflow_re lnsecedu_re lntertedu_re lnwage_re l1lnwage_re l2lnwage_re lngdp_re
l1lngdp_re l2lngdp_re
>   lntransition_re lntradefree_re lneconfree_re lnictinfra_re lnprimexport_re
l1lnprimexport_re l2lnprimexport_re
>  lnforbank_re privatisation_re instability_re d2008_re d2007_re d2006_re d2005_re d2004_re
d2003_re d2002_re d20
> 01_re d2000_re d1999_re d1998_re lnfdiflow_fe lnsecedu_fe lntertedu_fe lnwage_fe l1lnwage_fe
l2lnwage_fe lngdp_f
> e l1lngdp_fe l2lngdp_fe  lntransition_fe lntradefree_fe lneconfree_fe lnictinfra_fe
lnprimexport_fe l1lnprimexpo
> rt_fe l2lnprimexport_fe lnforbank_fe privatisation_fe instability_fe d2008_fe d2007_fe
d2006_fe d2005_fe d2004_f
```

```
> e d2003_fe d2002_fe d2001_fe d2000_fe d1999_fe d1998_fe if in_sample, lag(8)

. *Perform an asymptotically equivalent version of the test as proposed by Hausman (1978)
. test lnsecedu_fe lntertedu_fe lnwage_fe l1lnwage_fe l2lnwage_fe lngdp_fe l1lngdp_fe
l2lngdp_fe  lntransition_fe
> lntradefree_fe lneconfree_fe lnictinfra_fe lnprimexport_fe l1lnprimexport_fe
l2lnprimexport_fe lnforbank_fe priv
> atisation_fe instability_fe d2008_fe d2007_fe d2006_fe d2005_fe d2004_fe d2003_fe d2002_fe
d2001_fe d2000_fe d19
> 99_fe d1998_fe

 ( 1)  lnsecedu_fe = 0
 ( 2)  lntertedu_fe = 0
 ( 3)  lnwage_fe = 0
 ( 4)  l1lnwage_fe = 0
 ( 5)  l2lnwage_fe = 0
 ( 6)  lngdp_fe = 0
 ( 7)  l1lngdp_fe = 0
 ( 8)  l2lngdp_fe = 0
 ( 9)  lntransition_fe = 0
 (10)  lntradefree_fe = 0
 (11)  lneconfree_fe = 0
 (12)  lnictinfra_fe = 0
 (13)  lnprimexport_fe = 0
 (14)  l1lnprimexport_fe = 0
 (15)  l2lnprimexport_fe = 0
 (16)  lnforbank_fe = 0
 (17)  privatisation_fe = 0
 (18)  instability_fe = 0
 (19)  d2008_fe = 0
 (20)  d2007_fe = 0
 (21)  d2006_fe = 0
 (22)  d2005_fe = 0
 (23)  d2004_fe = 0
 (24)  d2003_fe = 0
 (25)  d2002_fe = 0
 (26)  d2001_fe = 0
 (27)  d2000_fe = 0
 (28)  d1999_fe = 0
 (29)  d1998_fe = 0

       F( 12,    11) = 3.8e+18
            Prob > F =    0.0000

. *RE estimator not consistent, therefore only FE estimators used
.
. **Driscoll-Kraay FE estimator
. xtscc lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree lnec
> onfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007 d20
> 06 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       143
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 32,    11)     =     73.71
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7717

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.4633169   1.664913    -0.28   0.786    -4.127765    3.201132
   lntertedu |  -.7689391   1.095653    -0.70   0.497    -3.180455    1.642577
      lnwage |   .0142601   .7397215     0.02   0.985    -1.613856    1.642376
    l1lnwage |   .5475273   1.018364     0.54   0.602    -1.693877    2.788931
    l2lnwage |  -.3932786   .6477473    -0.61   0.556    -1.818961    1.032404
       lngdp |   .3805829   .8062184     0.47   0.646    -1.393892    2.155058
     l1lngdp |  -.5564767   1.656194    -0.34   0.743    -4.201736    3.088782
     l2lngdp |   -.229746   .7879839    -0.29   0.776    -1.964087    1.504595
lntransition |    1.55692   3.339307     0.47   0.650    -5.792846    8.906685
 lntradefree |  -.4707713   .4911897    -0.96   0.358    -1.551872    .6103298
  lneconfree |   1.155114   1.172786     0.98   0.346     -1.42617    3.736398
  lnictinfra |  -.0536539   .2306969    -0.23   0.820    -.5614144    .4541066
lnprimexport |   .2395144   .1526793     1.57   0.145    -.0965304    .5755592
l1lnprimex~t |   .0042075   .2109392     0.02   0.984    -.4600665    .4684815
```

```
l2lnprimex~t |  -.1572141   .2949864    -0.53   0.605    -.8064748    .4920465
   lnforbank |   .2231828   .1454572     1.53   0.153    -.0969663     .543332
privatisat~n |   .4472416   .1291914     3.46   0.005     .1628932      .73159
 instability |  -.6138362   .4778674    -1.28   0.225    -1.665615    .4379428
       d2008 |  (omitted)
       d2007 |   .0064849    .124471     0.05   0.959    -.2674739    .2804437
       d2006 |  -.5640997   .2129543    -2.65   0.023    -1.032809   -.0953906
       d2005 |  -.9721877    .282827    -3.44   0.006    -1.594686   -.3496897
       d2004 |  -1.432818   .3228847    -4.44   0.001    -2.143483   -.7221538
       d2003 |  -1.795112   .3183692    -5.64   0.000    -2.495838   -1.094386
       d2002 |  -1.713854   .3914926    -4.38   0.001    -2.575523   -.8521845
       d2001 |  -1.878182   .4321582    -4.35   0.001    -2.829356   -.9270081
       d2000 |  -2.099616   .4937456    -4.25   0.001    -3.186342   -1.012889
       d1999 |   -2.16905    .500257    -4.34   0.001    -3.270108   -1.067992
       d1998 |  -1.961531    .478901    -4.10   0.002    -3.015585   -.9074765
       d1997 |  -2.118311   .5183656    -4.09   0.002    -3.259226   -.9773961
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   16.36289   13.60602     1.20   0.254    -13.58376    46.30955
------------------------------------------------------------------------------
```

Appendix 5.4: Initial specifications

```
**secedu only

. xtfevd lnfdiflow lnsecedu  lngdp lntransition lntradefree lneconfree lnforbank privatisation
instability d2008 d
> 2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, invariant (lnsecedu
lngdp)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       128          number of obs       =       161
mean squared error         = .1859815           F( 23, 128)         = 40.02397
root mean squared error    = .4312557           Prob > F            = 4.00e-46
Residual Sum of Squares    = 29.94302           R-squared           =  .915896
Total Sum of Squares       = 356.0239           adj. R-squared      =   .89487
Estimation Sum of Squares  = 326.0809

------------------------------------------------------------------------------
             |                fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   5.356397   2.838508     1.89   0.061    -.2600758    10.97287
 lntradefree |   -.478568   .7498234    -0.64   0.524    -1.962222    1.005086
  lneconfree |   1.015615   1.287807     0.79   0.432    -1.532531     3.56376
   lnforbank |   .3331903   .2577847     1.29   0.199    -.1768807    .8432613
privatisat~n |   .3967238   .1131736     3.51   0.001     .1727905    .6206572
 instability |  -.6373658   .3515562    -1.81   0.072     -1.33298    .0582482
       d2008 |   1.158198   .5669942     2.04   0.043     .0363029    2.280093
       d2007 |   1.187937   .5538793     2.14   0.034     .0919922    2.283882
       d2006 |   .6576642   .5563393     1.18   0.239    -.4431482    1.758476
       d2005 |   .3509573   .5413783     0.65   0.518    -.7202522    1.422167
       d2004 |   .0131117   .5339007     0.02   0.980    -1.043302    1.069525
       d2003 |   -.367296   .5184643    -0.71   0.480    -1.393166    .6585743
       d2002 |  -.3132066   .5018079    -0.62   0.534    -1.306119     .679706
       d2001 |  -.4494045   .4794552    -0.94   0.350    -1.398088    .4992794
       d2000 |  -.5379365   .4530832    -1.19   0.237    -1.434439     .358566
       d1999 |  -.4731643   .4234959    -1.12   0.266    -1.311123    .3647946
       d1998 |   -.178981   .3987864    -0.45   0.654     -.968048     .610086
       d1997 |   -.240217   .3886696    -0.62   0.538    -1.009266    .5288321
       d1996 |  -.2047121    .354228    -0.58   0.564    -.9056127    .4961885
    lnsecedu |  -.6129995   .5792951    -1.06   0.292    -1.759234    .5332349
       lngdp |   .5260324   .2071689     2.54   0.012     .1161134    .9359514
         eta |          1          .        .       .            .           .
       _cons |  -11.71173   6.559518    -1.79   0.077    -24.69085      1.2674
------------------------------------------------------------------------------
```

```
**tertedu only

. xtfevd lnfdiflow lntertedu  lngdp lntransition lntradefree lneconfree lnforbank
privatisation instability d2008
> d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, invariant
(lntertedu lngdp)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       128          number of obs       =       161
mean squared error         = .1841164           F( 23, 128)         =  41.8006
root mean squared error    = .4290879           Prob > F            = 3.75e-47
Residual Sum of Squares    = 29.64274           R-squared           = .9167395
Total Sum of Squares       = 356.0239           adj. R-squared      = .8959243
Estimation Sum of Squares  = 326.3812

------------------------------------------------------------------------------
             |               fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   5.065456   3.595322     1.41   0.161    -2.048502    12.17941
 lntradefree |  -.5005262    .806716    -0.62   0.536    -2.096752    1.095699
  lneconfree |    1.13442   1.347584     0.84   0.401    -1.532005    3.800845
   lnforbank |   .3355226   .2758931     1.22   0.226     -.210379    .8814243
privatisat~n |   .4033676   .1111797     3.63   0.000     .1833795    .6233557
 instability |  -.6161357   .3552252    -1.73   0.085     -1.31901    .0867382
       d2008 |   1.335864   .6992319     1.91   0.058    -.0476862    2.719413
       d2007 |   1.345936   .6947224     1.94   0.055    -.0286913    2.720562
       d2006 |   .7925446   .7005531     1.13   0.260    -.5936194    2.178709
       d2005 |   .4660706   .6830944     0.68   0.496    -.8855484     1.81769
       d2004 |   .1092848   .6674859     0.16   0.870     -1.21145     1.43002
       d2003 |   -.281251   .6482182    -0.43   0.665    -1.563862    1.001359
       d2002 |  -.2395973   .6532853    -0.37   0.714    -1.532234    1.053039
       d2001 |  -.3929505   .6302668    -0.62   0.534    -1.640041    .8541401
       d2000 |  -.5001761   .5962179    -0.84   0.403    -1.679895    .6795429
       d1999 |  -.4459966   .5414495    -0.82   0.412    -1.517347    .6253537
       d1998 |  -.1587937   .4921586    -0.32   0.747    -1.132614    .8150261
       d1997 |  -.2307012   .4491689    -0.51   0.608    -1.119459    .6580561
       d1996 |  -.2021054    .378378    -0.53   0.594    -.9507909    .5465801
   lntertedu |  -.6255987   .6939644    -0.90   0.369    -1.998726    .7475284
       lngdp |   .5463153   .2313063     2.36   0.020     .0886363    1.003994
         eta |          1          .        .       .            .           .
       _cons |  -13.42047   7.102442    -1.89   0.061    -27.47386    .6329281
------------------------------------------------------------------------------
```

```
*cognitive only
. xtfevd lnfdiflow lncognitive lngdp lntransition lntradefree lneconfree lnforbank
privatisation instability d2008
>  d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, invariant
(lncognitive lngdp)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       122          number of obs       =       155
mean squared error         = .1880317           F( 23, 122)         =   30.6598
root mean squared error    = .4336263           Prob > F            = 7.50e-39
Residual Sum of Squares    = 29.14492           R-squared           = .9214037
Total Sum of Squares       = 370.8179           adj. R-squared      = .9007883
Estimation Sum of Squares  =  341.673

------------------------------------------------------------------------------
             |                fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   4.420685    2.77026     1.60   0.113    -1.063323    9.904692
 lntradefree |  -.5043205   .7520113    -0.67   0.504    -1.993002    .9843609
  lneconfree |   1.210238   .9384561     1.29   0.200    -.6475295    3.068006
   lnforbank |   .5441142   .2715376     2.00   0.047     .0065785     1.08165
privatisat~n |   .3975968   .1168695     3.40   0.001      .166242    .6289515
 instability |  -.6800063   .3900897    -1.74   0.084    -1.452228    .0922151
       d2008 |   1.014567   .7590072     1.34   0.184    -.4879638    2.517097
       d2007 |    1.09521   .7335244     1.49   0.138    -.3568747    2.547295
       d2006 |   .5016368   .6599598     0.76   0.449    -.8048195    1.808093
       d2005 |   .1811519   .6345775     0.29   0.776    -1.075058    1.437361
       d2004 |  -.0460169   .5843823    -0.08   0.937     -1.20286    1.110826
       d2003 |  -.4827314   .5740631    -0.84   0.402    -1.619147    .6536838
       d2002 |  -.3936693   .5508646    -0.71   0.476    -1.484161    .6968222
       d2001 |  -.5339357   .5359303    -1.00   0.321    -1.594863    .5269919
       d2000 |  -.6044857    .479996    -1.26   0.210    -1.554686    .3457143
       d1999 |  -.5693758   .4374754    -1.30   0.196    -1.435402    .2966504
       d1998 |  -.2373199   .3972763    -0.60   0.551    -1.023768    .5491283
       d1997 |  -.2181913   .3901967    -0.56   0.577    -.9906246     .554242
       d1996 |   -.268626   .3159214    -0.85   0.397     -.894024     .356772
 lncognitive |  -.3461962   3.173119    -0.11   0.913    -6.627702    5.935309
       lngdp |   .6299125   .1497804     4.21   0.000     .3334073    .9264177
         eta |          1          .        .       .            .           .
       _cons |  -15.36924   5.660174    -2.72   0.008    -26.57411   -4.164356
------------------------------------------------------------------------------
```

```
*top only
. xtfevd lnfdiflow lntop  lngdp lntransition lntradefree lneconfree lnforbank privatisation
instability d2008 d200
> 7 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, invariant (lntop lngdp)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       122          number of obs       =       155
mean squared error         = .1880317          F( 23, 122)         = 29.82651
root mean squared error    = .4336263          Prob > F            = 2.95e-38
Residual Sum of Squares    = 29.14492          R-squared           = .9214037
Total Sum of Squares       = 370.8179          adj. R-squared      = .9007883
Estimation Sum of Squares  =  341.673

------------------------------------------------------------------------------
             |               fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   4.420685   2.627052     1.68   0.095    -.7798279    9.621197
 lntradefree |  -.5043205    .743656    -0.68   0.499    -1.976462    .9678207
  lneconfree |   1.210238   .9346493     1.29   0.198    -.6399935     3.06047
   lnforbank |   .5441142      .2667     2.04   0.043      .016155    1.072073
privatisat~n |   .3975968   .1209224     3.29   0.001     .1582188    .6369747
 instability |  -.6800063   .3885983    -1.75   0.083    -1.449275    .0892628
       d2008 |   1.014567   .8032543     1.26   0.209    -.5755553    2.604689
       d2007 |    1.09521    .771542     1.42   0.158    -.4321344    2.622555
       d2006 |   .5016368   .6960984     0.72   0.473    -.8763594    1.879633
       d2005 |   .1811519   .6699516     0.27   0.787    -1.145084    1.507388
       d2004 |  -.0460169   .6159515    -0.07   0.941    -1.265354    1.173321
       d2003 |  -.4827314    .609894    -0.79   0.430    -1.690077    .7246147
       d2002 |  -.3936693    .577182    -0.68   0.496    -1.536259    .7489201
       d2001 |  -.5339357     .57071    -0.94   0.351    -1.663713    .5958418
       d2000 |  -.6044857   .5117058    -1.18   0.240    -1.617458    .4084871
       d1999 |  -.5693759   .4676003    -1.22   0.226    -1.495037    .3562856
       d1998 |  -.2373199   .4249205    -0.56   0.578    -1.078492    .6038526
       d1997 |  -.2181913   .4195069    -0.52   0.604    -1.048647    .6122645
       d1996 |   -.268626    .342299    -0.78   0.434    -.9462411     .408989
       lntop |   .1959804   .4066572     0.48   0.631     -.609038    1.000999
       lngdp |   .5558178   .1617803     3.44   0.001     .2355575    .8760781
         eta |          1          .        .       .            .           .
       _cons |  -13.57802   6.843076    -1.98   0.049    -27.12458   -.0314733
```

```
**secede + tertedu + cognitive + top, no controls apart from GDP
. xtfevd lnfdiflow lnsecedu lntertedu lncognitive lntop lngdp d2008 d2007 d2006 d2005 d2004
d2003 d2002 d2001 d200
> 0 d1999 d1998 d1997 d1996, invariant (lnsecedu lntertedu lncognitive lntop lngdp)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       125          number of obs       =       154
mean squared error         = .2881555           F( 20, 125)         = 32.53735
root mean squared error    = .5368012           Prob > F            = 1.47e-38
Residual Sum of Squares    = 44.37595           R-squared           = .8786716
Total Sum of Squares       = 365.7506           adj. R-squared      =  .851494
Estimation Sum of Squares  = 321.3747

------------------------------------------------------------------------------
             |                 fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       d2008 |   2.097962   .4695057     4.47   0.000     1.168752    3.027172
       d2007 |   2.294056   .4358057     5.26   0.000     1.431542    3.156569
       d2006 |   1.967035   .3941124     4.99   0.000     1.187038    2.747032
       d2005 |   1.633203    .367383     4.45   0.000     .9061068      2.3603
       d2004 |   1.477392   .3425538     4.31   0.000     .7994361    2.155349
       d2003 |   .7670785   .3126302     2.45   0.016     .1483447    1.385812
       d2002 |   1.045132   .2850849     3.67   0.000     .4809134     1.60935
       d2001 |   .8366917   .2698381     3.10   0.002     .3026487    1.370735
       d2000 |   .7885345   .2610243     3.02   0.003      .271935    1.305134
       d1999 |    .458696   .2590832     1.77   0.079    -.0540619    .9714538
       d1998 |   .6375934   .2568383     2.48   0.014     .1292784    1.145908
       d1997 |   .3328475    .253222     1.31   0.191    -.1683102    .8340053
       d1996 |  -.1188265   .2525382    -0.47   0.639     -.618631     .380978
    lnsecedu |   .5007416   .4755116     1.05   0.294    -.4403549    1.441838
   lntertedu |   .1693764   .4980866     0.34   0.734    -.8163988    1.155152
 lncognitive |  -7.964224   4.635011    -1.72   0.088    -17.13749    1.209037
       lntop |   1.509943   .5486668     2.75   0.007     .4240628    2.595822
       lngdp |   .6325433   .1871594     3.38   0.001     .2621317    1.002955
         eta |          1          .        .       .            .           .
       _cons |   5.314719   9.243507     0.57   0.566    -12.97933    23.60877
------------------------------------------------------------------------------
```

Appendix 5.5: Testing down procedure

```
*Start from the baseline regression

. xtscc lnfdiflow lnsecedu lntertedu lnwage l1lnwage l2lnwage lngdp l1lngdp l2lngdp
lntransition lntradefree lnec
> onfree lnictinfra lnprimexport l1lnprimexport l2lnprimexport lnforbank privatisation
instability d2008 d2007 d20
> 06 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       143
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 32,     11)    =     73.71
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7717

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.4633169   1.664913    -0.28   0.786    -4.127765    3.201132
   lntertedu |  -.7689391   1.095653    -0.70   0.497    -3.180455    1.642577
      lnwage |   .0142601   .7397215     0.02   0.985    -1.613856    1.642376
    l1lnwage |   .5475273   1.018364     0.54   0.602    -1.693877    2.788931
    l2lnwage |  -.3932786   .6477473    -0.61   0.556    -1.818961    1.032404
       lngdp |   .3805829   .8062184     0.47   0.646    -1.393892    2.155058
     l1lngdp |  -.5564767   1.656194    -0.34   0.743    -4.201736    3.088782
     l2lngdp |   -.229746   .7879839    -0.29   0.776    -1.964087    1.504595
lntransition |    1.55692   3.339307     0.47   0.650    -5.792846    8.906685
 lntradefree |  -.4707713   .4911897    -0.96   0.358    -1.551872    .6103298
  lneconfree |   1.155114   1.172786     0.98   0.346     -1.42617    3.736398
  lnictinfra |  -.0536539   .2306969    -0.23   0.820    -.5614144    .4541066
lnprimexport |   .2395144   .1526793     1.57   0.145    -.0965304    .5755592
l1lnprimex~t |   .0042075   .2109392     0.02   0.984    -.4600665    .4684815
l2lnprimex~t |  -.1572141   .2949864    -0.53   0.605    -.8064748    .4920465
   lnforbank |   .2231828   .1454572     1.53   0.153    -.0969663     .543332
privatisat~n |   .4472416   .1291914     3.46   0.005     .1628932      .73159
 instability |  -.6138362   .4778674    -1.28   0.225    -1.665615    .4379428
       d2008 |  (omitted)
       d2007 |   .0064849    .124471     0.05   0.959    -.2674739    .2804437
       d2006 |  -.5640997   .2129543    -2.65   0.023    -1.032809   -.0953906
       d2005 |  -.9721877    .282827    -3.44   0.006    -1.594686   -.3496897
       d2004 |  -1.432818   .3228847    -4.44   0.001    -2.143483   -.7221538
       d2003 |  -1.795112   .3183692    -5.64   0.000    -2.495838   -1.094386
       d2002 |  -1.713854   .3914926    -4.38   0.001    -2.575523   -.8521845
       d2001 |  -1.878182   .4321582    -4.35   0.001    -2.829356   -.9270081
       d2000 |  -2.099616   .4937456    -4.25   0.001    -3.186342   -1.012889
       d1999 |   -2.16905    .500257    -4.34   0.001    -3.270108   -1.067992
       d1998 |  -1.961531    .478901    -4.10   0.002    -3.015585   -.9074765
       d1997 |  -2.118311   .5183656    -4.09   0.002    -3.259226   -.9773961
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   16.36289   13.60602     1.20   0.254    -13.58376    46.30955
------------------------------------------------------------------------------

.
. **testing down
. test lnprimexport=l1lnprimexport=l2lnprimexport=0

 ( 1)  lnprimexport - l1lnprimexport = 0
 ( 2)  lnprimexport - l2lnprimexport = 0
 ( 3)  lnprimexport = 0

       F(  3,    11) =    1.04
            Prob > F =    0.4111

. *lnprimexport l1lnprimexport l2lnprimexport dropped
.
```

```
. xtscc lnfdiflow lnsecedu lntertedu lngdp lnwage l1lnwage l2lnwage l1lngdp l2lngdp
lntransition lntradefree lnec
> onfree lnictinfra lnforbank privatisation instability d2008 d2007 d2006 d2005 d2004 d2003
d2002 d2001 d2000 d199
> 9 d1998 d1997 d1996 d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       143
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 29,    11)     =     76.03
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7696

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.3771131   1.637528    -0.23   0.822    -3.981289    3.227062
   lntertedu |  -1.048645   .9799451    -1.07   0.307    -3.205489      1.1082
       lngdp |    .324391   .7648338     0.42   0.680    -1.358997    2.007779
      lnwage |  -.0485696    .652992    -0.07   0.942    -1.485795    1.388656
    l1lnwage |    .563708   .9827377     0.57   0.578    -1.599283    2.726699
    l2lnwage |  -.3653256    .618266    -0.59   0.567     -1.72612    .9954687
     l1lngdp |  -.5844466   1.591709    -0.37   0.720    -4.087776    2.918882
     l2lngdp |   -.059768   .7691966    -0.08   0.939    -1.752758    1.633222
lntransition |   .9692884   2.555835     0.38   0.712    -4.656065    6.594642
 lntradefree |  -.4802472   .4999409    -0.96   0.357     -1.58061    .6201154
  lneconfree |   1.151382   1.028574     1.12   0.287    -1.112495    3.415258
  lnictinfra |   .0653135   .2123113     0.31   0.764    -.4019807    .5326076
   lnforbank |   .2539841   .1431212     1.77   0.104    -.0610236    .5689917
privatisat~n |   .4368253   .1161576     3.76   0.003     .1811642    .6924865
 instability |  -.4896169   .3608577    -1.36   0.202    -1.283859    .3046255
       d2008 |  (omitted)
       d2007 |   .0103053   .1117826     0.09   0.928    -.2357265    .2563371
       d2006 |  -.5091337   .1957218    -2.60   0.025    -.9399144   -.0783529
       d2005 |  -.8947227   .2546995    -3.51   0.005    -1.455312   -.3341329
       d2004 |  -1.369949   .3159297    -4.34   0.001    -2.065306   -.6745928
       d2003 |  -1.783363   .3296874    -5.41   0.000       -2.509   -1.057726
       d2002 |  -1.708304   .3904971    -4.37   0.001    -2.567782   -.8488258
       d2001 |  -1.851164    .433241    -4.27   0.001    -2.804721   -.8976067
       d2000 |  -2.028246   .4816067    -4.21   0.001    -3.088255   -.9682363
       d1999 |  -2.129266   .4927161    -4.32   0.001    -3.213726   -1.044805
       d1998 |  -1.920149    .491798    -3.90   0.002    -3.002589   -.8377086
       d1997 |  -2.043494   .5399295    -3.78   0.003    -3.231871   -.8551171
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   14.70304   15.14035     0.97   0.352    -18.62064    48.02672
------------------------------------------------------------------------------


. test lnwage=l1lnwage=l2lnwage=0

 ( 1)  lnwage - l1lnwage = 0
 ( 2)  lnwage - l2lnwage = 0
 ( 3)  lnwage = 0

       F(  3,    11) =    0.17
            Prob > F =    0.9134
```

```
. *lnwage l1lnwage l2lnwage dropped
.
. xtscc lnfdiflow lnsecedu lntertedu lngdp l1lngdp l2lngdp  lntransition lntradefree
lneconfree lnictinfra lnforba
> nk privatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999
d1998 d1997 d1996 d1995
> , fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       143
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 26,    11)     =    209.98
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7692

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.3309616   1.603159    -0.21   0.840     -3.85949    3.197567
   lntertedu |  -1.132672   .7874712    -1.44   0.178    -2.865884    .6005404
       lngdp |   .2472936   .5176596     0.48   0.642    -.8920675    1.386655
     l1lngdp |   .0214622     .80546     0.03   0.979    -1.751343    1.794268
     l2lngdp |  -.4380341    .286701    -1.53   0.155    -1.069059    .1929905
lntransition |   .8194406   3.112823     0.26   0.797    -6.031836    7.670717
 lntradefree |  -.4831496   .4762856    -1.01   0.332    -1.531447    .5651481
  lneconfree |   1.134157   1.016109     1.12   0.288    -1.102284    3.370598
  lnictinfra |   .0944659   .1985089     0.48   0.643    -.3424493    .5313811
   lnforbank |   .2623754   .1253009     2.09   0.060      -.01341    .5381609
privatisat~n |   .4433493   .1075314     4.12   0.002     .2066742    .6800244
 instability |  -.4674504   .3148991    -1.48   0.166    -1.160539    .2256378
       d2008 |  (omitted)
       d2007 |   .0054516   .1086993     0.05   0.961    -.2337938    .2446971
       d2006 |  -.5159944   .1759227    -2.93   0.014    -.9031976   -.1287912
       d2005 |  -.9051766    .235617    -3.84   0.003    -1.423766   -.3865871
       d2004 |  -1.366422   .3247421    -4.21   0.001    -2.081174   -.6516693
       d2003 |  -1.769301   .3536955    -5.00   0.000     -2.54778   -.9908225
       d2002 |   -1.69836   .3974846    -4.27   0.001    -2.573218   -.8235022
       d2001 |  -1.845141   .4109433    -4.49   0.001    -2.749621   -.9406605
       d2000 |  -1.998279   .4504739    -4.44   0.001    -2.989766   -1.006793
       d1999 |  -2.113392   .4201567    -5.03   0.000    -3.038151   -1.188634
       d1998 |  -1.903464   .3977942    -4.79   0.001    -2.779003   -1.027924
       d1997 |  -2.022921   .4160453    -4.86   0.001    -2.938631   -1.107212
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   12.08992    12.2683     0.99   0.346    -14.91242    39.09226
------------------------------------------------------------------------------

. test l1lngdp=l2lngdp=0

 ( 1)  l1lngdp - l2lngdp = 0
 ( 2)  l1lngdp = 0

       F(  2,    11) =    1.47
            Prob > F =    0.2708
```

```
. *l1lngdp l2lngdp dropped
.
. xtscc lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnictinfra
lnforbank privatisation
> instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       161
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 24,    11)     =   2221.09
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7972

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.2985031   1.361085    -0.22   0.830    -3.294231    2.697225
   lntertedu |  -.7683703   .6483295    -1.19   0.261    -2.195334    .6585934
       lngdp |  -.2121493   .4060959    -0.52   0.612     -1.10596    .6816617
lntransition |   5.033338   1.938876     2.60   0.025     .7659012    9.300775
 lntradefree |   -.489566   .3964931    -1.23   0.243    -1.362241    .3831093
  lneconfree |   1.118148   .7603085     1.47   0.169      -.55528    2.791576
  lnictinfra |  -.0551046   .1183415    -0.47   0.651    -.3155725    .2053633
   lnforbank |    .329932   .1262097     2.61   0.024     .0521463    .6077177
privatisat~n |   .4057775   .1073731     3.78   0.003      .169451     .642104
 instability |   -.649036   .1269566    -5.11   0.000    -.9284655   -.3696064
       d2008 |  (omitted)
       d2007 |   .0074095   .0499144     0.15   0.885    -.1024514    .1172704
       d2006 |   -.546573   .1235574    -4.42   0.001     -.818521    -.274625
       d2005 |  -.8787819   .1528978    -5.75   0.000    -1.215308   -.5422562
       d2004 |  -1.244921    .204825    -6.08   0.000    -1.695738   -.7941043
       d2003 |   -1.64187   .2096546    -7.83   0.000    -2.103316   -1.180423
       d2002 |  -1.607321    .267084    -6.02   0.000    -2.195169   -1.019473
       d2001 |  -1.774218   .2976082    -5.96   0.000    -2.429249   -1.119187
       d2000 |  -1.902729   .3384812    -5.62   0.000    -2.647721   -1.157737
       d1999 |   -1.86489   .3498803    -5.33   0.000    -2.634971   -1.094808
       d1998 |  -1.593711    .375671    -4.24   0.001    -2.420557   -.7668642
       d1997 |  -1.674576   .3944981    -4.24   0.001    -2.542861   -.8062918
       d1996 |   -1.66505   .4245808    -3.92   0.002    -2.599546   -.7305538
       d1995 |   -1.48374   .4937553    -3.01   0.012    -2.570489   -.3969923
       _cons |   7.931019   6.957071     1.14   0.279    -7.381392    23.24343
------------------------------------------------------------------------------

.
```

```
 *ictinfra dropped
**BASELINE REGRESSION:
. xtscc lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instability
>  d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       161
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 23,    11)     =  13218.83
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7971

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.1197061   1.188927    -0.10   0.922    -2.736518    2.497106
   lntertedu |  -.7697577    .648464    -1.19   0.260    -2.197017     .657502
       lngdp |  -.2470292   .3654323    -0.68   0.513     -1.05134    .5572819
lntransition |   5.076224    1.94496     2.61   0.024     .7953961    9.357051
 lntradefree |  -.4964094   .3841643    -1.29   0.223    -1.341949    .3491304
  lneconfree |    1.12866   .7650754     1.48   0.168    -.5552597     2.81258
   lnforbank |   .3345589   .1307638     2.56   0.027     .0467497    .6223682
privatisat~n |   .4026688   .1105342     3.64   0.004     .1593847    .6459529
 instability |  -.6108348      .1382    -4.42   0.001     -.915011   -.3066586
       d2008 |  (omitted)
       d2007 |   .0092618   .0514554     0.18   0.860    -.1039908    .1225144
       d2006 |  -.5447139   .1258323    -4.33   0.001    -.8216689   -.2677589
       d2005 |  -.8722318   .1590181    -5.49   0.000    -1.222228   -.5222354
       d2004 |  -1.230521   .2175621    -5.66   0.000    -1.709372   -.7516701
       d2003 |  -1.623655   .2215913    -7.33   0.000    -2.111374   -1.135935
       d2002 |  -1.584403   .2808361    -5.64   0.000    -2.202519   -.9662868
       d2001 |  -1.739983   .3126275    -5.57   0.000    -2.428072   -1.051895
       d2000 |  -1.849178   .3538286    -5.23   0.000     -2.62795   -1.070407
       d1999 |  -1.797017   .3549371    -5.06   0.000    -2.578228   -1.015806
       d1998 |  -1.511477   .3687633    -4.10   0.002    -2.323119   -.6998343
       d1997 |  -1.584419   .3918259    -4.04   0.002    -2.446822   -.7220159
       d1996 |  -1.557279   .3980971    -3.91   0.002    -2.433484   -.6810728
       d1995 |  -1.355782   .4460091    -3.04   0.011    -2.337441   -.3741225
       _cons |    7.77193   7.102661     1.09   0.297    -7.860922    23.40478
------------------------------------------------------------------------------

. **variance inflation factor (VIF)
. qui reg lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instabili
> ty d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995

. estat vif

    Variable |       VIF       1/VIF  
-------------+----------------------
lntransition |      6.40    0.156161
  lneconfree |      3.44    0.291059
       lngdp |      3.28    0.304814
       d1996 |      2.86    0.349518
       d1997 |      2.46    0.405694
       d1998 |      2.34    0.426554
       d1999 |      2.28    0.438047
       d2000 |      2.27    0.440350
 lntradefree |      2.23    0.449385
       d2004 |      2.21    0.452997
   lntertedu |      2.14    0.468111
       d2003 |      2.12    0.471924
       d2001 |      2.11    0.474180
       d2002 |      2.09    0.478514
       d1995 |      2.05    0.487948
    lnsecedu |      2.00    0.500857
       d2005 |      1.99    0.501346
       d2006 |      1.95    0.512766
       d2007 |      1.87    0.534935
   lnforbank |      1.79    0.558450
 instability |      1.35    0.743016
privatisat~n |      1.28    0.779558
-------------+----------------------
    Mean VIF |      2.39

. *multicollinearity significantly reduced after testing down
```

Appendix 5.6: Model 5.1 results

```
. **parsimonious 5.1 model, baseline model
. **Driscoll-Kraay FE
. xtscc lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instability
>  d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       161
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 23,    11)     =  13218.83
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7971

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.1197061   1.188927    -0.10   0.922    -2.736518    2.497106
   lntertedu |  -.7697577    .648464    -1.19   0.260    -2.197017     .657502
       lngdp |  -.2470292   .3654323    -0.68   0.513     -1.05134    .5572819
lntransition |   5.076224    1.94496     2.61   0.024     .7953961    9.357051
 lntradefree |  -.4964094   .3841643    -1.29   0.223    -1.341949    .3491304
  lneconfree |    1.12866   .7650754     1.48   0.168    -.5552597     2.81258
   lnforbank |   .3345589   .1307638     2.56   0.027     .0467497    .6223682
privatisat~n |   .4026688   .1105342     3.64   0.004     .1593847    .6459529
 instability |  -.6108348      .1382    -4.42   0.001     -.915011   -.3066586
       d2008 |  (omitted)
       d2007 |   .0092618   .0514554     0.18   0.860    -.1039908    .1225144
       d2006 |  -.5447139   .1258323    -4.33   0.001    -.8216689   -.2677589
       d2005 |  -.8722318   .1590181    -5.49   0.000    -1.222228   -.5222354
       d2004 |  -1.230521   .2175621    -5.66   0.000    -1.709372   -.7516701
       d2003 |  -1.623655   .2215913    -7.33   0.000    -2.111374   -1.135935
       d2002 |  -1.584403   .2808361    -5.64   0.000    -2.202519   -.9662868
       d2001 |  -1.739983   .3126275    -5.57   0.000    -2.428072   -1.051895
       d2000 |  -1.849178   .3538286    -5.23   0.000     -2.62795   -1.070407
       d1999 |  -1.797017   .3549371    -5.06   0.000    -2.578228   -1.015806
       d1998 |  -1.511477   .3687633    -4.10   0.002    -2.323119   -.6998343
       d1997 |  -1.584419   .3918259    -4.04   0.002    -2.446822   -.7220159
       d1996 |  -1.557279   .3980971    -3.91   0.002    -2.433484   -.6810728
       d1995 |  -1.355782   .4460091    -3.04   0.011    -2.337441   -.3741225
       _cons |    7.77193   7.102661     1.09   0.297    -7.860922    23.40478
------------------------------------------------------------------------------
```

```
. **FEVD
. xtfevd lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instabilit
> y d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, invariant
(lnsecedu lntertedu l
> ngdp)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       127          number of obs       =       161
mean squared error         = .1841029           F( 24, 127)         = 39.97923
root mean squared error    = .4290721           Prob > F            = 1.45e-46
Residual Sum of Squares    = 29.64056           R-squared           = .9167456
Total Sum of Squares       = 356.0239           adj. R-squared      = .8951125
Estimation Sum of Squares  = 326.3834

------------------------------------------------------------------------------
             |              fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   5.076224   3.278408     1.55   0.124    -1.411155     11.5636
 lntradefree |  -.4964095   .7327268    -0.68   0.499    -1.946344    .9535247
  lneconfree |    1.12866   1.314091     0.86   0.392     -1.47169     3.72901
   lnforbank |   .3345589   .2738955     1.22   0.224    -.2074309    .8765488
privatisat~n |   .4026688    .112055     3.59   0.000     .1809321    .6244055
 instability |  -.6108348    .354684    -1.72   0.087     -1.31269    .0910208
       d2008 |   1.355782   .5825829     2.33   0.022     .2029554    2.508608
       d2007 |   1.365044   .5740508     2.38   0.019     .2291008    2.500987
       d2006 |    .811068   .5842918     1.39   0.168      -.34514    1.967276
       d2005 |   .4835501   .5761841     0.84   0.403    -.6566143    1.623714
       d2004 |   .1252609   .5700484     0.22   0.826    -1.002762    1.253284
       d2003 |  -.2678727   .5585404    -0.48   0.632    -1.373123     .837378
       d2002 |  -.2286209   .5498479    -0.42   0.678    -1.316671    .8594289
       d2001 |  -.3842013   .5272514    -0.73   0.468    -1.427537    .6591341
       d2000 |  -.4933962   .5003166    -0.99   0.326    -1.483432      .49664
       d1999 |  -.4412351   .4712571    -0.94   0.351    -1.373768    .4912976
       d1998 |  -.1556949    .437597    -0.36   0.723     -1.02162    .7102306
       d1997 |   -.228637   .4228525    -0.54   0.590    -1.065386    .6081117
       d1996 |  -.2014967   .3751049    -0.54   0.592    -.9437616    .5407683
    lnsecedu |  -.3287548   .5359311    -0.61   0.541    -1.389266     .731756
   lntertedu |  -.4923385   .5830922    -0.84   0.400    -1.646173    .6614959
       lngdp |   .5307859   .2260036     2.35   0.020     .0835655    .9780063
         eta |          1          .        .       .            .           .
       _cons |  -12.08435   6.509716    -1.86   0.066    -24.96591    .7971988
------------------------------------------------------------------------------

.
```

```
. **baseline model robustness checks
. **panel-robust FE
. xtreg lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instability
>  d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, fe
robust
note: d1995 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       161
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.7971                         Obs per group: min =        11
       between = 0.0969                                        avg =      13.4
       overall = 0.3720                                        max =        14

                                                F(11,11)           =         .
corr(u_i, Xb)  = -0.0025                        Prob > F           =         .

                               (Std. Err. adjusted for 12 clusters in country)
------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.1197061   1.370948    -0.09   0.932    -3.137142     2.89773
   lntertedu |  -.7697577   1.069552    -0.72   0.487    -3.123826     1.58431
       lngdp |  -.2470292   .5498437    -0.45   0.662    -1.457227    .9631686
lntransition |   5.076224   1.960386     2.59   0.025     .7614422    9.391005
 lntradefree |  -.4964094    .433271    -1.15   0.276    -1.450032    .4572136
  lneconfree |    1.12866   .9192933     1.23   0.245    -.8946909    3.152011
   lnforbank |   .3345589   .1684206     1.99   0.072    -.0361322    .7052501
privatisat~n |   .4026688   .0885954     4.55   0.001     .2076716    .5976661
 instability |  -.6108348   .2186769    -2.79   0.017    -1.092139   -.1295301
       d2008 |   1.355782   1.270149     1.07   0.309    -1.439798    4.151362
       d2007 |   1.365044   1.177778     1.16   0.271    -1.227228    3.957316
       d2006 |    .811068   .9095068     0.89   0.392    -1.190743    2.812879
       d2005 |   .4835501   .8271486     0.58   0.571    -1.336992    2.304092
       d2004 |   .1252609   .6568525     0.19   0.852    -1.320462    1.570984
       d2003 |  -.2678727   .5357853    -0.50   0.627    -1.447128    .9113829
       d2002 |  -.2286209    .540008    -0.42   0.680     -1.41717    .9599287
       d2001 |  -.3842012   .4602437    -0.83   0.422    -1.397191    .6287883
       d2000 |  -.4933962   .3408151    -1.45   0.176    -1.243525    .2567328
       d1999 |  -.4412351   .3876759    -1.14   0.279    -1.294504    .4120338
       d1998 |  -.1556949   .3731024    -0.42   0.684    -.9768877     .665498
       d1997 |   -.228637   .3768698    -0.61   0.556    -1.058122    .6008479
       d1996 |  -.2014967   .2855653    -0.71   0.495    -.8300217    .4270284
       d1995 |  (omitted)
       _cons |   6.416148   12.59179     0.51   0.620     -21.2982     34.1305
-------------+----------------------------------------------------------------
     sigma_u |  1.1338305
     sigma_e |  .48310483
         rho |  .84634882   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
. **two-way cluster-robust FE (clusters: country & year), small-sample adjustment

. xtivreg2 lnfdiflow lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instability d20
> 08 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, fe
cluster(country year) small
Warning: estimated covariance matrix of moment conditions not of full rank.
         standard errors and model tests should be interpreted with caution.
Possible causes:
         number of clusters insufficient to calculate robust covariance matrix
         singleton dummy variable (dummy with one 1 and N-1 0s or vice versa)
partial option may address problem.

FIXED EFFECTS ESTIMATION
------------------------
Number of groups =        12                    Obs per group: min =        11
                                                               avg =      13.4
                                                               max =        14

OLS estimation
--------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on country and year

Number of clusters (country) =      12                Number of obs =      161
Number of clusters (year) =         14                F( 22,    11) =    11.17
                                                      Prob > F      =   0.0001
Total (centered) SS     =  146.0739744                Centered R2   =   0.7971
Total (uncentered) SS   =  146.0739744                Uncentered R2 =   0.7971
Residual SS             =  29.64056556                Root MSE      =    .4831

------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.1197061   1.541854    -0.08   0.940    -3.513305    3.273892
   lntertedu |  -.7697577   1.100132    -0.70   0.499    -3.191132    1.651617
       lngdp |  -.2470292    .500921    -0.49   0.632    -1.349549    .8554904
lntransition |   5.076224   2.060217     2.46   0.031     .5417168     9.61073
 lntradefree |  -.4964094   .4291283    -1.16   0.272    -1.440914    .4480955
  lneconfree |    1.12866    .879382     1.28   0.226    -.8068468    3.064167
   lnforbank |   .3345589   .2012192     1.66   0.125    -.1083216    .7774394
privatisat~n |   .4026688   .1096154     3.67   0.004      .161407    .6439307
 instability |  -.6108348   .2247348    -2.72   0.020    -1.105473   -.1161968
       d2008 |   1.355782   .9164258     1.48   0.167    -.6612576    3.372821
       d2007 |   1.365044    .868219     1.57   0.144    -.5458934    3.275981
       d2006 |    .811068   .6489852     1.25   0.237    -.6173387    2.239475
       d2005 |   .4835501   .5869892     0.82   0.428    -.8084045    1.775505
       d2004 |   .1252609   .3957253     0.32   0.758    -.7457247    .9962465
       d2003 |  -.2678727   .3002555    -0.89   0.391    -.9287305    .3929852
       d2002 |  -.2286209   .3365222    -0.68   0.511    -.9693012    .5120595
       d2001 |  -.3842012   .3030284    -1.27   0.231    -1.051162    .2827599
       d2000 |  -.4933962   .0291878   -16.90   0.000    -.5576382   -.4291542
       d1999 |  -.4412351   .2043401    -2.16   0.054    -.8909846    .0085144
       d1998 |  -.1556949    .195433    -0.80   0.443    -.5858401    .2744503
       d1997 |   -.228637   .2546274    -0.90   0.388    -.7890681    .3317942
       d1996 |  -.2014967   .1402195    -1.44   0.179    -.5101178    .1071244
------------------------------------------------------------------------------
Warning: estimated covariance matrix of moment conditions not of full rank.
         standard errors and model tests should be interpreted with caution.
Possible causes:
         number of clusters insufficient to calculate robust covariance matrix
         singleton dummy variable (dummy with one 1 and N-1 0s or vice versa)
partial option may address problem.
------------------------------------------------------------------------------
Included instruments: lnsecedu lntertedu lngdp lntransition lntradefree
                      lneconfree lnforbank privatisation instability d2008 d2007
                      d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
                      d1997 d1996
------------------------------------------------------------------------------
```

Appendix 5.7: Models 5.2-5.4 results

```
**model 5.2
. **FEVD
. xtfevd lnfdiflow lnsecedu lntertedu lngenvocratio lngdp lntransition lntradefree lneconfree
lnforbank privatisat
> ion instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997
d1996, invariant (lnsece
> du lntertedu lngdp lngenvocratio)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       126          number of obs       =       161
mean squared error         = .1841029          F( 25, 126)         = 41.14599
root mean squared error    = .4290721          Prob > F            = 1.16e-47
Residual Sum of Squares    = 29.64056          R-squared           = .9167456
Total Sum of Squares       = 356.0239          adj. R-squared      = .8942801
Estimation Sum of Squares  = 326.3834

------------------------------------------------------------------------------
             |                fevd
   lnfdiflow |      Coef.  Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   5.076224   3.254858     1.56   0.121    -1.365045    11.51749
 lntradefree |  -.4964094   .7266036    -0.68   0.496    -1.934337    .9415178
  lneconfree |    1.12866   1.320899     0.85   0.394    -1.485359    3.742679
   lnforbank |   .3345589    .267463     1.25   0.213    -.1947424    .8638603
privatisat~n |   .4026688   .1113381     3.62   0.000     .1823341    .6230036
 instability |  -.6108347   .3584418    -1.70   0.091    -1.320181    .0985111
       d2008 |   1.355782   .5810615     2.33   0.021     .2058784    2.505685
       d2007 |   1.365044   .5719967     2.39   0.018     .2330791    2.497008
       d2006 |    .811068    .580221     1.40   0.165    -.3371724    1.959308
       d2005 |   .4835501   .5705436     0.85   0.398    -.6455389    1.612639
       d2004 |   .1252609   .5636853     0.22   0.825    -.9902557    1.240777
       d2003 |  -.2678727   .5498498    -0.49   0.627    -1.356009    .8202638
       d2002 |  -.2286209   .5404437    -0.42   0.673    -1.298143    .8409013
       d2001 |  -.3842013   .5179701    -0.74   0.460    -1.409249    .6408463
       d2000 |  -.4933962   .4940989    -1.00   0.320    -1.471203     .484411
       d1999 |  -.4412351   .4598204    -0.96   0.339    -1.351206     .468736
       d1998 |  -.1556949   .4270309    -0.36   0.716    -1.000776    .6893867
       d1997 |   -.228637   .4073868    -0.56   0.576    -1.034843    .5775695
       d1996 |  -.2014967   .3542701    -0.57   0.571    -.9025869    .4995935
    lnsecedu |  -.3189886   .5298442    -0.60   0.548    -1.367535    .7295575
   lntertedu |   -.428064   .7707516    -0.56   0.580    -1.953359    1.097231
       lngdp |   .5137274   .2291567     2.24   0.027     .0602329    .9672218
lngenvocra~o |  -.0552107   .3658122    -0.15   0.880    -.7791422    .6687208
         eta |          1          .        .       .            .           .
       _cons |  -11.88948   6.365258    -1.87   0.064    -24.48614    .7071753
```

```
. **model 5.3
. **FEVD
. xtfevd lnfdiflow lnsecedu lntertedu lnedutr1 lngdp lntransition lntradefree lneconfree
lnforbank privatisation i
> nstability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996,
invariant (lnsecedu ln
> tertedu lngdp lnedutr1)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =      126           number of obs       =      161
mean squared error         = .1841029           F( 25, 126)         = 36.47658
root mean squared error    = .4290721           Prob > F            = 7.65e-45
Residual Sum of Squares    = 29.64057           R-squared           = .9167456
Total Sum of Squares       = 356.0239           adj. R-squared      = .8942801
Estimation Sum of Squares  = 326.3834

------------------------------------------------------------------------------
             |                fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   5.076224   2.985388     1.70   0.092    -.8317714    10.98422
 lntradefree |  -.4964095   .7162338    -0.69   0.490    -1.913815    .9209962
  lneconfree |    1.12866   1.301289     0.87   0.387    -1.446553    3.703873
   lnforbank |   .3345589   .2408748     1.39   0.167    -.1421252     .811243
privatisat~n |   .4026688   .1101926     3.65   0.000     .1846009    .6207368
 instability |  -.6108348   .3530232    -1.73   0.086    -1.309457    .0877877
       d2008 |   1.355782    .598041     2.27   0.025     .1722763    2.539288
       d2007 |   1.365044   .5817162     2.35   0.021     .2138446    2.516243
       d2006 |    .811068   .5789397     1.40   0.164    -.3346366    1.956773
       d2005 |   .4835501    .565222     0.86   0.394    -.6350076    1.602108
       d2004 |   .1252609   .5524884     0.23   0.821    -.9680974    1.218619
       d2003 |  -.2678727    .533324    -0.50   0.616    -1.323305    .7875599
       d2002 |  -.2286209   .5159143    -0.44   0.658      -1.2496    .7923584
       d2001 |  -.3842012   .4908528    -0.78   0.435    -1.355584     .587182
       d2000 |  -.4933962   .4693119    -1.05   0.295    -1.422151    .4353583
       d1999 |  -.4412351     .43338    -1.02   0.311    -1.298881    .4164112
       d1998 |  -.1556949   .3953311    -0.39   0.694    -.9380436    .6266538
       d1997 |   -.228637   .3784126    -0.60   0.547    -.9775044    .5202304
       d1996 |  -.2014967    .329943    -0.61   0.542    -.8544442    .4514508
    lnsecedu |  -.3645756   .5312595    -0.69   0.494    -1.415922    .6867713
   lntertedu |  -.5740212   .5265747    -1.09   0.278    -1.616097    .4680547
       lngdp |   .4251323   .2143216     1.98   0.049     .0009962    .8492684
    lnedutr1 |  -1.414284   1.508223    -0.94   0.350    -4.399012    1.570444
         eta |          1          .        .       .            .           .
       _cons |   -10.7882   6.206171    -1.74   0.085    -23.07003    1.493633
```

```
**model 5.4
. **Driscoll-Kraay FE
. xtscc lnfdiflow lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
lnforbank privatisation in
> stability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =       107
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 23,     11)    =    346.66
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7825

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.7990205   1.651207    -0.48   0.638    -4.433302    2.835261
   lntertedu |   -1.02028   .3865625    -2.64   0.023    -1.871098   -.1694617
    lnedutr2 |   11.35946   2.786995     4.08   0.002     5.225326    17.49359
       lngdp |  -1.086931   .4286627    -2.54   0.028    -2.030411   -.1434509
lntransition |  -.9312099   3.983058    -0.23   0.819    -9.697862    7.835442
 lntradefree |  -.4775107   .3679055    -1.30   0.221    -1.287265    .3322438
  lneconfree |  -.3184353   1.085194    -0.29   0.775    -2.706931     2.07006
   lnforbank |   .3335295   .1223288     2.73   0.020     .0642857    .6027734
privatisat~n |   .3794268   .1232884     3.08   0.011     .1080709    .6507826
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |   .5667871   .1631372     3.47   0.005     .2077245    .9258498
       d2006 |   .5958942    .327618     1.82   0.096    -.1251881    1.316977
       d2005 |   .9514534    .511122     1.86   0.090    -.1735185    2.076425
       d2004 |   1.564274   .7947424     1.97   0.075    -.1849424     3.31349
       d2003 |   2.133989   1.025065     2.08   0.062    -.1221634    4.390141
       d2002 |   3.366952   1.346115     2.50   0.029     .4041736    6.329731
       d2001 |   4.699161   1.731943     2.71   0.020     .8871803    8.511142
       d2000 |   6.312527   2.198298     2.87   0.015     1.474106    11.15095
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       _cons |   60.62371   9.606906     6.31   0.000     39.47905    81.76837
```

```
**Model 5.4
**panel-robust FE
. xtreg lnfdiflow lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
lnforbank privatisation in
> stability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, fe
robust
note: instability omitted because of collinearity
note: d2008 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1996 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       107
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.7825                         Obs per group: min =         8
       between = 0.5271                                        avg =       8.9
       overall = 0.1742                                        max =         9

                                                F(11,11)           =         .
corr(u_i, Xb)  = -0.9336                        Prob > F           =         .

                                (Std. Err. adjusted for 12 clusters in country)
------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.7990205   1.609193    -0.50   0.629     -4.34083    2.742789
   lntertedu |   -1.02028     1.5139    -0.67   0.514    -4.352351    2.311791
    lnedutr2 |   11.35946   4.629214     2.45   0.032     1.170628    21.54829
       lngdp |  -1.086931   1.267435    -0.86   0.409    -3.876536    1.702674
lntransition |  -.9312099   4.302016    -0.22   0.833    -10.39988    8.537465
 lntradefree |  -.4775107   1.103373    -0.43   0.674    -2.906018    1.950997
  lneconfree |  -.3184353   1.183674    -0.27   0.793    -2.923683    2.286813
   lnforbank |   .3335295   .3455008     0.97   0.355    -.4269127    1.093972
privatisat~n |   .3794268   .1293191     2.93   0.014     .0947972    .6640563
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |   .5667871   .2382675     2.38   0.037      .042364     1.09121
       d2006 |   .5958942    .443151     1.34   0.206    -.3794745    1.571263
       d2005 |   .9514534   .5600551     1.70   0.117    -.2812196    2.184126
       d2004 |   1.564274   .8104142     1.93   0.080    -.2194358    3.347983
       d2003 |   2.133989   1.054008     2.02   0.068    -.1858661    4.453844
       d2002 |   3.366952   1.318436     2.55   0.027     .4650934    6.268812
       d2001 |   4.699161   1.803052     2.61   0.024     .7306713    8.667651
       d2000 |   6.312527   2.489947     2.54   0.028     .8321905    11.79286
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       _cons |   60.62371   38.50919     1.57   0.144    -24.13446    145.3819
-------------+----------------------------------------------------------------
     sigma_u |  3.4335813
     sigma_e |  .43663278
         rho |   .9840863   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
. **two-way cluster-robust FE (clusters: country & year), small-sample adjustment
. xtivreg2 lnfdiflow lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
lnforbank privatisation instab
> ility d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, fe
cluster(country year) small
Warning: estimated covariance matrix of moment conditions not of full rank.
         standard errors and model tests should be interpreted with caution.
Possible causes:
         number of clusters insufficient to calculate robust covariance matrix
         singleton dummy variable (dummy with one 1 and N-1 0s or vice versa)
partial option may address problem.
Warning - collinearities detected
Vars dropped:  instability d2000 d1999 d1998 d1997 d1996

FIXED EFFECTS ESTIMATION
------------------------
Number of groups =        12                    Obs per group: min =         8
                                                               avg =       8.9
                                                               max =         9

OLS estimation
--------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on country and year

Number of clusters (country) =      12                Number of obs =      107
Number of clusters (year) =          9                F( 17,     8) =     0.86
                                                      Prob > F      =   0.6285
Total (centered) SS     =  68.36354012                Centered R2   =   0.7825
Total (uncentered) SS   =  68.36354012                Uncentered R2 =   0.7825
Residual SS             =  14.87055865                Root MSE      =    .4366

------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -.7990205   1.489491    -0.54   0.606    -4.233794    2.635753
   lntertedu |   -1.02028   1.412756    -0.72   0.491    -4.278102    2.237542
    lnedutr2 |   11.35946   4.349243     2.61   0.031     1.330087    21.38883
       lngdp |  -1.086931   1.168591    -0.93   0.380    -3.781706    1.607844
lntransition |  -.9312099   5.569214    -0.17   0.871    -13.77384    11.91142
 lntradefree |  -.4775107   1.043737    -0.46   0.659    -2.884373    1.929352
  lneconfree |  -.3184353   1.477547    -0.22   0.835    -3.725665    3.088795
   lnforbank |   .3335295   .2418876     1.38   0.205    -.2242642    .8913232
privatisat~n |   .3794268   .1597211     2.38   0.045     .0111093    .7477442
       d2008 |  -6.312527   2.552748    -2.47   0.039    -12.19917   -.4258798
       d2007 |   -5.74574   2.343857    -2.45   0.040    -11.15068   -.3407959
       d2006 |  -5.716633   2.256395    -2.53   0.035    -10.91989   -.5133758
       d2005 |  -5.361074   2.081727    -2.58   0.033    -10.16155   -.5606015
       d2004 |  -4.748253   1.778748    -2.67   0.028    -8.850053   -.6464539
       d2003 |  -4.178538   1.508894    -2.77   0.024    -7.658054   -.6990219
       d2002 |  -2.945575   1.149142    -2.56   0.033      -5.5955   -.2956494
       d2001 |  -1.613366   .6404581    -2.52   0.036    -3.090265   -.1364671
------------------------------------------------------------------------------
Warning: estimated covariance matrix of moment conditions not of full rank.
         standard errors and model tests should be interpreted with caution.
Possible causes:
         number of clusters insufficient to calculate robust covariance matrix
         singleton dummy variable (dummy with one 1 and N-1 0s or vice versa)
partial option may address problem.
------------------------------------------------------------------------------
Included instruments: lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree
                      lneconfree lnforbank privatisation d2008 d2007 d2006 d2005
                      d2004 d2003 d2002 d2001
Dropped collinear:    instability d2000 d1999 d1998 d1997 d1996
------------------------------------------------------------------------------
```

Appendix 5.8: Models 5.5-5.7 results

```
**Model 5.5
**FEVD
. xtfevd lnfdiflow lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
lnforbank privatisation
> d2005 d2004 d2003, invariant (lnsecedu lntertedu lngdp lnvacancy)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =        24          number of obs       =        48
mean squared error         = .0883556           F( 14, 24)          =   9.82583
root mean squared error    = .2972467           Prob > F            = 1.45e-06
Residual Sum of Squares    = 4.241069           R-squared           = .9375918
Total Sum of Squares       = 67.95695           adj. R-squared      =   .877784
Estimation Sum of Squares  = 63.71588

------------------------------------------------------------------------------
             |                fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   5.192804   70.00127     0.07   0.941    -139.2827    149.6683
 lntradefree |  -1.025658   10.17839    -0.10   0.921    -22.03282     19.9815
  lneconfree |  -4.195524   4.598553    -0.91   0.371    -13.68647    5.295424
   lnforbank |   .2211436   3.320147     0.07   0.947    -6.631302    7.073589
privatisat~n |   .5754189   .5556053     1.04   0.311    -.5712941    1.722132
       d2005 |   .4173607   1.081872     0.39   0.703    -1.815513    2.650234
       d2004 |   .0397049   1.245805     0.03   0.975     -2.53151     2.61092
       d2003 |   -.166552    .397613    -0.42   0.679    -.9871849    .6540808
    lnsecedu |   .4925184   1.715465     0.29   0.776    -3.048027    4.033064
   lntertedu |   .3462602   6.931933     0.05   0.961    -13.96055    14.65307
       lngdp |   .6376342    3.15114     0.20   0.841       -5.866    7.141268
   lnvacancy |  -.2549383   6.466808    -0.04   0.969    -13.60177     13.0919
         eta |          1          .        .       .            .           .
       _cons |   4.578285   58.70432     0.08   0.938    -116.5815    125.7381
```

```
. **model 5.5
. **Driscoll-Kraay FE
. xtscc lnfdiflow lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
lnforbank privatisation i
> nstability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
d1995, fe

Regression with Driscoll-Kraay standard errors   Number of obs     =        48
Method: Fixed-effects regression                 Number of groups  =        12
Group variable (i): country                      F( 24,    11)     =     25.53
maximum lag: 1                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.7150

------------------------------------------------------------------------------
             |             Drisc/Kraay
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -7.362814   3.866754    -1.90   0.083    -15.87348    1.147853
   lntertedu |  -1.617557   .4828556    -3.35   0.006    -2.680315   -.5547994
   lnvacancy |   .2964394   .1332782     2.22   0.048      .003096    .5897827
       lngdp |   1.532452   .6216916     2.46   0.031     .1641177    2.900786
lntransition |   5.192804   3.472798     1.50   0.163    -2.450774    12.83638
 lntradefree |  -1.025658    .623642    -1.64   0.128    -2.398284    .3469691
  lneconfree |  -4.195524   1.518957    -2.76   0.018    -7.538726   -.8523229
   lnforbank |   .2211437   .4908849     0.45   0.661    -.8592866    1.301574
privatisat~n |   .5754189   .1023149     5.62   0.000     .3502254    .8006124
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |  (omitted)
       d2006 |  (omitted)
       d2005 |   16.20471   16.51479     0.98   0.348    -20.14411    52.55353
       d2004 |   15.82706   16.36398     0.97   0.354    -20.18983    51.84394
       d2003 |    15.6208   16.28146     0.96   0.358    -20.21446    51.45606
       d2002 |   15.78735   16.10244     0.98   0.348    -19.65387    51.22857
       d2001 |  (omitted)
       d2000 |  (omitted)
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |  (omitted)
```

```
**model 5.5 robustness checks
. **panel-robust FE
. xtreg lnfdiflow lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
lnforbank privatisation i
> nstability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
d1995, fe robust
note: instability omitted because of collinearity
note: d2008 omitted because of collinearity
note: d2007 omitted because of collinearity
note: d2006 omitted because of collinearity
note: d2004 omitted because of collinearity
note: d2001 omitted because of collinearity
note: d2000 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1996 omitted because of collinearity
note: d1995 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =        48
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.7150                         Obs per group: min =         4
       between = 0.2125                                        avg =       4.0
       overall = 0.2040                                        max =         4

                                                F(11,11)           =         .
corr(u_i, Xb)  = -0.9582                        Prob > F           =         .

                               (Std. Err. adjusted for 12 clusters in country)
------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -7.362814   5.021575    -1.47   0.171    -18.41523    3.689597
   lntertedu |  -1.617557   2.440575    -0.66   0.521    -6.989227    3.754112
   lnvacancy |   .2964394   .6519483     0.45   0.658    -1.138489    1.731368
       lngdp |   1.532452   1.809276     0.85   0.415    -2.449737     5.51464
lntransition |   5.192804   5.057197     1.03   0.327    -5.938013    16.32362
 lntradefree |  -1.025658   1.464621    -0.70   0.498    -4.249266    2.197951
  lneconfree |  -4.195524    3.08922    -1.36   0.202    -10.99485    2.603803
   lnforbank |   .2211437    .997418     0.22   0.829    -1.974158    2.416446
privatisat~n |   .5754189   .1729685     3.33   0.007     .1947179    .9561199
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |  (omitted)
       d2006 |  (omitted)
       d2005 |   .3776558   .4360385     0.87   0.405    -.5820586     1.33737
       d2004 |  (omitted)
       d2003 |  -.2062569   .2882827    -0.72   0.489    -.8407628     .428249
       d2002 |  -.0397049   .6914996    -0.06   0.955    -1.561685    1.482275
       d2001 |  (omitted)
       d2000 |  (omitted)
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   15.82706   43.87987     0.36   0.725    -80.75188     112.406
-------------+----------------------------------------------------------------
     sigma_u |  3.7215238
     sigma_e |  .42037028
         rho |  .98740158   (fraction of variance due to u_i)
```

```
. **two-way cluster-robust FE (clusters: country & year), small-sample adjustment
. xtivreg2 lnfdiflow lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
lnforbank privatisation insta
> bility d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996, fe
cluster(country year) small
Warning: estimated covariance matrix of moment conditions not of full rank.
         standard errors and model tests should be interpreted with caution.
Possible causes:
         number of clusters insufficient to calculate robust covariance matrix
         singleton dummy variable (dummy with one 1 and N-1 0s or vice versa)
partial option may address problem.
Warning - collinearities detected
Vars dropped:  instability d2008 d2007 d2006 d2002 d2001 d2000 d1999 d1998 d1997
               d1996

FIXED EFFECTS ESTIMATION
------------------------
Number of groups =        12                    Obs per group: min =         4
                                                               avg =       4.0
                                                               max =         4

OLS estimation
--------------

Estimates efficient for homoskedasticity only
Statistics robust to heteroskedasticity and clustering on country and year

Number of clusters (country) =      12              Number of obs =       48
Number of clusters (year) =          4              F( 12,     3) =     2.87
                                                    Prob > F      =   0.2089
Total (centered) SS     =  14.87872551              Centered R2   =   0.7150
Total (uncentered) SS   =  14.87872551              Uncentered R2 =   0.7150
Residual SS             =  4.241068124              Root MSE      =    .4204

------------------------------------------------------------------------------
             |               Robust
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnsecedu |  -7.362814   6.694397    -1.10   0.352    -28.66737    13.94174
   lntertedu |  -1.617557   1.346714    -1.20   0.316    -5.903404    2.668289
   lnvacancy |   .2964394    .332908     0.89   0.439    -.7630224    1.355901
       lngdp |   1.532452   1.333552     1.15   0.334    -2.711505    5.776409
lntransition |   5.192804   4.263002     1.22   0.310    -8.373972    18.75958
 lntradefree |  -1.025658   1.226393    -0.84   0.464    -4.928588    2.877273
  lneconfree |  -4.195524   2.948984    -1.42   0.250    -13.58051    5.189459
    lnforbank |   .2211437   .8049584     0.27   0.801    -2.340593    2.782881
privatisat~n |   .5754189   .1604665     3.59   0.037     .0647429    1.086095
       d2005 |   .4173607   .7489441     0.56   0.616    -1.966114    2.800835
       d2004 |   .0397049   .3812042     0.10   0.924    -1.173457    1.252867
       d2003 |   -.166552   .3178929    -0.52   0.637    -1.178229    .8451252
------------------------------------------------------------------------------
Warning: estimated covariance matrix of moment conditions not of full rank.
         standard errors and model tests should be interpreted with caution.
Possible causes:
         number of clusters insufficient to calculate robust covariance matrix
         singleton dummy variable (dummy with one 1 and N-1 0s or vice versa)
partial option may address problem.
------------------------------------------------------------------------------
Included instruments: lnsecedu lntertedu lnvacancy lngdp lntransition
                      lntradefree lneconfree lnforbank privatisation d2005 d2004
                      d2003
Dropped collinear:    instability d2008 d2007 d2006 d2002 d2001 d2000 d1999
                      d1998 d1997 d1996
------------------------------------------------------------------------------
```

```
. **model 5.6
. **FEVD
. xtfevd lnfdiflow lnsecedu lntertedu lncognitive lngdp lntransition lntradefree lneconfree
lnforbank privatisatio
> n instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996,
invariant (lnsecedu
>  lntertedu lngdp lncognitive)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       114          number of obs       =       148
mean squared error         = .1895275           F( 25, 114)         = 34.79964
root mean squared error    = .4353476           Prob > F            = 4.54e-41
Residual Sum of Squares    = 28.05007           R-squared           = .9195435
Total Sum of Squares       = 348.6367           adj. R-squared      = .8962535
Estimation Sum of Squares  = 320.5866

------------------------------------------------------------------------------
             |                fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   4.164404   3.421488     1.22   0.226    -2.613537    10.94234
 lntradefree |  -.6065213   .7645734    -0.79   0.429    -2.121135    .9080927
  lneconfree |   1.308299   1.209804     1.08   0.282    -1.088314    3.704913
   lnforbank |   .5379091   .3507974     1.53   0.128    -.1570178    1.232836
privatisat~n |   .3951362   .1248085     3.17   0.002     .1478916    .6423809
 instability |  -.6689404   .3633525    -1.84   0.068    -1.388739    .0508582
       d2008 |   1.314611    .759752     1.73   0.086    -.1904513    2.819674
       d2007 |   1.344188    .724338     1.86   0.066    -.0907199    2.779096
       d2006 |   .7289289   .6940138     1.05   0.296    -.6459071    2.103765
       d2005 |   .4422089   .6641826     0.67   0.507    -.8735317     1.75795
       d2004 |   .0912998   .6263405     0.15   0.884    -1.149476    1.332076
       d2003 |  -.3671024   .5992905    -0.61   0.541    -1.554292    .8200875
       d2002 |  -.2956889    .563415    -0.52   0.601     -1.41181    .8204319
       d2001 |  -.4453612   .5398705    -0.82   0.411    -1.514841    .6241181
       d2000 |  -.5392883   .4782913    -1.13   0.262     -1.48678     .408203
       d1999 |   -.521057   .4488259    -1.16   0.248    -1.410178    .3680637
       d1998 |  -.1993567   .4152317    -0.48   0.632    -1.021927    .6232141
       d1997 |  -.2079851   .3850522    -0.54   0.590    -.9707705    .5548003
       d1996 |  -.2765067   .3255859    -0.85   0.398      -.92149    .3684765
    lnsecedu |  -.4124725   .5226991    -0.79   0.432    -1.447935    .6229904
   lntertedu |  -.5501259   .6640389    -0.83   0.409    -1.865582      .76533
       lngdp |   .5012058   .2175962     2.30   0.023     .0701493    .9322622
 lncognitive |    2.41587   3.884817     0.62   0.535    -5.279923    10.11166
         eta |          1          .        .       .            .           .
       _cons |  -13.71058   6.707268    -2.04   0.043    -26.99763   -.4235353
```

```
. **model 5.7
. **FEVD
. xtfevd lnfdiflow lnsecedu lntertedu lntop lngdp lntransition lntradefree lneconfree
lnforbank privatisation inst
> ability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996,
invariant (lnsecedu lnter
> tedu lngdp lntop)

panel fixed effects regression with vector decomposition

degrees of freedom fevd    =       114          number of obs       =      148
mean squared error         = .1895275           F( 25, 114)         = 32.67579
root mean squared error    = .4353476           Prob > F            = 9.56e-40
Residual Sum of Squares    = 28.05007           R-squared           = .9195435
Total Sum of Squares       = 348.6367           adj. R-squared      = .8962535
Estimation Sum of Squares  = 320.5866

------------------------------------------------------------------------------
             |              fevd
   lnfdiflow |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lntransition |   4.164404   3.194222     1.30   0.195    -2.163326    10.49213
 lntradefree |  -.6065213   .7390153    -0.82   0.414    -2.070505    .8574624
  lneconfree |   1.308299   1.196722     1.09   0.277    -1.062398    3.678997
   lnforbank |   .5379091    .331839     1.62   0.108    -.1194615     1.19528
privatisat~n |   .3951362   .1241694     3.18   0.002     .1491576    .6411149
 instability |  -.6689404    .361589    -1.85   0.067    -1.385245    .0473645
       d2008 |   1.314612     .73272     1.79   0.075    -.1369011    2.766124
       d2007 |   1.344188   .6996647     1.92   0.057    -.0418424    2.730218
       d2006 |   .7289289   .6713526     1.09   0.280    -.6010154    2.058873
       d2005 |   .4422089   .6428006     0.69   0.493    -.8311741    1.715592
       d2004 |   .0912998   .6093314     0.15   0.881    -1.115781     1.29838
       d2003 |  -.3671023   .5897418    -0.62   0.535    -1.535376    .8011715
       d2002 |  -.2956889   .5581891    -0.53   0.597    -1.401457    .8100794
       d2001 |  -.4453612    .540905    -0.82   0.412     -1.51689    .6261674
       d2000 |  -.5392883   .4801443    -1.12   0.264     -1.49045    .4118738
       d1999 |   -.521057   .4532775    -1.15   0.253    -1.418996    .3768823
       d1998 |  -.1993567   .4229686    -0.47   0.638    -1.037254    .6385408
       d1997 |  -.2079851   .3961099    -0.53   0.601    -.9926757    .5767055
       d1996 |  -.2765067    .336526    -0.82   0.413    -.9431621    .3901487
    lnsecedu |  -.3370755   .4856186    -0.69   0.489    -1.299082    .6249313
   lntertedu |  -.5978336   .6339079    -0.94   0.348      -1.8536    .6579331
       lngdp |   .4168696   .2310097     1.80   0.074    -.0407588     .874498
       lntop |   .5065795   .3949159     1.28   0.202    -.2757458    1.288905
         eta |          1          .        .       .            .           .
       _cons |  -6.678992    8.26356    -0.81   0.421    -23.04904    9.691058
```

Appendix 5.9: Stock-adjustment Models 5.15-5.17 results

```
. **Model 5.15
. **LSDVC
. xtlsdvc lnfdistock lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
privatisation instabil
> ity d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995,
initial(bb) vcov(100) f
> irst
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: country                         Number of obs      =       154
Time variable : year                            Number of groups   =        12
Number of instruments = 110                     Obs per group: min =        11
Wald chi2(23) = 740064.52                                      avg =     12.83
Prob > chi2   =     0.000                                      max =        13
------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lnfdistock |
         L1. |   .9050609   .0472958    19.14   0.000     .8123628    .9977589
             |
    lnsecedu |   .1048215   .0475025     2.21   0.027     .0117184    .1979247
   lntertedu |   .0560304   .0385592     1.45   0.146    -.0195442    .1316051
       lngdp |   .0867569   .0497128     1.75   0.081    -.0106784    .1841922
lntransition |   .4294225   .3159713     1.36   0.174    -.1898699    1.048715
 lntradefree |   .1467702   .1159331     1.27   0.206    -.0804544    .3739948
  lneconfree |  -.6146536   .1528279    -4.02   0.000    -.9141908   -.3151164
   lnforbank |   .0618411   .0282625     2.19   0.029     .0064475    .1172346
privatisat~n |   .0796853   .0250226     3.18   0.001      .030642    .1287287
 instability |   .0636878   .1054409     0.60   0.546    -.1429725    .2703481
       d2008 |  -.3435988   1.127405    -0.30   0.761    -2.553272    1.866074
       d2007 |  -.0124753   1.132472    -0.01   0.991     -2.23208     2.20713
       d2006 |  -.0218381   1.134666    -0.02   0.985    -2.245743    2.202066
       d2005 |  -.2408557   1.131223    -0.21   0.831    -2.458012    1.976301
       d2004 |  -.0828847   1.136584    -0.07   0.942    -2.310548    2.144778
       d2003 |  -.0387322   1.137437    -0.03   0.973    -2.268068    2.190604
       d2002 |  -.1009702   1.138244    -0.09   0.929    -2.331888    2.129947
       d2001 |  -.2690082    1.13591    -0.24   0.813    -2.495351    1.957334
       d2000 |   -.346811   1.132726    -0.31   0.759    -2.566914    1.873292
       d1999 |  -.2618724    1.13926    -0.23   0.818    -2.494782    1.971037
       d1998 |  -.1511151   1.147168    -0.13   0.895    -2.399523    2.097293
       d1997 |  -.0799517   1.149525    -0.07   0.945    -2.332978    2.173075
       d1996 |  -.0083581   1.154677    -0.01   0.994    -2.271484    2.254768
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
    privatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000 d1999 d1998 d1997 d1996)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.lnfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
    privatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000 d1999 d1998 d1997 d1996
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.29  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.82  Pr > z =  0.413
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(87)    = 114.39  Prob > chi2 =  0.026
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
```

```
  GMM instruments for levels
    Sargan test excluding group:     chi2(75)   =  84.39  Prob > chi2 =  0.214
    Difference (null H = exogenous): chi2(12)   =  30.00  Prob > chi2 =  0.003
  iv(lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank privatisation
instability d2008 d2007
> d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
    Sargan test excluding group:     chi2(65)   =  87.49  Prob > chi2 =  0.033
    Difference (null H = exogenous): chi2(22)   =  26.90  Prob > chi2 =  0.215


note: d2008 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
    privatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000 d1999 d1998 d1997 d1996)
    L(1/.).L.lnfdistock
    lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank
    privatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000 d1999 d1998 d1997 d1996
    D.L.lnfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lngdp lntransition lntradefree lneconfree lnforbank privatisation
instability d2008 d2007
> d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lnfdistock |
         L1. |   .7828173   .0610114    12.83   0.000     .6632372    .9023974
             |
    lnsecedu |  -.0284297   .5658546    -0.05   0.960    -1.137484    1.080625
   lntertedu |  -.4000683   .2779822    -1.44   0.150    -.9449034    .1447668
       lngdp |  -.0491923   .1960674    -0.25   0.802    -.4334772    .3350927
lntransition |   .3480042   .6129296     0.57   0.570    -.8533156    1.549324
 lntradefree |   .1583884    .170685     0.93   0.353     -.176148    .4929248
  lneconfree |   .0330567    .318517     0.10   0.917    -.5912251    .6573385
   lnforbank |   .0205479   .0550637     0.37   0.709    -.0873749    .1284708
privatisat~n |   .0829518   .0283772     2.92   0.003     .0273334    .1385701
 instability |   .1478013   .1451835     1.02   0.309     -.136753    .4323557
       d2007 |   .2539941    .078786     3.22   0.001     .0995765    .4084118
       d2006 |   .1464951   .1107009     1.32   0.186    -.0704747    .3634648
       d2005 |   -.109588    .136392    -0.80   0.422    -.3769113    .1577353
       d2004 |  -.0309901   .1578472    -0.20   0.844    -.3403648    .2783847
       d2003 |  -.0609853   .1931142    -0.32   0.752    -.4394821    .3175114
       d2002 |  -.2027927   .2384648    -0.85   0.395     -.670175    .2645897
       d2001 |  -.4262735   .2663993    -1.60   0.110    -.9484065    .0958596
       d2000 |  -.5228783   .2745711    -1.90   0.057    -1.061028    .0152711
       d1999 |  -.4823994   .2937901    -1.64   0.101    -1.058217    .0934187
       d1998 |  -.4199612    .293462    -1.43   0.152    -.9951362    .1552137
       d1997 |  -.3960572    .325822    -1.22   0.224    -1.034657    .2425422
       d1996 |  -.3659851   .3395602    -1.08   0.281    -1.031511    .2995406
------------------------------------------------------------------------------
```

```
. . **FE
. xtreg lnfdistock l1lnfdistock lnsecedu lntertedu lngdp lntransition lntradefree lneconfree
lnforbank privatisati
> on instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
d1995, fe
note: d2008 omitted because of collinearity
note: d1995 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       154
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.9822                         Obs per group: min =        11
       between = 0.9599                                        avg =      12.8
       overall = 0.9384                                        max =        13

                                                F(22,120)          =    301.66
corr(u_i, Xb)  = 0.5456                         Prob > F           =    0.0000

------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
l1lnfdistock |   .6674096   .0544314    12.26   0.000     .5596393    .7751799
    lnsecedu |  -.1045754    .418508    -0.25   0.803    -.9331921    .7240413
   lntertedu |  -.4363795   .2103971    -2.07   0.040    -.8529512   -.0198078
       lngdp |  -.0212873   .1515265    -0.14   0.889    -.3212993    .2787246
lntransition |   .8798334   .5872634     1.50   0.137    -.2829072    2.042574
 lntradefree |   .1420477   .1558496     0.91   0.364    -.1665237     .450619
  lneconfree |   .0999724   .2685426     0.37   0.710    -.4317232    .6316681
   lnforbank |   .0352891   .0460527     0.77   0.445    -.0558921    .1264703
privatisat~n |   .0743428   .0290266     2.56   0.012      .016872    .1318135
 instability |   .2261211   .1232095     1.84   0.069    -.0178251    .4700674
       d2008 |  (omitted)
       d2007 |   .2176431   .0675212     3.22   0.002     .0839557    .3513305
       d2006 |   .0734303   .0974285     0.75   0.453    -.1194714     .266332
       d2005 |  -.1919698   .1144406    -1.68   0.096    -.4185542    .0346146
       d2004 |  -.1423731   .1415373    -1.01   0.316    -.4226072    .1378609
       d2003 |  -.2037683   .1708699    -1.19   0.235    -.5420788    .1345423
       d2002 |  -.3702204   .2030861    -1.82   0.071    -.7723167     .031876
       d2001 |   -.600323   .2244245    -2.67   0.009    -1.044668   -.1559782
       d2000 |  -.6947769   .2359514    -2.94   0.004    -1.161944   -.2276096
       d1999 |  -.6658584   .2430238    -2.74   0.007    -1.147029   -.1846882
       d1998 |   -.623954   .2531636    -2.46   0.015      -1.1252   -.1227077
       d1997 |  -.6248347   .2764059    -2.26   0.026    -1.172099   -.0775702
       d1996 |  -.6070858   .2891836    -2.10   0.038    -1.179649   -.0345224
       d1995 |  (omitted)
       _cons |   3.143199   3.993757     0.79   0.433    -4.764161    11.05056
-------------+----------------------------------------------------------------
     sigma_u |  .45336375
     sigma_e |  .14498628
         rho |  .90721641   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(11, 120) =     2.71             Prob > F = 0.0038
```

```
. **OLS
. reg lnfdistock l1lnfdistock lnsecedu lntertedu lngdp lntransition lntradefree lneconfree
lnforbank privatisation
>  instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
d1995
note: d1996 omitted because of collinearity
note: d1995 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =     154
-------------+------------------------------           F( 22,   131) =  700.55
       Model |  370.363824    22  16.8347193           Prob > F      =  0.0000
    Residual |  3.14802702   131  .024030741           R-squared     =  0.9916
-------------+------------------------------           Adj R-squared =  0.9902
       Total |  373.511851   153  2.44125393           Root MSE      =  .15502

------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
l1lnfdistock |   .8441584   .0410207    20.58   0.000     .7630097    .9253071
    lnsecedu |   .1280657   .0530201     2.42   0.017     .0231793    .2329521
   lntertedu |    .064451   .0442231     1.46   0.147    -.0230328    .1519348
       lngdp |   .1523334    .045465     3.35   0.001     .0623929    .2422739
lntransition |   .5047635   .3281414     1.54   0.126    -.1443784    1.153905
 lntradefree |   .1635247   .1321116     1.24   0.218    -.0978235    .4248729
  lneconfree |  -.5271588   .1713888    -3.08   0.003    -.8662068   -.1881108
   lnforbank |   .0507018   .0307065     1.65   0.101     -.010043    .1114466
privatisat~n |   .0828858   .0285046     2.91   0.004     .0264969    .1392748
 instability |   .0527444   .1132203     0.47   0.642    -.1712324    .2767212
       d2008 |  -.2588742   .0929773    -2.78   0.006    -.4428055   -.0749428
       d2007 |   .0621191   .0900157     0.69   0.491    -.1159534    .2401915
       d2006 |   .0467715   .0862475     0.54   0.589    -.1238466    .2173895
       d2005 |  -.1689089   .0846073    -2.00   0.048    -.3362824   -.0015354
       d2004 |  -.0217619   .0831464    -0.26   0.794    -.1862453    .1427215
       d2003 |   .0198915   .0788035     0.25   0.801    -.1360007    .1757837
       d2002 |  -.0455109   .0812658    -0.56   0.576    -.2062741    .1152523
       d2001 |  -.2117026   .0811458    -2.61   0.010    -.3722283   -.0511769
       d2000 |  -.2855473   .0826721    -3.45   0.001    -.4490925   -.1220021
       d1999 |  -.2088546   .0760986    -2.74   0.007    -.3593959   -.0583134
       d1998 |  -.1134067   .0726287    -1.56   0.121    -.2570837    .0302702
       d1997 |  -.0517242   .0698502    -0.74   0.460    -.1899046    .0864563
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |  -1.738992   1.138829    -1.53   0.129    -3.991867    .5138824
------------------------------------------------------------------------------
```

```
. **Model 5.16
. **LSDVC
. xtlsdvc lnfdistock lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
lnforbank privatisation
>  instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
d1995, initial(bb) vc
> ov(100) first
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: country                         Number of obs      =       107
Time variable : year                            Number of groups   =        12
Number of instruments = 94                      Obs per group: min =         8
Wald chi2(19) = 704780.79                                      avg =      8.92
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lnfdistock |
         L1. |   .8806979    .055748    15.80   0.000     .7714338    .9899621
             |
    lnsecedu |   .0299378   .0544312     0.55   0.582    -.0767455    .1366211
   lntertedu |   .0304191   .0437684     0.70   0.487    -.0553653    .1162035
    lnedutr2 |  -.2582851     .17619    -1.47   0.143    -.6036113     .087041
       lngdp |   .0820024   .0526182     1.56   0.119    -.0211274    .1851323
lntransition |    .746077   .4455357     1.67   0.094     -.127157    1.619311
 lntradefree |   .0594042   .1628641     0.36   0.715    -.2598035    .3786119
  lneconfree |   -.417111   .1937858    -2.15   0.031    -.7969242   -.0372978
   lnforbank |   .0998654   .0542925     1.84   0.066    -.0065459    .2062767
privatisat~n |   .0793495   .0252475     3.14   0.002     .0298654    .1288336
       d2008 |   -.789825   1.422272    -0.56   0.579    -3.577426    1.997776
       d2007 |  -.4853085    1.43622    -0.34   0.735    -3.300249    2.329632
       d2006 |  -.5319362   1.445626    -0.37   0.713    -3.365312    2.301439
       d2005 |  -.7687698   1.448503    -0.53   0.596    -3.607784    2.070245
       d2004 |  -.6503797   1.464501    -0.44   0.657    -3.520749     2.21999
       d2003 |   -.639123   1.480486    -0.43   0.666    -3.540822    2.262576
       d2002 |  -.7364389   1.500407    -0.49   0.624    -3.677183    2.204305
       d2001 |  -.9431126   1.515681    -0.62   0.534    -3.913792    2.027567
       d2000 |  -1.063012   1.530216    -0.69   0.487     -4.06218    1.936157
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.lnfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.30  Pr > z =  0.195
Arellano-Bond test for AR(2) in first differences: z =  -0.91  Pr > z =  0.361
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(75)   = 120.53  Prob > chi2 =  0.001
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(66)   =  87.02  Prob > chi2 =  0.043
    Difference (null H = exogenous): chi2(9)    =  33.51  Prob > chi2 =  0.000
  iv(lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree lnforbank
privatisation d2008 d2007 d20
> 06 d2005 d2004 d2003 d2002 d2001 d2000)
    Sargan test excluding group:     chi2(57)   =  81.18  Prob > chi2 =  0.019
    Difference (null H = exogenous): chi2(18)   =  39.34  Prob > chi2 =  0.003
```

```
note: d2000 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000)
    L(1/.).L.lnfdistock
    lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001
    d2000
    D.L.lnfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree lneconfree lnforbank
privatisation d2008 d2007 d20
> 06 d2005 d2004 d2003 d2002 d2001 d2000)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lnfdistock |
         L1. |   .8118696   .0992795     8.18   0.000     .6172853    1.006454
             |
    lnsecedu |  -.9165034   .8664793    -1.06   0.290    -2.614772    .7817648
   lntertedu |   -.359973    .391451    -0.92   0.358    -1.127203    .4072568
    lnedutr2 |    1.31286   .9460754     1.39   0.165    -.5414138    3.167134
       lngdp |   .0501852   .2840239     0.18   0.860    -.5064915    .6068618
lntransition |  -1.606036   1.260893    -1.27   0.203     -4.07734    .8652683
 lntradefree |   .3245785   .2781746     1.17   0.243    -.2206337    .8697908
  lneconfree |  -.0315855   .4044924    -0.08   0.938     -.824376    .7612049
   lnforbank |  -.1534018   .1383517    -1.11   0.268    -.4245662    .1177626
privatisat~n |   .0774709   .0338998     2.29   0.022     .0110285    .1439134
       d2008 |  -.5413411     .72054    -0.75   0.452    -1.953574    .8708913
       d2007 |  -.1851626    .667905    -0.28   0.782    -1.494232    1.123907
       d2006 |  -.1685373    .609181    -0.28   0.782     -1.36251    1.025435
       d2005 |   -.337425   .5533745    -0.61   0.542    -1.422019    .7471691
       d2004 |   -.133752   .4538721    -0.29   0.768    -1.023325    .7558209
       d2003 |  -.0393706   .3827414    -0.10   0.918     -.78953     .7107888
       d2002 |  -.0199234   .2749607    -0.07   0.942    -.5588365    .5189896
       d2001 |  -.0838206   .1537376    -0.55   0.586    -.3851408    .2174997
------------------------------------------------------------------------------

.
```

```
. **FE
. xtreg lnfdistock l1lnfdistock lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree
lneconfree lnforbank pr
> ivatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995, fe
note: instability omitted because of collinearity
note: d2008 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1996 omitted because of collinearity
note: d1995 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       107
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.9759                         Obs per group: min =         8
       between = 0.6048                                        avg =       8.9
       overall = 0.6770                                        max =         9

                                                F(18,77)           =    173.34
corr(u_i, Xb)  = 0.2384                         Prob > F           =    0.0000

------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
l1lnfdistock |   .5900802   .0878604     6.72   0.000     .4151278    .7650326
    lnsecedu |  -.5770833   .6965158    -0.83   0.410    -1.964024    .8098569
   lntertedu |  -.5116411   .2926712    -1.75   0.084    -1.094424    .0711417
    lnedutr2 |   1.338536   .8693599     1.54   0.128    -.3925811    3.069652
       lngdp |   .0187818   .2458746     0.08   0.939    -.4708172    .5083807
lntransition |  -1.447564   1.194645    -1.21   0.229    -3.826407    .9312782
 lntradefree |   .3735807   .2330567     1.60   0.113    -.0904945    .8376559
  lneconfree |   .2529951   .3686371     0.69   0.495    -.4810552    .9870454
   lnforbank |  -.1783467   .1113174    -1.60   0.113    -.4000078    .0433145
privatisat~n |   .0632226    .031922     1.98   0.051    -.0003422    .1267875
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |   .2752057   .0808232     3.41   0.001      .114266    .4361453
       d2006 |   .2065971   .1410076     1.47   0.147    -.0741848     .487379
       d2005 |   .0091293   .1879512     0.05   0.961    -.3651294     .383388
       d2004 |    .148199   .2657344     0.56   0.579    -.3809458    .6773438
       d2003 |   .1648078   .3424179     0.48   0.632    -.5170334     .846649
       d2002 |   .1188257   .4349789     0.27   0.785    -.7473279    .9849793
       d2001 |   .0273457    .540983     0.05   0.960    -1.049889    1.104581
       d2000 |   .1187729    .661319     0.18   0.858    -1.198081    1.435627
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |   7.940602   7.217681     1.10   0.275    -6.431636    22.31284
-------------+----------------------------------------------------------------
     sigma_u |  .88236582
     sigma_e |  .13591617
         rho |  .97682281   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(11, 77) =     3.17              Prob > F = 0.0014
```

```
. **OLS

. reg lnfdistock l1lnfdistock lnsecedu lntertedu lnedutr2 lngdp lntransition lntradefree
lneconfree lnforbank priv
> atisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995
note: instability omitted because of collinearity

      Source |       SS       df       MS              Number of obs =     107
-------------+------------------------------           F( 18,    88) =  537.32
       Model |  227.229012    18  12.623834            Prob > F      =  0.0000
    Residual |  2.06746257    88  .023493893           R-squared     =  0.9910
-------------+------------------------------           Adj R-squared =  0.9891
       Total |  229.296474   106  2.16317429           Root MSE      =  .15328

------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
l1lnfdistock |   .8640939   .0683807    12.64   0.000     .7282017    .9999861
    lnsecedu |   .0159029   .0702704     0.23   0.821    -.1237446    .1555505
   lntertedu |   .0232967   .0567916     0.41   0.683    -.0895646     .136158
    lnedutr2 |  -.3325469   .2255358    -1.47   0.144    -.7807519    .1156581
       lngdp |   .0946493   .0657928     1.44   0.154       -.0361    .2253987
lntransition |   .7744966   .5514502     1.40   0.164    -.3213948    1.870388
 lntradefree |   .0908684   .2098557     0.43   0.666    -.3261757    .5079125
  lneconfree |  -.3398062   .2467012    -1.38   0.172     -.830073    .1504606
   lnforbank |   .1158861   .0687244     1.69   0.095    -.0206892    .2524614
privatisat~n |   .0744099   .0322801     2.31   0.024       .01026    .1385598
 instability |  (omitted)
       d2008 |   .3420262    .237467     1.44   0.153    -.1298895     .813942
       d2007 |   .6392588   .2126119     3.01   0.003     .2167374     1.06178
       d2006 |   .5860322   .1900586     3.08   0.003     .2083306    .9637337
       d2005 |   .3462564   .1776614     1.95   0.054    -.0068084    .6993212
       d2004 |   .4566108   .1508898     3.03   0.003     .1567491    .7564726
       d2003 |   .4544518   .1245066     3.65   0.000     .2070211    .7018825
       d2002 |   .3456252   .0934968     3.70   0.000     .1598199    .5314305
       d2001 |   .1281347   .0733051     1.75   0.084    -.0175438    .2738133
       d2000 |  (omitted)
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |  -1.792921   1.944592    -0.92   0.359    -5.657388    2.071546
------------------------------------------------------------------------------

.
```

```
. **Model 5.17
. **LSDVC
. xtlsdvc lnfdistock l1lnfdistock lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree
lneconfree lnforbank
>  privatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995,
> initial(bb) vcov(100) first

note: d2001 dropped because of collinearity
note: l1lnfdistock dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: country                         Number of obs      =        48
Time variable : year                            Number of groups   =        12
Number of instruments = 41                      Obs per group: min =         4
Wald chi2(14) = 488290.14                                      avg =      4.00
Prob > chi2   =     0.000                                      max =         4
------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lnfdistock |
         L1. |   .8977995   .0854526    10.51   0.000     .7303155    1.065283
             |
    lnsecedu |   .0485539   .0715418     0.68   0.497    -.0916654    .1887732
   lntertedu |   .1910826   .0729563     2.62   0.009      .048091    .3340743
   lnvacancy |   .2246185   .0910351     2.47   0.014      .046193    .4030441
       lngdp |   .0778563   .0931203     0.84   0.403    -.1046561    .2603687
lntransition |   .1558071   .6244971     0.25   0.803    -1.068185    1.379799
 lntradefree |   -.062606    .207485    -0.30   0.763    -.4692691    .3440571
  lneconfree |   -.967274   .2399055    -4.03   0.000     -1.43748   -.4970679
   lnforbank |   .2217583   .0771907     2.87   0.004     .0704672    .3730493
privatisat~n |   .1045229   .0328716     3.18   0.001     .0400957    .1689501
       d2005 |   2.468708    2.02655     1.22   0.223    -1.503257    6.440673
       d2004 |   2.591857   2.029857     1.28   0.202    -1.386591    6.570304
       d2003 |   2.627675   2.037782     1.29   0.197    -1.366303    6.621653
       d2002 |   2.552531   2.036454     1.25   0.210    -1.438845    6.543907
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2005 d2004 d2003 d2002)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.lnfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2005 d2004 d2003 d2002
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.61  Pr > z =  0.009
Arellano-Bond test for AR(2) in first differences: z =   1.10  Pr > z =  0.270
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(27)   =  46.99  Prob > chi2 =  0.010
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(23)   =  34.68  Prob > chi2 =  0.056
    Difference (null H = exogenous): chi2(4)    =  12.31  Prob > chi2 =  0.015
  iv(lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree lnforbank
privatisation d2005 d2004 d2
> 003 d2002)
    Sargan test excluding group:     chi2(14)   =  19.95  Prob > chi2 =  0.132
    Difference (null H = exogenous): chi2(13)   =  27.05  Prob > chi2 =  0.012


note: d2003 dropped because of collinearity
      in the LSDV regression
```

```
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2005 d2004 d2003 d2002)
    L(1/.).L.lnfdistock
    lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree
    lnforbank privatisation d2005 d2004 d2003 d2002
    D.L.lnfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree lneconfree lnforbank
privatisation d2005 d2004 d2
> 003 d2002)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lnfdistock |
         L1. |   .8002723   .1714412     4.67   0.000     .4642537    1.136291
             |
    lnsecedu |  -.9372391   1.790581    -0.52   0.601    -4.446713    2.572235
   lntertedu |     .15019   .9760434     0.15   0.878     -1.76282      2.0632
   lnvacancy |   .2876396   .2296195     1.25   0.210    -.1624064    .7376855
       lngdp |   .9855574   .4763982     2.07   0.039      .051834    1.919281
lntransition |  -.3605443   1.831897    -0.20   0.844    -3.950996    3.229908
 lntradefree |    .401198   .3918783     1.02   0.306    -.3668693    1.169265
  lneconfree |  -1.471083    .902214    -1.63   0.103     -3.23939     .297224
   lnforbank |  -.4011407    .249009    -1.61   0.107    -.8891894    .0869081
privatisat~n |   .0438374   .0550406     0.80   0.426    -.0640402     .151715
       d2005 |  -.3316825   .2389914    -1.39   0.165    -.8000971     .136732
       d2004 |  -.1113344   .1293712    -0.86   0.389    -.3648974    .1422286
       d2002 |   .0632003   .1561237     0.40   0.686    -.2427965    .3691971
------------------------------------------------------------------------------
.
```

```
. **FE
. xtreg lnfdistock l1lnfdistock lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree
lneconfree lnforbank p
> rivatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995,fe
note: instability omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =        48
Group variable: country                         Number of groups   =        12

R-sq:  within  = 0.9791                         Obs per group: min =         4
       between = 0.5147                                        avg =       4.0
       overall = 0.5259                                        max =         4

                                                F(13,23)           =     83.08
corr(u_i, Xb)  = -0.7828                        Prob > F           =    0.0000

------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
l1lnfdistock |   .3099765   .1602137     1.93   0.065    -.0214509    .6414038
    lnsecedu |  -2.475255   1.116257    -2.22   0.037    -4.784408   -.1661017
   lntertedu |  -.5593412   .5969751    -0.94   0.359    -1.794278    .6755959
   lnvacancy |   .1357895   .1068955     1.27   0.217    -.0853407    .3569197
       lngdp |   1.287851   .3239115     3.98   0.001     .6177894    1.957913
lntransition |   .0026686   1.358066     0.00   0.998    -2.806704    2.812042
 lntradefree |    .448129   .2018111     2.22   0.037     .0306508    .8656071
  lneconfree |  -.3238841   .6438529    -0.50   0.620    -1.655795    1.008027
   lnforbank |  -.5604368   .1708097    -3.28   0.003    -.9137835     -.20709
privatisat~n |   .0074137   .0285687     0.26   0.798    -.0516852    .0665125
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |  (omitted)
       d2006 |  (omitted)
       d2005 |  -.0643408   .0895869    -0.72   0.480    -.2496654    .1209838
       d2004 |  (omitted)
       d2003 |  -.0388948    .098381    -0.40   0.696    -.2424115    .1646219
       d2002 |  -.0847756   .1911969    -0.44   0.662    -.4802966    .3107454
       d2001 |  (omitted)
       d2000 |  (omitted)
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       _cons |  -15.25231   8.820247    -1.73   0.097    -33.49838    2.993767
-------------+----------------------------------------------------------------
     sigma_u |  1.5068576
     sigma_e |  .07056648
         rho |  .99781173   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(11, 23) =     7.40              Prob > F = 0.0000
```

```
. **OLS
. reg lnfdistock l1lnfdistock lnsecedu lntertedu lnvacancy lngdp lntransition lntradefree
lneconfree lnforbank pri
> vatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995 d1996
note: instability omitted because of collinearity

      Source |       SS       df       MS              Number of obs =      48
-------------+------------------------------           F( 13,    34) =  409.13
       Model |  81.3319117    13  6.2563009           Prob > F      =  0.0000
    Residual |  .519917216    34  .015291683           R-squared     =  0.9936
-------------+------------------------------           Adj R-squared =  0.9912
       Total |  81.8518289    47  1.74152827           Root MSE      =  .12366

------------------------------------------------------------------------------
  lnfdistock |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
l1lnfdistock |   .9729042   .0896259    10.86   0.000     .7907624    1.155046
    lnsecedu |  -.0063703   .0862696    -0.07   0.942    -.1816913    .1689506
   lntertedu |   .1696389   .0943231     1.80   0.081    -.0220487    .3613266
   lnvacancy |   .2367733   .1197646     1.98   0.056    -.0066176    .4801641
       lngdp |   -.000332   .1002784    -0.00   0.997    -.2041221    .2034582
lntransition |  -.1898742   .7579255    -0.25   0.804    -1.730164    1.350416
 lntradefree |  -.0013784   .2669808    -0.01   0.996    -.5439487    .5411919
  lneconfree |  -.8789366   .3044616    -2.89   0.007    -1.497677   -.2601962
   lnforbank |   .2295101   .0990511     2.32   0.027      .028214    .4308061
privatisat~n |   .1138667     .04285     2.66   0.012     .0267851    .2009484
 instability |  (omitted)
       d2008 |  (omitted)
       d2007 |  (omitted)
       d2006 |  (omitted)
       d2005 |  -.1763234   .0591216    -2.98   0.005    -.2964729    -.056174
       d2004 |  -.0444551   .0571931    -0.78   0.442    -.1606854    .0717752
       d2003 |  (omitted)
       d2002 |  -.0784778   .0547007    -1.43   0.161     -.189643    .0326873
       d2001 |  (omitted)
       d2000 |  (omitted)
       d1999 |  (omitted)
       d1998 |  (omitted)
       d1997 |  (omitted)
       d1996 |  (omitted)
       d1995 |  (omitted)
       d1996 |  (omitted)
       _cons |   3.893939   2.342262     1.66   0.106    -.8661106    8.653989
------------------------------------------------------------------------------
```

Appendix 6

Contents

Appendix 6.1: Descriptive statistics and raw correlations

Variable		Mean	Std. Dev.	Min	Max	Observations
manfdi~k	overall	6814.486	10475.6	39.1255	55474.5	N = 153
	between		7983.675	183.9826	23616.39	n = 14
	within		6830.655	-11600.8	38672.6	T-bar = 10.9286
manvac~y	overall	4.155934	1.907717	1.51351	9.94	N = 52
	between		1.863207	2.125	8.77	n = 13
	within		0.609959	2.398837	5.913027	
manpri~n	overall	0.163399	0.370943	0	1	N = 153
	between		0.12112	0	0.5	n = 14
	within		0.35567	-0.3366	1.086476	T-bar = 10.9286
indfdi~k	overall	557.6086	1160.246	1.00E-06	10575.5	N = 1609
	between		887.619	0.065769	4306.717	n = 154
	within		718.8372	-2795.94	6973.497	T-bar = 10.4481
indpri~n	overall	0.010597	0.102413	0	1	N = 2548
	between		0.031407	0	0.214286	n = 182
	within		0.097504	-0.20369	0.939168	T = 14
primedu	overall	91.84012	6.694157	72.5	99.8	N = 168
	between		6.63157	77.12	98.88714	n = 12
	within		2.063354	87.21154	96.16012	T = 14
secedu	overall	45.50548	15.62276	22	80.7	N = 168
	between		15.64613	22.68429	68.08286	n = 12
	within		4.280841	32.22262	58.12262	T = 14
tertedu	overall	7.353095	3.173817	3.3	15.2	N = 168
	between		3.130256	3.471428	13.7	n = 12
	within		1.018513	4.553095	11.17738	T = 14
genvoc~o	overall	0.43949	0.441992	0.146684	1.780488	N = 196
	between		0.457505	0.146684	1.780488	n = 14
	within		0	0.43949	0.43949	T = 14
cognit~e	overall	4.75875	0.399063	3.785	5.192	N = 168
	between		0.415566	3.785	5.192	n = 12
	within		0	4.75875	4.75875	T = 14

top	overall	0.070167	0.035297	0.013	0.122	N = 168
	between		0.036757	0.013	0.122	n = 12
	within		0	0.070167	0.070167	T = 14
vacancy	overall	3.893044	1.362624	1.68085	7.23077	N = 56
	between		1.277325	2.07614	5.463493	n = 14
	within		0.560518	2.023689	5.762399	T = 4
transi~n	overall	3.226143	0.496287	1.111111	3.962222	N = 193
	between		0.43192	2.182619	3.816508	n = 14
	within		0.268185	2.154635	3.821301	T-bar = 13.7857
tradef~e	overall	73.04396	9.87613	46.8	87.8	N = 182
	between		5.907103	62	82.58571	n = 14
	within		8.02428	49.85934	94.21538	T-bar = 13
econfree	overall	57.88642	9.169961	24.42891	77.00185	N = 182
	between		8.099609	39.65407	72.5352	n = 14
	within		4.924805	42.29225	71.63622	T-bar = 13
ictinfra	overall	77.19616	52.2034	1.34503	249.1646	N = 196
	between		22.51218	35.22544	109.7186	n = 14
	within		47.45717	-1.75492	216.6421	T = 14
gdp	overall	4.89E+10	7.23E+10	1.87E+09	5.28E+11	N = 196
	between		6.36E+10	5.02E+09	2.44E+11	n = 14
	within		3.82E+10	-5.65E+10	3.33E+11	T = 14
primex~t	overall	0.116997	0.068248	0.02774	0.334344	N = 196
	between		0.058766	0.046485	0.215017	n = 14
	within		0.037876	-0.00437	0.238943	T = 14
forbank	overall	0.531771	0.220978	0	1	N = 192
	between		0.148502	0.253571	0.779286	n = 14
	within		0.166837	0.030342	0.922485	T-bar = 13.7143
wage	overall	489.474	353.8258	60.8529	2038.203	N = 188
	between		247.6512	149.9469	1070.345	n = 14
	within		256.326	-82.9617	1457.333	T-bar = 13.4286
gini	overall	0.326326	0.042414	0.243	0.406	N = 106
	between		0.039385	0.267	0.377	n = 10
	within		0.021011	0.24454	0.37704	T = 10.6

privat~n	overall	0.408163	0.492752	0	1	N =	196
	between		0.18463	0.214286	0.785714	n =	14
	within		0.459335	-0.37755	1.193878	T =	14
instab~y	overall	0.02551	0.158073	0	1	N =	196
	between		0.066342	0	0.214286	n =	14
	within		0.144496	-0.18878	0.882653	T =	14

```
. corr lnindfdistock lntransition lntradefree lneconfree lnictinfra   lnprimedu lnsecedu lntertedu lngenvocratio l
> nedutr1 lnedutr2 lncognitive lnmanvacancy lngdp lntop
(obs=436)
```

	lnindf~k	lntran~n	lntrad~e	lnecon~e	lnicti~a	lnprim~u	lnsecedu	lntert~u	lngenv~o	lnedutr1	lnedutr2
lnindfdist~k	1.0000										
lntransition	0.3693	1.0000									
lntradefree	-0.0418	0.6437	1.0000								
lneconfree	-0.1511	0.5474	0.7167	1.0000							
lnictinfra	0.3230	0.7060	0.4098	0.4431	1.0000						
lnprimedu	-0.0189	0.5754	0.6081	0.6955	0.1595	1.0000					
lnsecedu	-0.0245	0.3915	0.4837	0.6169	0.3762	0.5440	1.0000				
lntertedu	-0.1009	0.6185	0.7156	0.7028	0.4638	0.4673	0.4482	1.0000			
lngenvocra~o	-0.3512	0.2582	0.6389	0.8035	0.0538	0.6088	0.4993	0.7515	1.0000		
lnedutr1	-0.5068	-0.5051	-0.0341	0.1011	-0.6986	0.1982	-0.0995	-0.0148	0.5272	1.0000	
lnedutr2	-0.1463	-0.0758	0.0954	0.1471	-0.0767	0.2283	-0.0964	0.0817	0.3371	0.6002	1.0000
lncognitive	0.3708	0.8365	0.5338	0.4504	0.8027	0.1890	0.3264	0.4648	0.0600	-0.7290	-0.3532
lnmanvacancy	-0.1573	0.3224	0.4105	0.4147	0.3332	0.1578	0.3788	0.3426	0.1859	-0.1725	-0.0932
lngdp	0.6756	0.4253	-0.1317	-0.3357	0.3035	-0.0045	-0.2089	-0.2398	-0.5694	-0.6277	-0.1597
lntop	0.5018	0.7626	0.2740	0.2002	0.5798	0.2367	0.1043	0.1008	-0.2087	-0.6785	-0.3285

	lncogn~e	lnmanv~y	lngdp	lntop
lncognitive	1.0000			
lnmanvacancy	0.4106	1.0000		
lngdp	0.3514	-0.3275	1.0000	
lntop	0.8427	0.1152	0.6088	1.0000

Appendix 6.2: Models 6.1-6.3 results

```
. **Model (6.1) (LSDVC)
. xtlsdvc manfdistock lnsecedu lntertedu lnwage lngdp lntransition lntradefree
lneconfree lnictinfra manprivatisat
> ion instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995, initial(bb)
>  vcov(100) first
note: variable instability is time-invariant over the
      estimation sample and has been discarded
note: d1995 dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: countryid                       Number of obs      =       123
Time variable : year                            Number of groups   =        12
Number of instruments = 111                     Obs per group: min =         5
Wald chi2(23) =   9866.80                                      avg =     10.25
Prob > chi2   =     0.000                                      max =        13
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |     1.0726   .0261763    40.98   0.000     1.021295    1.123904
             |
    lnsecedu |  -340.3054   618.3513    -0.55   0.582    -1552.252    871.6408
   lntertedu |  -1300.381   656.8293    -1.98   0.048    -2587.742   -13.01892
      lnwage |  -1283.133   516.4708    -2.48   0.013    -2295.397   -270.8687
       lngdp |   691.7068    312.126     2.22   0.027     79.95112    1303.463
lntransition |    5686.72    5120.33     1.11   0.267    -4348.943    15722.38
 lntradefree |   1352.337   1732.993     0.78   0.435    -2044.267    4748.941
  lneconfree |  -191.0656   2032.056    -0.09   0.925    -4173.822    3791.691
  lnictinfra |    1392.16    971.352     1.43   0.152    -511.6546    3295.975
manprivati~n |   1051.042   401.2772     2.62   0.009     264.5531    1837.531
       d2008 |  -25047.28   11848.44    -2.11   0.035    -48269.79   -1824.756
       d2007 |  -21641.46   11831.68    -1.83   0.067    -44831.13    1548.209
       d2006 |  -23297.53   11745.48    -1.98   0.047    -46318.26    -276.811
       d2005 |  -22839.36   11679.05    -1.96   0.051    -45729.87    51.16094
       d2004 |  -22013.19   11629.25    -1.89   0.058    -44806.11    779.7247
       d2003 |  -22247.25   11619.41    -1.91   0.056    -45020.89    526.3767
       d2002 |  -23202.36   11608.43    -2.00   0.046    -45954.46   -450.2528
       d2001 |   -22943.6    11616.4    -1.98   0.048    -45711.32   -175.8761
       d2000 |  -23001.52   11540.42    -1.99   0.046    -45620.34   -382.7105
       d1999 |  -22333.99   11590.56    -1.93   0.054    -45051.07     383.102
       d1998 |  -21692.46   11644.12    -1.86   0.062    -44514.52    1129.605
       d1997 |     -21647    11475.3    -1.89   0.059    -44138.17    844.1746
       d1996 |  -20877.25   11221.91    -1.86   0.063    -42871.78    1117.284
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.manfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.manfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.46  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.72  Pr > z =  0.085
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(88)    = 113.69  Prob > chi2 =  0.034
  (Not robust, but not weakened by many instruments.)
```

```
Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(76)    = 110.57  Prob > chi2 =  0.006
    Difference (null H = exogenous): chi2(12)    =   3.12  Prob > chi2 =  0.995
  iv(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree lnictinfra
manprivatisation d2008 d2007 d
> 2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
    Sargan test excluding group:     chi2(66)    =  99.75  Prob > chi2 =  0.005
    Difference (null H = exogenous): chi2(22)    =  13.94  Prob > chi2 =  0.904


note: d2008 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996)
    L(1/.).L.manfdistock
    lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996
    D.L.manfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree lnictinfra
manprivatisation d2008 d2007 d
> 2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.109882   .0323443    34.31   0.000     1.046488    1.173275
             |
    lnsecedu |  -1594.429   7601.586    -0.21   0.834    -16493.26    13304.41
   lntertedu |  -3574.935   2455.596    -1.46   0.145    -8387.814    1237.944
      lnwage |  -1429.649   3519.215    -0.41   0.685    -8327.184    5467.885
       lngdp |   813.2126   3416.311     0.24   0.812    -5882.635     7509.06
lntransition |   7920.074   12549.35     0.63   0.528    -16676.21    32516.36
 lntradefree |  -86.76408   2289.004    -0.04   0.970    -4573.129    4399.601
  lneconfree |  -2989.151   4433.338    -0.67   0.500    -11678.33    5700.032
  lnictinfra |   2322.138   1712.925     1.36   0.175    -1035.132    5679.409
manprivati~n |   1063.526   508.2505     2.09   0.036     67.37326    2059.679
       d2007 |   3547.624   770.1055     4.61   0.000     2038.245    5057.003
       d2006 |   1887.352   1230.582     1.53   0.125    -524.5442    4299.248
       d2005 |   2321.564    1450.08     1.60   0.109    -520.5407    5163.669
       d2004 |   3224.769   1892.483     1.70   0.088    -484.4285    6933.967
       d2003 |   3149.485   2072.877     1.52   0.129    -913.2784    7212.248
       d2002 |   2278.702   2674.508     0.85   0.394    -2963.237    7520.642
       d2001 |   2616.286   3040.977     0.86   0.390     -3343.92    8576.491
       d2000 |    2479.81   3416.885     0.73   0.468    -4217.161    9176.781
       d1999 |   3371.186   3599.064     0.94   0.349    -3682.851    10425.22
       d1998 |   4194.479   3867.205     1.08   0.278    -3385.103    11774.06
       d1997 |   4049.657   4263.892     0.95   0.342    -4307.418    12406.73
       d1996 |   4040.653   4500.675     0.90   0.369    -4780.509    12861.81
------------------------------------------------------------------------------

.
```

```
. **Model 6.2(LSDVC)
. xtlsdvc manfdistock lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition
lntradefree lneconfree lnictinfra manp
> rivatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000
d1999 d1998 d1997 d1996 d1995, in
> itial(bb) vcov(100) first
note: variable instability is time-invariant over the
      estimation sample and has been discarded
note: variable d1998 is time-invariant over the
      estimation sample and has been discarded
note: variable d1997 is time-invariant over the
      estimation sample and has been discarded
note: variable d1996 is time-invariant over the
      estimation sample and has been discarded
note: variable d1995 is time-invariant over the
      estimation sample and has been discarded
note: d1999 dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: countryid                       Number of obs      =       100
Time variable : year                            Number of groups   =        12
Number of instruments = 95                      Obs per group: min =         5
Wald chi2(20) =   8136.06                                      avg =      8.33
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.052522   .0322886    32.60   0.000     .9892371    1.115806
             |
    lnsecedu |  -23.11787   860.4007    -0.03   0.979    -1709.472    1663.236
   lntertedu |  -1397.665   775.3874    -1.80   0.071    -2917.396    122.0667
    lnedutr2 |   874.9979    2694.53     0.32   0.745    -4406.184     6156.18
      lnwage |  -1280.672   607.6725    -2.11   0.035    -2471.689   -89.65622
       lngdp |   958.7519   403.8551     2.37   0.018     167.2105    1750.293
lntransition |   6663.675   6441.502     1.03   0.301    -5961.437    19288.79
 lntradefree |   1005.576   2548.743     0.39   0.693    -3989.868     6001.02
  lneconfree |  -531.4659   3004.468    -0.18   0.860    -6420.115    5357.183
  lnictinfra |   1209.865    1394.95     0.87   0.386    -1524.187    3943.917
manprivati~n |   1023.948   466.8776     2.19   0.028     108.8851    1939.012
       d2008 |  -28684.51   14891.79    -1.93   0.054    -57871.88    502.8663
       d2007 |  -25253.97    14961.8    -1.69   0.091    -54578.55    4070.611
       d2006 |  -26859.49   14948.99    -1.80   0.072    -56158.97    2439.996
       d2005 |  -26369.34   14957.59    -1.76   0.078    -55685.68     2947.01
       d2004 |   -25486.8   15046.67    -1.69   0.090    -54977.74    4004.134
       d2003 |  -25597.07   15180.02    -1.69   0.092    -55349.36    4155.215
       d2002 |  -26391.33   15369.09    -1.72   0.086    -56514.19     3731.53
       d2001 |  -26007.33   15611.36    -1.67   0.096    -56605.03    4590.375
       d2000 |  -25942.48      15787    -1.64   0.100    -56884.43    4999.473
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003
    d2002 d2001 d2000)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.manfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003
    d2002 d2001 d2000
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.manfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.91  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.74  Pr > z =  0.082
------------------------------------------------------------------------------
```

```
Sargan test of overid. restrictions: chi2(75)   =  92.39  Prob > chi2 =  0.084
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(66)   =  90.12  Prob > chi2 =  0.026
    Difference (null H = exogenous): chi2(9)    =   2.26  Prob > chi2 =  0.987
  iv(lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition lntradefree lneconfree
lnictinfra manprivatisation d200
> 8 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000)
    Sargan test excluding group:     chi2(56)   =  79.55  Prob > chi2 =  0.021
    Difference (null H = exogenous): chi2(19)   =  12.84  Prob > chi2 =  0.847


note: d2008 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003
    d2002 d2001 d2000)
    L(1/.).L.manfdistock
    lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003
    d2002 d2001 d2000
    D.L.manfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lnedutr2 lnwage lngdp lntransition lntradefree lneconfree
lnictinfra manprivatisation d200
> 8 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.088028   .0412909    26.35   0.000     1.007099    1.168957
             |
    lnsecedu |  -3265.546   11491.29    -0.28   0.776    -25788.06    19256.97
   lntertedu |  -1711.834   4335.963    -0.39   0.693    -10210.16    6786.497
    lnedutr2 |  -13602.46   12138.54    -1.12   0.262    -37393.55    10188.64
      lnwage |   1134.347   4976.724     0.23   0.820    -8619.853    10888.55
       lngdp |  -1190.473   6112.637    -0.19   0.846    -13171.02    10790.08
lntransition |   7844.214    20536.8     0.38   0.702    -32407.17    48095.59
 lntradefree |   211.0329   3910.167     0.05   0.957    -7452.753    7874.819
  lneconfree |  -4061.495   4946.871    -0.82   0.412    -13757.18    5634.193
  lnictinfra |   2575.773   2358.717     1.09   0.275    -2047.227    7198.774
manprivati~n |   1090.971   615.0621     1.77   0.076    -114.5289     2296.47
       d2007 |    2751.99   1173.893     2.34   0.019     451.2012    5052.779
       d2006 |   332.2169   1758.272     0.19   0.850    -3113.932    3778.366
       d2005 |  -255.6132   2634.327    -0.10   0.923    -5418.799    4907.572
       d2004 |  -696.7297   3582.555    -0.19   0.846    -7718.409    6324.949
       d2003 |  -2260.891   4651.731    -0.49   0.627    -11378.12    6856.334
       d2002 |  -4729.846   5917.202    -0.80   0.424    -16327.35    6867.656
       d2001 |  -6308.386   7546.808    -0.84   0.403    -21099.86    8483.086
       d2000 |  -8755.319   9273.901    -0.94   0.345    -26931.83    9421.192
------------------------------------------------------------------------------

.
```

```
. **Model 6.3(LSDVC)
. xtlsdvc manfdistock lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition
lntradefree lneconfree lnictinfra
> manprivatisation instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000
d1999 d1998 d1997 d1996 d1995
> , initial(bb) vcov(100) first
note: variable instability is time-invariant over the
      estimation sample and has been discarded
note: variable d2008 is time-invariant over the
      estimation sample and has been discarded
note: variable d2007 is time-invariant over the
      estimation sample and has been discarded
note: variable d2006 is time-invariant over the
      estimation sample and has been discarded
note: variable d2000 is time-invariant over the
      estimation sample and has been discarded
note: variable d1999 is time-invariant over the
      estimation sample and has been discarded
note: variable d1998 is time-invariant over the
      estimation sample and has been discarded
note: variable d1997 is time-invariant over the
      estimation sample and has been discarded
note: variable d1996 is time-invariant over the
      estimation sample and has been discarded
note: variable d1995 is time-invariant over the
      estimation sample and has been discarded
note: d2001 dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: countryid                       Number of obs      =        42
Time variable : year                            Number of groups   =        11
Number of instruments = 42                      Obs per group: min =         2
Wald chi2(15) =   4799.88                                      avg =      3.82
Prob > chi2   =     0.000                                      max =         4
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.123667   .0622207    18.06   0.000     1.001716    1.245617
             |
    lnsecedu |   -1041.55   823.2802    -1.27   0.206     -2655.15    572.0491
   lntertedu |  -1349.383   1051.208    -1.28   0.199    -3409.712    710.9461
lnmanvacancy |   710.7931   764.0726     0.93   0.352    -786.7618    2208.348
      lnwage |  -1244.385   711.7049    -1.75   0.080    -2639.301    150.5304
       lngdp |   608.5713    546.446     1.11   0.265    -462.4432    1679.586
lntransition |   4894.127   8667.262     0.56   0.572    -12093.39    21881.65
 lntradefree |     1969.3   2982.297     0.66   0.509    -3875.894    7814.495
  lneconfree |  -1334.806   3648.063    -0.37   0.714    -8484.878    5815.267
  lnictinfra |   1516.244   1533.711     0.99   0.323    -1489.774    4522.262
manprivati~n |   815.1173   490.8693     1.66   0.097     -146.969    1777.204
       d2005 |  -17218.18   17684.34    -0.97   0.330    -51878.84    17442.48
       d2004 |  -16132.48   17762.84    -0.91   0.364       -50947    18682.04
       d2003 |  -16342.54   17754.02    -0.92   0.357    -51139.77     18454.7
       d2002 |  -17378.44   17721.23    -0.98   0.327    -52111.43    17354.54
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2005 d2004 d2003 d2002)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.manfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2005 d2004 d2003 d2002
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.manfdistock
------------------------------------------------------------------------------
```

```
Arellano-Bond test for AR(1) in first differences: z =  -1.63  Pr > z =  0.103
Arellano-Bond test for AR(2) in first differences: z =  -1.62  Pr > z =  0.105
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(27)   =  42.84  Prob > chi2 =  0.027
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(23)   =  41.14  Prob > chi2 =  0.011
    Difference (null H = exogenous): chi2(4)    =   1.70  Prob > chi2 =  0.790
  iv(lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition lntradefree lneconfree
lnictinfra manprivatisation
> d2005 d2004 d2003 d2002)
    Sargan test excluding group:     chi2(13)   =  14.97  Prob > chi2 =  0.309
    Difference (null H = exogenous): chi2(14)   =  27.87  Prob > chi2 =  0.015


note: d2002 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2005 d2004 d2003 d2002)
    L(1/.).L.manfdistock
    lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition lntradefree
    lneconfree lnictinfra manprivatisation d2005 d2004 d2003 d2002
    D.L.manfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lnmanvacancy lnwage lngdp lntransition lntradefree lneconfree
lnictinfra manprivatisation
> d2005 d2004 d2003 d2002)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |    1.20136   .1448339     8.29   0.000     .9174913     1.48523
             |
    lnsecedu |   32802.57   32123.64     1.02   0.307    -30158.61    95763.74
   lntertedu |  -6925.728   16240.79    -0.43   0.670     -38757.1    24905.64
lnmanvacancy |   5870.575   3191.668     1.84   0.066    -384.9786    12126.13
      lnwage |  -1879.595   21845.65    -0.09   0.931    -44696.28     40937.1
       lngdp |  -5682.114   20281.17    -0.28   0.779    -45432.47    34068.24
lntransition |  -67394.92   40335.44    -1.67   0.095    -146450.9    11661.08
 lntradefree |   3942.533   4907.706     0.80   0.422    -5676.394    13561.46
  lneconfree |  -11957.93   12904.55    -0.93   0.354    -37250.37    13334.52
  lnictinfra |   6223.325   6382.685     0.98   0.330    -6286.507    18733.16
manprivati~n |   423.7125   872.1456     0.49   0.627    -1285.661    2133.086
       d2005 |   2715.529   5036.157     0.54   0.590    -7155.158    12586.22
       d2004 |   3492.799   3906.217     0.89   0.371    -4163.246    11148.84
       d2003 |   1981.686   2441.031     0.81   0.417    -2802.646    6766.018
------------------------------------------------------------------------------

.
.
```

```
. **Testing down Model (6.1)to reduce the instrument count
. **Initial full Model
. xtlsdvc manfdistock lnsecedu lntertedu lnwage lngdp lntransition lntradefree
lneconfree lnictinfra manprivatisat
> ion instability d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998
d1997 d1996 d1995, initial(bb)
>  vcov(100) first
note: variable instability is time-invariant over the
      estimation sample and has been discarded
note: d1995 dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: countryid                       Number of obs      =       123
Time variable : year                            Number of groups   =        12
Number of instruments = 111                     Obs per group: min =         5
Wald chi2(23) =   9866.80                                      avg =     10.25
Prob > chi2   =     0.000                                      max =        13
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |     1.0726   .0261763    40.98   0.000     1.021295    1.123904
             |
    lnsecedu |  -340.3054   618.3513    -0.55   0.582    -1552.252    871.6408
   lntertedu |  -1300.381   656.8293    -1.98   0.048    -2587.742   -13.01892
      lnwage |  -1283.133   516.4708    -2.48   0.013    -2295.397   -270.8687
       lngdp |   691.7068    312.126     2.22   0.027     79.95112    1303.463
lntransition |    5686.72    5120.33     1.11   0.267    -4348.943    15722.38
 lntradefree |   1352.337   1732.993     0.78   0.435    -2044.267    4748.941
  lneconfree |  -191.0656   2032.056    -0.09   0.925    -4173.822    3791.691
  lnictinfra |    1392.16    971.352     1.43   0.152    -511.6546    3295.975
manprivati~n |   1051.042   401.2772     2.62   0.009     264.5531    1837.531
       d2008 |  -25047.28   11848.44    -2.11   0.035    -48269.79   -1824.756
       d2007 |  -21641.46   11831.68    -1.83   0.067    -44831.13    1548.209
       d2006 |  -23297.53   11745.48    -1.98   0.047    -46318.26    -276.811
       d2005 |  -22839.36   11679.05    -1.96   0.051    -45729.87    51.16094
       d2004 |  -22013.19   11629.25    -1.89   0.058    -44806.11    779.7247
       d2003 |  -22247.25   11619.41    -1.91   0.056    -45020.89    526.3767
       d2002 |  -23202.36   11608.43    -2.00   0.046    -45954.46   -450.2528
       d2001 |   -22943.6    11616.4    -1.98   0.048    -45711.32   -175.8761
       d2000 |  -23001.52   11540.42    -1.99   0.046    -45620.34   -382.7105
       d1999 |  -22333.99   11590.56    -1.93   0.054    -45051.07     383.102
       d1998 |  -21692.46   11644.12    -1.86   0.062    -44514.52    1129.605
       d1997 |     -21647    11475.3    -1.89   0.059    -44138.17    844.1746
       d1996 |  -20877.25   11221.91    -1.86   0.063    -42871.78    1117.284
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.manfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.manfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.46  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.72  Pr > z =  0.085
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(88)   = 113.69  Prob > chi2 =  0.034
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
```

```
  GMM instruments for levels
    Sargan test excluding group:     chi2(76)   = 110.57  Prob > chi2 =  0.006
    Difference (null H = exogenous): chi2(12)   =   3.12  Prob > chi2 =  0.995
  iv(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree lnictinfra
manprivatisation d2008 d2007 d
> 2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
    Sargan test excluding group:     chi2(66)   =  99.75  Prob > chi2 =  0.005
    Difference (null H = exogenous): chi2(22)   =  13.94  Prob > chi2 =  0.904


note: d2008 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996)
    L(1/.).L.manfdistock
    lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree
    lnictinfra manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002
    d2001 d2000 d1999 d1998 d1997 d1996
    D.L.manfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lnwage lngdp lntransition lntradefree lneconfree lnictinfra
manprivatisation d2008 d2007 d
> 2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.109882   .0323443    34.31   0.000     1.046488    1.173275
             |
    lnsecedu |  -1594.429   7601.586    -0.21   0.834    -16493.26    13304.41
   lntertedu |  -3574.935   2455.596    -1.46   0.145    -8387.814    1237.944
      lnwage |  -1429.649   3519.215    -0.41   0.685    -8327.184    5467.885
       lngdp |   813.2126   3416.311     0.24   0.812    -5882.635     7509.06
lntransition |   7920.074   12549.35     0.63   0.528    -16676.21    32516.36
 lntradefree |  -86.76408   2289.004    -0.04   0.970    -4573.129    4399.601
  lneconfree |  -2989.151   4433.338    -0.67   0.500    -11678.33    5700.032
  lnictinfra |   2322.138   1712.925     1.36   0.175    -1035.132    5679.409
manprivati~n |   1063.526   508.2505     2.09   0.036     67.37326    2059.679
       d2007 |   3547.624   770.1055     4.61   0.000     2038.245    5057.003
       d2006 |   1887.352   1230.582     1.53   0.125    -524.5442    4299.248
       d2005 |   2321.564    1450.08     1.60   0.109    -520.5407    5163.669
       d2004 |   3224.769   1892.483     1.70   0.088    -484.4285    6933.967
       d2003 |   3149.485   2072.877     1.52   0.129    -913.2784    7212.248
       d2002 |   2278.702   2674.508     0.85   0.394    -2963.237    7520.642
       d2001 |   2616.286   3040.977     0.86   0.390     -3343.92    8576.491
       d2000 |    2479.81   3416.885     0.73   0.468    -4217.161    9176.781
       d1999 |   3371.186   3599.064     0.94   0.349    -3682.851    10425.22
       d1998 |   4194.479   3867.205     1.08   0.278    -3385.103    11774.06
       d1997 |   4049.657   4263.892     0.95   0.342    -4307.418    12406.73
       d1996 |   4040.653   4500.675     0.90   0.369    -4780.509    12861.81
------------------------------------------------------------------------------

. test lntradefree=lnwage

 ( 1)  - lnwage + lntradefree = 0

           chi2(  1) =    0.14
         Prob > chi2 =    0.7080
```

```
. **lntradefree & lnwage dropped
. xtlsdvc manfdistock lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra
manprivatisation instability d20
> 08 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995,
initial(bb) vcov(100) first
note: variable instability is time-invariant over the
      estimation sample and has been discarded
note: d1995 dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: countryid                       Number of obs      =       123
Time variable : year                            Number of groups   =        12
Number of instruments = 109                     Obs per group: min =         5
Wald chi2(21) =   9683.23                                      avg =     10.25
Prob > chi2   =     0.000                                      max =        13
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.078477   .0262135    41.14   0.000       1.0271    1.129855
             |
    lnsecedu |   453.8763   527.1814     0.86   0.389    -579.3803    1487.133
   lntertedu |  -463.7821    568.805    -0.82   0.415    -1578.619    651.0553
       lngdp |   730.4102    311.379     2.35   0.019     120.1187    1340.702
lntransition |   1033.303   4642.291     0.22   0.824    -8065.419    10132.03
  lneconfree |   89.87123   2043.452     0.04   0.965     -3915.22    4094.963
  lnictinfra |  -252.3672   715.9008    -0.35   0.724    -1655.507    1150.773
manprivati~n |   1055.678   400.6972     2.63   0.008     270.3263     1841.03
       d2008 |  -20450.76   10261.33    -1.99   0.046    -40562.59   -338.9233
       d2007 |  -17002.97   10242.76    -1.66   0.097    -37078.41    3072.461
       d2006 |  -18623.74   10214.39    -1.82   0.068    -38643.57    1396.099
       d2005 |  -18233.52   10151.93    -1.80   0.072    -38130.94    1663.904
       d2004 |  -17585.72   10172.57    -1.73   0.084    -37523.59    2352.152
       d2003 |  -17841.27   10139.17    -1.76   0.078    -37713.67    2031.137
       d2002 |  -18655.09   10081.78    -1.85   0.064    -38415.02    1104.844
       d2001 |  -18501.87    10083.4    -1.83   0.067    -38264.96    1261.225
       d2000 |  -18845.12   10021.38    -1.88   0.060    -38486.67    796.4189
       d1999 |  -18708.81   10103.63    -1.85   0.064    -38511.57    1093.947
       d1998 |  -18387.52   10135.48    -1.81   0.070     -38252.7    1477.651
       d1997 |  -18778.31   10061.98    -1.87   0.062    -38499.43    942.8156
       d1996 |  -18193.15   9831.386    -1.85   0.064    -37462.32     1076.01
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra
    manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000
    d1999 d1998 d1997 d1996)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.manfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra
    manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000
    d1999 d1998 d1997 d1996
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.manfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.65  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.74  Pr > z =  0.082
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(88)   = 117.51  Prob > chi2 =  0.019
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(76)   = 113.21  Prob > chi2 =  0.004
    Difference (null H = exogenous): chi2(12)   =   4.30  Prob > chi2 =  0.977
```

```
  iv(lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra manprivatisation
d2008 d2007 d2006 d2005 d2004 d2
> 003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
    Sargan test excluding group:     chi2(68)   = 106.51  Prob > chi2 =  0.002
    Difference (null H = exogenous): chi2(20)   =  11.00  Prob > chi2 =  0.946


note: d2008 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra
    manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000
    d1999 d1998 d1997 d1996)
    L(1/.).L.manfdistock
    lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra
    manprivatisation d2008 d2007 d2006 d2005 d2004 d2003 d2002 d2001 d2000
    d1999 d1998 d1997 d1996
    D.L.manfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lngdp lntransition lneconfree lnictinfra manprivatisation
d2008 d2007 d2006 d2005 d2004 d2
> 003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.109596   .0319144    34.77   0.000     1.047045    1.172147
             |
    lnsecedu |  -1664.669   7488.975    -0.22   0.824    -16342.79    13013.45
   lntertedu |   -3377.63   2364.661    -1.43   0.153    -8012.281    1257.021
       lngdp |  -152.6028    2072.84    -0.07   0.941    -4215.294    3910.088
lntransition |   9594.075   10908.45     0.88   0.379     -11786.1    30974.25
  lneconfree |  -3203.673   4433.677    -0.72   0.470    -11893.52    5486.173
  lnictinfra |   2078.302    1624.33     1.28   0.201    -1105.326    5261.929
manprivati~n |    1074.64   503.5038     2.13   0.033     87.79097     2061.49
       d2007 |   3653.279   745.3131     4.90   0.000     2192.492    5114.066
       d2006 |   2102.954    1171.01     1.80   0.073    -192.1826    4398.091
       d2005 |    2569.91   1376.149     1.87   0.062    -127.2934    5267.113
       d2004 |   3502.326   1807.185     1.94   0.053    -39.69133    7044.343
       d2003 |   3454.557   2000.264     1.73   0.084    -465.8889    7375.003
       d2002 |   2663.975   2601.781     1.02   0.306    -2435.422    7763.373
       d2001 |   3057.517   2970.441     1.03   0.303    -2764.441    8879.474
       d2000 |   2939.487   3355.627     0.88   0.381    -3637.421    9516.396
       d1999 |   3762.966    3601.28     1.04   0.296    -3295.414    10821.35
       d1998 |   4652.535   3790.458     1.23   0.220    -2776.626     12081.7
       d1997 |   4585.972   4092.148     1.12   0.262    -3434.491    12606.44
       d1996 |   4682.647   4207.508     1.11   0.266    -3563.917    12929.21
------------------------------------------------------------------------------

. test lntransition=lneconfree=0

 ( 1)  lntransition - lneconfree = 0
 ( 2)  lntransition = 0

           chi2(  2) =    0.86
         Prob > chi2 =    0.6490

.
```

```
. **lntransition & lneconfree dropped
. xtlsdvc manfdistock lnsecedu lntertedu lngdp lnictinfra manprivatisation
instability d2008 d2007 d2006 d2005 d20
> 04 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996 d1995, initial(bb) vcov(100)
first
note: variable instability is time-invariant over the
      estimation sample and has been discarded
note: d1995 dropped because of collinearity
Note: Bias correction initialized by Blundell and Bond estimator

Note: Blundell and Bond estimator is implemented through
      the user-written Stata command -xtabond2- by David Roodman,
      Center for Global Development, Washington, DC droodman@cgdev.org
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: countryid                       Number of obs      =       123
Time variable : year                            Number of groups   =        12
Number of instruments = 107                     Obs per group: min =         5
Wald chi2(19) =   9688.47                                      avg =     10.25
Prob > chi2   =     0.000                                      max =        13
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.078748   .0261542    41.25   0.000     1.027487     1.13001
             |
    lnsecedu |    510.602   471.3558     1.08   0.279    -413.2383    1434.442
   lntertedu |  -361.7917   429.7157    -0.84   0.400    -1204.019    480.4356
       lngdp |   775.4905   238.9738     3.25   0.001     307.1105     1243.87
  lnictinfra |    -197.26   641.9894    -0.31   0.759    -1455.536    1061.016
manprivati~n |   1070.962   401.8862     2.66   0.008     283.2792    1858.644
       d2008 |  -20595.35   6223.301    -3.31   0.001    -32792.79   -8397.902
       d2007 |   -17141.4   6247.456    -2.74   0.006    -29386.19   -4896.615
       d2006 |  -18745.82   6216.559    -3.02   0.003    -30930.06   -6561.593
       d2005 |  -18346.49   6204.613    -2.96   0.003    -30507.31   -6185.669
       d2004 |  -17699.98   6211.021    -2.85   0.004    -29873.36     -5526.6
       d2003 |  -17941.32   6174.393    -2.91   0.004    -30042.91   -5839.734
       d2002 |  -18743.82   6124.903    -3.06   0.002    -30748.41   -6739.231
       d2001 |  -18587.01    6135.62    -3.03   0.002     -30612.6   -6561.415
       d2000 |  -18933.28   6121.088    -3.09   0.002    -30930.39   -6936.166
       d1999 |  -18793.62    6145.96    -3.06   0.002    -30839.48   -6747.759
       d1998 |  -18479.31   6134.312    -3.01   0.003    -30502.34   -6456.275
       d1997 |  -18874.02   6120.981    -3.08   0.002    -30870.92   -6877.114
       d1996 |  -18325.85     6019.1    -3.04   0.002    -30123.07   -6528.625
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lnsecedu lntertedu lngdp lnictinfra manprivatisation d2008 d2007 d2006
    d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.manfdistock
Instruments for levels equation
  Standard
    lnsecedu lntertedu lngdp lnictinfra manprivatisation d2008 d2007 d2006
    d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.manfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -5.02  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.64  Pr > z =  0.101
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(88)   = 117.40  Prob > chi2 =  0.020
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(76)   = 112.71  Prob > chi2 =  0.004
    Difference (null H = exogenous): chi2(12)   =   4.69  Prob > chi2 =  0.968
  iv(lnsecedu lntertedu lngdp lnictinfra manprivatisation d2008 d2007 d2006 d2005
d2004 d2003 d2002 d2001 d2000 d1
> 999 d1998 d1997 d1996)
    Sargan test excluding group:     chi2(70)   = 108.37  Prob > chi2 =  0.002
    Difference (null H = exogenous): chi2(18)   =   9.02  Prob > chi2 =  0.959
```

```
note: d2008 dropped because of collinearity
      in the LSDV regression
note: Bias correction up to order O(1/T)

    D.(lnsecedu lntertedu lngdp lnictinfra manprivatisation d2008 d2007 d2006
    d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996)
    L(1/.).L.manfdistock
    lnsecedu lntertedu lngdp lnictinfra manprivatisation d2008 d2007 d2006
    d2005 d2004 d2003 d2002 d2001 d2000 d1999 d1998 d1997 d1996
    D.L.manfdistock
  GMM instruments for levels
  iv(lnsecedu lntertedu lngdp lnictinfra manprivatisation d2008 d2007 d2006 d2005
d2004 d2003 d2002 d2001 d2000 d1
> 999 d1998 d1997 d1996)
LSDVC dynamic regression
(bootstrapped SE)
------------------------------------------------------------------------------
 manfdistock |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 manfdistock |
         L1. |   1.115415   .0286414    38.94   0.000     1.059279    1.171551
             |
    lnsecedu |   497.0232   6624.399     0.08   0.940    -12486.56    13480.61
   lntertedu |  -3585.485   2385.215    -1.50   0.133    -8260.422    1089.451
       lngdp |   168.8159   1777.261     0.09   0.924    -3314.552    3652.184
  lnictinfra |   2243.391   1582.473     1.42   0.156    -858.1999    5344.982
manprivati~n |   1103.146   495.3471     2.23   0.026      132.284    2074.009
       d2007 |   3744.107   754.0481     4.97   0.000       2266.2    5222.015
       d2006 |   2235.989   1105.156     2.02   0.043     69.92333    4402.055
       d2005 |   2811.592   1314.114     2.14   0.032     235.9761    5387.207
       d2004 |   3706.883   1730.324     2.14   0.032     315.5104    7098.256
       d2003 |   3678.514   1852.524     1.99   0.047      47.6335    7309.394
       d2002 |    2971.32   2430.712     1.22   0.222    -1792.787    7735.427
       d2001 |   3334.252   2751.173     1.21   0.226    -2057.949    8726.452
       d2000 |   3331.485   3172.755     1.05   0.294    -2886.999     9549.97
       d1999 |   3999.806   3373.288     1.19   0.236    -2611.717    10611.33
       d1998 |   4767.836   3561.059     1.34   0.181    -2211.711    11747.38
       d1997 |       4675   3876.807     1.21   0.228    -2923.403     12273.4
       d1996 |   5106.965    4090.08     1.25   0.212    -2909.444    13123.37
------------------------------------------------------------------------------
```

Appendix 6.3: Technological intensity classification

NACE Rev 1.1 code and economic activity		Original OECD classification	Technology dummy variables
DA	Food products, beverages and tobacco	L	Low
DB/DC	Textiles/leather and textile/leather products	L	Low
DD/DE	Wood and wood products; pulp, paper and paper products; publishing and printing	L	Low
DF	Coke, refined petroleum products and nuclear fuel	M-L	Medium
DG*	Chemicals, chemical products and man-made fibers	M-H	High
DH	Rubber and plastic products	M-L	Medium
DI	(Other) non-metallic mineral products	M-L	Medium
DJ	Basic metals and fabricated metal products	M-L	Medium
DK	Machinery and equipment n.e.c.	M-H	High
DL**	Electrical and optical equipment	H	High
DM	Transport equipment	M-H	High
D*	Furniture; n.e.c.; recycling	L	Low

Source: OECD (2011)

*All sub-groups except for one are classified as 'medium-high' in the original classification

**Three out of four sub-groups are classified as 'high' in the original classification

Appendix 6.4: Unit root tests and initial specification tests

```
***Fisher unit root tests, using demean option to account for cross-sectional
dependence

. xtunitroot fisher lnindfdistock, pp lag(1) demean
could not compute test for panel 16
could not compute test for panel 80

Fisher-type unit-root test for lnindfdistock
Based on Phillips-Perron tests
-------------------------------------------
Ho: All panels contain unit roots          Number of panels       =    154
Ha: At least one panel is stationary       Avg. number of periods =  10.45

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included              Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(304)  P       469.2289       0.0000
 Inverse normal            Z        -2.9576       0.0016
 Inverse logit t(709)      L*       -4.0156       0.0000
 Modified inv. chi-squared Pm        6.7009       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher  lntransition, pp lag(1) demean

Fisher-type unit-root test for lntransition
Based on Phillips-Perron tests
-------------------------------------------
Ho: All panels contain unit roots          Number of panels       =    182
Ha: At least one panel is stationary       Avg. number of periods =  13.79

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included              Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(364)  P      1280.3454       0.0000
 Inverse normal            Z       -20.7716       0.0000
 Inverse logit t(914)      L*      -24.6875       0.0000
 Modified inv. chi-squared Pm       33.9620       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher  lntradefree, pp lag(1) demean

Fisher-type unit-root test for lntradefree
Based on Phillips-Perron tests
------------------------------------------
Ho: All panels contain unit roots          Number of panels       =    182
Ha: At least one panel is stationary       Avg. number of periods =  13.00

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included              Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(364)  P       662.7768       0.0000
 Inverse normal            Z        -9.7649       0.0000
 Inverse logit t(914)      L*       -9.8332       0.0000
 Modified inv. chi-squared Pm       11.0734       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
```

```
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher  lneconfree, pp lag(1) demean

Fisher-type unit-root test for lneconfree
Based on Phillips-Perron tests
-----------------------------------------
Ho: All panels contain unit roots           Number of panels       =    182
Ha: At least one panel is stationary        Avg. number of periods =  13.00

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included               Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(364)  P      1231.2940       0.0000
 Inverse normal            Z       -12.8428       0.0000
 Inverse logit t(914)      L*      -20.5767       0.0000
 Modified inv. chi-squared Pm       32.1441       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher  lnictinfra, pp lag(1) demean

Fisher-type unit-root test for lnictinfra
Based on Phillips-Perron tests
-----------------------------------------
Ho: All panels contain unit roots           Number of panels  =    182
Ha: At least one panel is stationary        Number of periods =     14

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included               Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(364)  P       232.2167       1.0000
 Inverse normal            Z         8.3788       1.0000
 Inverse logit t(914)      L*        8.6198       1.0000
 Modified inv. chi-squared Pm       -4.8842       1.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher  lnsecedu, pp lag(1) demean

Fisher-type unit-root test for lnsecedu
Based on Phillips-Perron tests
---------------------------------------
Ho: All panels contain unit roots           Number of panels  =     12
Ha: At least one panel is stationary        Number of periods =     14

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included               Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(24)   P        54.0188       0.0004
 Inverse normal            Z        -2.6761       0.0037
 Inverse logit t(54)       L*       -3.4712       0.0005
 Modified inv. chi-squared Pm        4.3328       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

.
```

```
. xtunitroot fisher  lngdp, pp lag(1) demean

Fisher-type unit-root test for lngdp
Based on Phillips-Perron tests
------------------------------------
Ho: All panels contain unit roots          Number of panels  =     14
Ha: At least one panel is stationary       Number of periods =     14

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included              Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(28)   P       106.7239       0.0000
 Inverse normal            Z        -2.1162       0.0172
 Inverse logit t(74)       L*       -5.5884       0.0000
 Modified inv. chi-squared Pm       10.5199       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

```
. xtunitroot fisher  lntertedu, pp lag(1) demean

Fisher-type unit-root test for lntertedu
Based on Phillips-Perron tests
----------------------------------------
Ho: All panels contain unit roots          Number of panels  =    156
Ha: At least one panel is stationary       Number of periods =     14

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included              Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(312)  P       257.3760       0.9893
 Inverse normal            Z         6.6218       1.0000
 Inverse logit t(654)      L*        7.5725       1.0000
 Modified inv. chi-squared Pm       -2.1867       0.9856
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher  lnedutransition2, pp lag(1) demean

Fisher-type unit-root test for lnedutransition2
Based on Phillips-Perron tests
-----------------------------------------------
Ho: All panels contain unit roots          Number of panels       =    156
Ha: At least one panel is stationary       Avg. number of periods =   8.92

AR parameter:    Panel-specific            Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included              Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(312)  P      2298.1686       0.0000
 Inverse normal            Z       -18.8831       0.0000
 Inverse logit t(784)      L*      -42.5685       0.0000
 Modified inv. chi-squared Pm       79.5104       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

```
. xtunitroot fisher  lnwage, pp lag(1) demean

Fisher-type unit-root test for lnwage
Based on Phillips-Perron tests
-------------------------------------
Ho: All panels contain unit roots           Number of panels       =    182
Ha: At least one panel is stationary        Avg. number of periods =  13.43

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Not included               Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(364)  P       727.1602       0.0000
 Inverse normal            Z        -2.4153       0.0079
 Inverse logit t(914)      L*       -5.9800       0.0000
 Modified inv. chi-squared Pm       13.4596       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

```
**initial specification
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock)
iv(lnsecedu lntertedu  lnwage lngdp
>    lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-d2008 c2-
c14 s2-s13) two robust small o
> rthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Number of instruments may be large relative to number of observations.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 134                     Obs per group: min =         1
F(44, 129)    =     67.62                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2978747   .1451054     2.05   0.042     .0107801    .5849692
             |
    lnsecedu |  -.7572554   1.126232    -0.67   0.503    -2.985534    1.471023
   lntertedu |  -.3391896   1.069308    -0.32   0.752    -2.454842    1.776462
      lnwage |  -.5601606   .5341135    -1.05   0.296    -1.616917    .4965961
       lngdp |   .5910103   .6396796     0.92   0.357    -.6746115    1.856632
 lntradefree |  -.1064939   .2762006    -0.39   0.700    -.6529637    .4399758
  lneconfree |   1.182877   .7703745     1.54   0.127    -.3413275    2.707082
lntransition |    2.08377   1.370431     1.52   0.131    -.6276612    4.795202
  lnictinfra |   .3746656   .3347958     1.12   0.265    -.2877362    1.037067
indprivati~n |   1.470644   .8406541     1.75   0.083    -.1926106    3.133899
       d1996 |  -.8238078   .9906252    -0.83   0.407    -2.783784    1.136168
       d1997 |  -.7123139   .9452012    -0.75   0.452    -2.582418     1.15779
       d1998 |  -.6416653   .8744837    -0.73   0.464    -2.371853    1.088522
       d1999 |  -.5669629   .7863053    -0.72   0.472    -2.122687    .9887614
       d2000 |  -.9257001   .5840057    -1.59   0.115     -2.08117    .2297696
       d2001 |   -.681652   .5886138    -1.16   0.249    -1.846239    .4829349
       d2002 |   -.549423   .5465017    -1.01   0.317     -1.63069     .531844
       d2003 |  -.4686766   .5202426    -0.90   0.369    -1.497989     .560636
       d2004 |  -.2185787   .3180992    -0.69   0.493    -.8479458    .4107884
       d2005 |  -.1601537   .2349323    -0.68   0.497     -.624973    .3046657
       d2006 |  -.2169285   .1548289    -1.40   0.164    -.5232613    .0894042
       d2007 |  -.1622286   .2340824    -0.69   0.490    -.6253663    .3009091
          c4 |   1.857914   1.019322     1.82   0.071    -.1588397    3.874668
          c5 |   2.510407    1.97487     1.27   0.206    -1.396921    6.417735
          c6 |   1.836361     1.6223     1.13   0.260    -1.373399    5.046121
          c7 |   2.515459   2.237896     1.12   0.263    -1.912274    6.943192
          c8 |   1.084082   1.116441     0.97   0.333    -1.124823    3.292987
          c9 |   1.744383   1.618597     1.08   0.283    -1.458051    4.946816
         c11 |    1.53665   2.702688     0.57   0.571    -3.810684    6.883984
         c12 |   2.138795   1.991041     1.07   0.285    -1.800529    6.078118
         c13 |   1.864911   1.382707     1.35   0.180    -.8708092     4.60063
         c14 |   1.979948   1.218421     1.63   0.107    -.4307289    4.390624
          s2 |  -.9736692   .3596255    -2.71   0.008    -1.685197   -.2621414
          s3 |  -2.878196   .7822486    -3.68   0.000    -4.425894   -1.330498
          s4 |  -.3385739   .3330705    -1.02   0.311     -.997562    .3204141
          s5 |  -2.140208   .6554023    -3.27   0.001    -3.436937   -.8434781
          s6 |  -.2407095   .2534548    -0.95   0.344     -.742176    .2607571
          s7 |  -.8328143   .3243414    -2.57   0.011    -1.474532   -.1910969
          s8 |  -.2402478   .2611621    -0.92   0.359    -.7569636    .2764679
          s9 |  -.3602723   .2929357    -1.23   0.221    -.9398527    .2193082
         s10 |  -.9522802   .3378148    -2.82   0.006    -1.620655   -.2839054
         s11 |  -.3553612   .2779339    -1.28   0.203    -.9052602    .1945378
         s12 |  -.3956231   .3578738    -1.11   0.271    -1.103685    .3124389
```

```
         s13 |  -1.660634   .4666511    -3.56   0.001    -2.583915   -.7373533
       _cons |  -13.17014   12.66758    -1.04   0.300    -38.23326    11.89298
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.lnindfdistock
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.72  Pr > z =  0.085
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.287
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(89)   = 235.13  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(89)   = 106.45  Prob > chi2 =  0.100
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(77)    =  98.20  Prob > chi2 =  0.052
    Difference (null H = exogenous): chi2(12)    =   8.25  Prob > chi2 =  0.765
  iv(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996 d1997 d
> 1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7
c8 c9 c10 c11 c12 c13 c14 s2
> s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
    Hansen test excluding group:     chi2(46)    =  79.47  Prob > chi2 =  0.002
    Difference (null H = exogenous): chi2(43)    =  26.98  Prob > chi2 =  0.973
```

```
. *fails instrument validity tests
. **collapsing instruments
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp 
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock, 
collapse) iv(lnsecedu lntertedu  lnwa
> ge lngdp     lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-
d2008 c2-c14 s2-s13) two robu
> st small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor 
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step 
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 57                      Obs per group: min =         1
F(44, 129)    =    107.63                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2500422     .188926     1.32   0.188    -.1237525    .6238369
             |
    lnsecedu |  -.5773644    1.066541    -0.54   0.589    -2.687542    1.532813
   lntertedu |  -1.112778    .7320694    -1.52   0.131    -2.561195    .3356388
      lnwage |  -.2794698    .5274014    -0.53   0.597    -1.322946    .7640068
       lngdp |   .3561638     .711584     0.50   0.618    -1.051723     1.76405
 lntradefree |   .0154571    .2243494     0.07   0.945    -.4284237    .4593379
  lneconfree |   1.158458    .5886368     1.97   0.051    -.0061743     2.32309
lntransition |   1.869017    1.266205     1.48   0.142    -.6362018    4.374235
  lnictinfra |   .2367734    .2054149     1.15   0.251     -.169645    .6431918
indprivati~n |   .8135382    .6201818     1.31   0.192    -.4135067    2.040583
       d1996 |  -1.372023    .8596409    -1.60   0.113    -3.072844    .3287973
       d1997 |  -1.225842    .8639593    -1.42   0.158    -2.935207    .4835226
       d1998 |   -1.13865     .791561    -1.44   0.153    -2.704773    .4274724
       d1999 |  -.9051986    .7522497    -1.20   0.231    -2.393543    .5831459
       d2000 |  -.9981159    .7077054    -1.41   0.161    -2.398328    .4020966
       d2001 |  -.8451333    .6221579    -1.36   0.177    -2.076088    .3858213
       d2002 |   -.782863    .5661996    -1.38   0.169    -1.903103    .3373768
       d2003 |  -.5407693     .522688    -1.03   0.303     -1.57492    .4933817
       d2004 |  -.3207463    .3707723    -0.87   0.389    -1.054328    .4128358
       d2005 |  -.2370668    .2601797    -0.91   0.364    -.7518387    .2777052
       d2006 |  -.2179109    .2085666    -1.04   0.298    -.6305651    .1947432
       d2007 |  -.0771359    .1433772    -0.54   0.592    -.3608111    .2065393
          c4 |   2.140484    1.154837     1.85   0.066    -.1443907    4.425358
          c5 |   3.435726    2.099101     1.64   0.104    -.7173964    7.588849
          c6 |   2.848118    1.168679     2.44   0.016     .5358583    5.160378
          c7 |   3.902396    2.309029     1.69   0.093    -.6660739    8.470866
          c8 |   1.937948    .9760687     1.99   0.049     .0067716    3.869123
          c9 |   2.677491     1.40508     1.91   0.059    -.1024942    5.457477
         c11 |   3.091655    3.101057     1.00   0.321    -3.043861    9.227172
         c12 |   3.184441    2.330199     1.37   0.174    -1.425915    7.794798
         c13 |   2.747404     1.56396     1.76   0.081    -.3469301    5.841738
         c14 |   2.714441    1.423317     1.91   0.059    -.1016261    5.530508
          s2 |  -1.236095    .4680308    -2.64   0.009    -2.162106   -.3100852
          s3 |  -3.151883    1.072035    -2.94   0.004    -5.272931   -1.030835
          s4 |  -.3412179    .3007158    -1.13   0.259    -.9361916    .2537558
          s5 |  -2.656843    .9330251    -2.85   0.005    -4.502856   -.8108297
          s6 |  -.3073535    .2946886    -1.04   0.299    -.8904021    .2756951
          s7 |  -.9873224    .3897406    -2.53   0.012    -1.758434    -.216211
          s8 |  -.3394888    .2716105    -1.25   0.214    -.8768769    .1978993
          s9 |  -.5655168    .3051004    -1.85   0.066    -1.169165    .0381318
         s10 |  -1.089904    .4213304    -2.59   0.011    -1.923516   -.2562911
         s11 |  -.6444302    .3331455    -1.93   0.055    -1.303567    .0147064
         s12 |  -.5115812    .3096923    -1.65   0.101    -1.124315    .1011525
         s13 |   -1.76802    .6385367    -2.77   0.006    -3.031381   -.5046598
```

```
       _cons |  -8.303172   13.52679    -0.61   0.540    -35.06625    18.45991
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/.).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.65  Pr > z =  0.099
Arellano-Bond test for AR(2) in first differences: z =  -1.10  Pr > z =  0.270
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)   =  12.50  Prob > chi2 =  0.407
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)   =  17.01  Prob > chi2 =  0.149
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(11)   =  16.55  Prob > chi2 =  0.122
    Difference (null H = exogenous): chi2(1)    =   0.45  Prob > chi2 =  0.501

. *fails instrument validity tests
.
```

```
. **limiting lags
. **laglimit 1 7
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 7) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 52                      Obs per group: min =         1
F(44, 129)    =     89.92                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2309852   .1807398     1.28   0.204    -.1266129    .5885833
             |
    lnsecedu |  -1.088259   .9304486    -1.17   0.244    -2.929175    .7526559
   lntertedu |    -1.3572   .7063731    -1.92   0.057    -2.754776    .0403768
      lnwage |  -.2652029   .5010582    -0.53   0.598    -1.256559     .726153
       lngdp |   .2367891   .6401898     0.37   0.712    -1.029842     1.50342
 lntradefree |   .0171587    .240038     0.07   0.943    -.4577623    .4920797
  lneconfree |   1.470017    .551895     2.66   0.009     .3780795    2.561955
lntransition |   2.229198    1.36254     1.64   0.104    -.4666202    4.925016
  lnictinfra |   .2205244    .201947     1.09   0.277    -.1790328    .6200815
indprivati~n |   .8209957   .6493979     1.26   0.208     -.463854    2.105845
       d1996 |  -1.525234   .7887951    -1.93   0.055    -3.085884    .0354165
       d1997 |  -1.414453   .7846816    -1.80   0.074    -2.966965    .1380588
       d1998 |  -1.362243   .7296521    -1.87   0.064    -2.805878    .0813911
       d1999 |  -1.144813   .6926467    -1.65   0.101    -2.515231    .2256056
       d2000 |  -1.245283   .6243748    -1.99   0.048    -2.480624   -.0099424
       d2001 |  -1.069569   .5800807    -1.84   0.068    -2.217273    .0781346
       d2002 |  -.9566041   .5219732    -1.83   0.069    -1.989341    .0761327
       d2003 |  -.6644162   .4650337    -1.43   0.155    -1.584497    .2556644
       d2004 |  -.4450536   .3278205    -1.36   0.177    -1.093655    .2035474
       d2005 |  -.3181526   .2339901    -1.36   0.176    -.7811078    .1448025
       d2006 |  -.2931066   .1851431    -1.58   0.116    -.6594168    .0732035
       d2007 |  -.1164891   .1567937    -0.74   0.459    -.4267092     .193731
          c4 |   2.408179   1.015014     2.37   0.019     .3999493    4.416409
          c5 |   4.201327   2.006357     2.09   0.038     .2316993    8.170954
          c6 |   3.494356   1.231289     2.84   0.005     1.058221    5.930492
          c7 |   4.745473    2.13597     2.22   0.028     .5194036    8.971543
          c8 |    2.38102   .9930784     2.40   0.018     .4161906     4.34585
          c9 |    3.33119   1.401998     2.38   0.019     .5573017    6.105078
         c11 |   3.417969   2.582476     1.32   0.188    -1.691523    8.527461
         c12 |   3.817644   2.124046     1.80   0.075    -.3848331    8.020122
         c13 |   3.181473   1.384366     2.30   0.023     .4424711    5.920475
         c14 |    2.92619   1.224713     2.39   0.018     .5030659    5.349314
          s2 |   -1.15711   .4619907    -2.50   0.014     -2.07117   -.2430505
          s3 |  -3.202046   .9767917    -3.28   0.001    -5.134652    -1.26944
          s4 |  -.3004116   .2995535    -1.00   0.318    -.8930856    .2922623
          s5 |  -2.459125   .9146748    -2.69   0.008    -4.268832   -.6494185
          s6 |  -.2507455   .2849278    -0.88   0.380    -.8144821     .312991
          s7 |  -.9653842    .383586    -2.52   0.013    -1.724318   -.2064499
          s8 |  -.3150256   .2849359    -1.11   0.271    -.8787782     .248727
          s9 |  -.4884267   .3296375    -1.48   0.141    -1.140623    .1637693
         s10 |  -1.044445   .4042178    -2.58   0.011    -1.844199   -.2446897
         s11 |  -.5560698   .3374256    -1.65   0.102    -1.223675    .1115349
         s12 |  -.4151755   .3513518    -1.18   0.240    -1.110334    .2799827
         s13 |  -1.840366   .6237273    -2.95   0.004    -3.074425    -.606306
```

```
       _cons |  -5.030602   12.56883    -0.40   0.690    -29.89835    19.83714
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.66  Pr > z =  0.096
Arellano-Bond test for AR(2) in first differences: z =  -1.14  Pr > z =  0.254
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(7)    =  11.46  Prob > chi2 =  0.120
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(7)    =  10.02  Prob > chi2 =  0.187
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(6)    =   9.15  Prob > chi2 =  0.165
    Difference (null H = exogenous): chi2(1)    =   0.87  Prob > chi2 =  0.351

. **fails instrument validity tests
```

```
. *laglimit 1 6
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 6) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 51                      Obs per group: min =         1
F(44, 129)    =     86.18                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2390337   .1966717     1.22   0.226    -.1500861    .6281536
             |
    lnsecedu |   -1.28277   .9623953    -1.33   0.185    -3.186893    .6213528
   lntertedu |  -1.434477   .6839355    -2.10   0.038    -2.787661   -.0812943
      lnwage |  -.4273924   .4874329    -0.88   0.382     -1.39179    .5370055
       lngdp |   .4154806   .6051685     0.69   0.494    -.7818601    1.612821
 lntradefree |   .0239786   .2398197     0.10   0.921    -.4505105    .4984676
  lneconfree |    1.60263    .542653     2.95   0.004     .5289778    2.676282
lntransition |   1.993196   1.355238     1.47   0.144    -.6881763    4.674569
  lnictinfra |   .1798124   .1999585     0.90   0.370    -.2158105    .5754353
indprivati~n |   .6724807   .5845294     1.15   0.252     -.484025    1.828986
       d1996 |  -1.615774   .7630455    -2.12   0.036    -3.125478   -.1060701
       d1997 |  -1.529522   .7617723    -2.01   0.047    -3.036707   -.0223372
       d1998 |  -1.461658   .7117659    -2.05   0.042    -2.869904   -.0534115
       d1999 |   -1.23225     .67475    -1.83   0.070    -2.567259    .1027593
       d2000 |  -1.258025    .609739    -2.06   0.041    -2.464408   -.0516413
       d2001 |  -1.146693   .5631636    -2.04   0.044    -2.260926   -.0324604
       d2002 |   -1.01776   .5023007    -2.03   0.045    -2.011574   -.0239457
       d2003 |  -.6866092   .4475565    -1.53   0.127    -1.572111    .1988922
       d2004 |  -.4824349   .3122022    -1.55   0.125    -1.100135    .1352648
       d2005 |  -.3558089   .2203166    -1.61   0.109    -.7917106    .0800929
       d2006 |   -.325524   .1754884    -1.85   0.066    -.6727321    .0216841
       d2007 |    -.15096   .1604419    -0.94   0.349    -.4683984    .1664783
          c4 |   2.403135   .9931236     2.42   0.017      .438216    4.368055
          c5 |   4.147065   1.941143     2.14   0.035      .306465    7.987665
          c6 |   3.869094   1.280763     3.02   0.003     1.335074    6.403114
          c7 |   4.741191   2.058617     2.30   0.023     .6681665    8.814216
          c8 |   2.568419   .9942508     2.58   0.011     .6012692    4.535568
          c9 |   3.515857   1.388282     2.53   0.013     .7691064    6.262608
         c11 |   2.996037    2.42457     1.24   0.219    -1.801035    7.793108
         c12 |   3.551355   2.029156     1.75   0.082    -.4633796    7.566089
         c13 |    3.14826   1.338325     2.35   0.020     .5003513    5.796168
         c14 |    2.95814   1.210151     2.44   0.016     .5638259    5.352455
          s2 |   -1.09723   .4760994    -2.30   0.023    -2.039204   -.1552555
          s3 |  -3.117078   1.038017    -3.00   0.003    -5.170821   -1.063335
          s4 |  -.2436169   .2961099    -0.82   0.412    -.8294777    .3422438
          s5 |  -2.273454    .919797    -2.47   0.015    -4.093295   -.4536135
          s6 |  -.2071005   .2722683    -0.76   0.448      -.74579    .3315889
          s7 |  -.9320774   .3943994    -2.36   0.020    -1.712406   -.1517484
          s8 |  -.2770551   .2805851    -0.99   0.325    -.8321996    .2780895
          s9 |  -.4562269   .3209339    -1.42   0.158    -1.091202    .1787486
         s10 |  -.9985429    .407937    -2.45   0.016    -1.805656   -.1914295
         s11 |  -.5147579   .3379247    -1.52   0.130     -1.18335    .1538343
         s12 |  -.3899694   .3425042    -1.14   0.257    -1.067622    .2876835
         s13 |  -1.783003   .6610878    -2.70   0.008    -3.090982   -.4750251
       _cons |  -7.619425   11.77162    -0.65   0.519    -30.90986    15.67101
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/6).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.65  Pr > z =  0.098
Arellano-Bond test for AR(2) in first differences: z =  -1.11  Pr > z =  0.268
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  11.16  Prob > chi2 =  0.084
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   7.82  Prob > chi2 =  0.251
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(5)    =   6.66  Prob > chi2 =  0.247
    Difference (null H = exogenous): chi2(1)    =   1.16  Prob > chi2 =  0.281

. *fails instrument validity tests
```

```
. **laglimit 1 5
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 5) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 50                      Obs per group: min =         1
F(44, 129)    =     84.74                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2542499   .1990111     1.28   0.204    -.1394984    .6479981
             |
    lnsecedu |  -1.224096   .9772412    -1.25   0.213    -3.157592    .7093992
   lntertedu |  -1.425792    .686128    -2.08   0.040    -2.783313   -.0682713
      lnwage |  -.3988685   .4689869    -0.85   0.397    -1.326771    .5290335
       lngdp |   .3683495   .5856158     0.63   0.530    -.7903056    1.527005
 lntradefree |   .0351866   .2349989     0.15   0.881    -.4297645    .5001377
  lneconfree |   1.597474   .5598505     2.85   0.005     .4897965    2.705152
lntransition |    2.07022   1.223761     1.69   0.093    -.3510202     4.49146
  lnictinfra |   .2044371   .2071102     0.99   0.325    -.2053355    .6142097
indprivati~n |   .6938887   .5687006     1.22   0.225    -.4312993    1.819077
       d1996 |  -1.536009   .7969854    -1.93   0.056    -3.112864    .0408466
       d1997 |   -1.45585   .7928259    -1.84   0.069    -3.024475    .1127757
       d1998 |  -1.401749   .7304588    -1.92   0.057    -2.846979    .0434818
       d1999 |  -1.175589   .6930778    -1.70   0.092    -2.546861    .1956818
       d2000 |  -1.222003    .608644    -2.01   0.047     -2.42622   -.0177859
       d2001 |  -1.107799    .574056    -1.93   0.056    -2.243583    .0279844
       d2002 |  -.9805031   .5109816    -1.92   0.057    -1.991493    .0304864
       d2003 |  -.6511412   .4490512    -1.45   0.149      -1.5396    .2373177
       d2004 |  -.4666768   .3111568    -1.50   0.136    -1.082308    .1489546
       d2005 |  -.3401881   .2242148    -1.52   0.132    -.7838026    .1034263
       d2006 |  -.3164963   .1764648    -1.79   0.075    -.6656362    .0326436
       d2007 |  -.1298889   .1685222    -0.77   0.442    -.4633142    .2035363
          c4 |   2.373513   .9933206     2.39   0.018     .4082035    4.338822
          c5 |   4.060385   1.925736     2.11   0.037      .250268    7.870501
          c6 |   3.697852   1.416051     2.61   0.010     .8961615    6.499543
          c7 |   4.671209   2.040897     2.29   0.024     .6332451    8.709173
          c8 |   2.502176   1.031693     2.43   0.017     .4609469    4.543405
          c9 |    3.42926   1.418802     2.42   0.017      .622126    6.236395
         c11 |    3.03133   2.297106     1.32   0.189     -1.51355     7.57621
         c12 |   3.541673   1.934167     1.83   0.069    -.2851231     7.36847
         c13 |   3.105287   1.321468     2.35   0.020     .4907299    5.719845
         c14 |   2.930575   1.210965     2.42   0.017     .5346504      5.3265
          s2 |  -1.119763   .4419428    -2.53   0.012    -1.994158   -.2453687
          s3 |  -3.075185   1.009204    -3.05   0.003    -5.071919   -1.078451
          s4 |  -.2718567    .283656    -0.96   0.340     -.833077    .2893636
          s5 |  -2.277129   .8693215    -2.62   0.010    -3.997103   -.5571551
          s6 |  -.2405538   .2586972    -0.93   0.354    -.7523926     .271285
          s7 |  -.9362682    .378114    -2.48   0.015    -1.684376   -.1881605
          s8 |  -.2984532   .2669193    -1.12   0.266    -.8265595    .2296532
          s9 |  -.4724958    .308181    -1.53   0.128    -1.082239    .1372478
         s10 |  -.9984026   .3927583    -2.54   0.012    -1.775485   -.2213206
         s11 |  -.5345241   .3133501    -1.71   0.090    -1.154495    .0854467
         s12 |  -.4036736   .3377785    -1.20   0.234    -1.071977    .2646294
         s13 |  -1.749802   .6447251    -2.71   0.008    -3.025406   -.4741972
       _cons |  -7.160907   11.48477    -0.62   0.534     -29.8838    15.56199
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/5).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.71  Pr > z =  0.088
Arellano-Bond test for AR(2) in first differences: z =  -1.08  Pr > z =  0.281
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(5)    =  10.89  Prob > chi2 =  0.054
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(5)    =   7.31  Prob > chi2 =  0.199
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =   6.61  Prob > chi2 =  0.158
    Difference (null H = exogenous): chi2(1)    =   0.70  Prob > chi2 =  0.403

. *fails instrument validity tests
```

```
. **laglimit 1 4
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 4) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 49                      Obs per group: min =         1
F(44, 129)    =     85.01                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3024129   .2134972     1.42   0.159    -.1199965    .7248224
             |
    lnsecedu |   -1.13002   .9657758    -1.17   0.244    -3.040831     .780791
   lntertedu |  -1.364065   .6788464    -2.01   0.047     -2.70718   -.0209512
      lnwage |  -.4352596      .4539    -0.96   0.339    -1.333312    .4627927
       lngdp |   .3572461   .5662922     0.63   0.529    -.7631768    1.477669
 lntradefree |   .0554154   .2450246     0.23   0.821    -.4293716    .5402025
  lneconfree |   1.492667    .629089     2.37   0.019     .2479986    2.737334
lntransition |   2.100232    1.17817     1.78   0.077    -.2308065    4.431271
  lnictinfra |   .2998424   .2121628     1.41   0.160    -.1199268    .7196116
indprivati~n |   .5361775   .4518528     1.19   0.238    -.3578243    1.430179
       d1996 |  -1.258261      .8135    -1.55   0.124    -2.867791    .3512681
       d1997 |  -1.196462   .7961502    -1.50   0.135    -2.771664    .3787409
       d1998 |  -1.159283   .7448122    -1.56   0.122    -2.632912    .3143466
       d1999 |   -.969594   .6898461    -1.41   0.162    -2.334471    .3952834
       d2000 |  -1.058315   .6062626    -1.75   0.083     -2.25782    .1411906
       d2001 |  -.9888058   .5718586    -1.73   0.086    -2.120242    .1426304
       d2002 |  -.8691837   .5063631    -1.72   0.088    -1.871036    .1326682
       d2003 |   -.483949    .464646    -1.04   0.300    -1.403262    .4353644
       d2004 |  -.4023017   .3006777    -1.34   0.183    -.9971999    .1925965
       d2005 |  -.2999952   .2191383    -1.37   0.173    -.7335657    .1335753
       d2006 |  -.2915678   .1745373    -1.67   0.097    -.6368942    .0537586
       d2007 |  -.0714007   .1703547    -0.42   0.676    -.4084515    .2656502
          c4 |    2.21009   .9923683     2.23   0.028     .2466646    4.173514
          c5 |   3.716253   1.872689     1.98   0.049      .011091    7.421414
          c6 |   3.434372   1.473184     2.33   0.021      .519641    6.349103
          c7 |   4.311798   2.003286     2.15   0.033     .3482482    8.275348
          c8 |   2.272973   1.068335     2.13   0.035     .1592464      4.3867
          c9 |   3.170378   1.419903     2.23   0.027     .3610646    5.979692
         c11 |   2.788759   2.110697     1.32   0.189    -1.387307    6.964825
         c12 |   3.280979   1.821392     1.80   0.074     -.322689    6.884646
         c13 |   2.864216   1.296045     2.21   0.029     .2999593    5.428472
         c14 |   2.737283   1.211082     2.26   0.025     .3411268    5.133439
          s2 |  -1.057156   .4405108    -2.40   0.018    -1.928717   -.1855948
          s3 |  -2.806622   1.075658    -2.61   0.010    -4.934839   -.6784059
          s4 |  -.2824133   .2723672    -1.04   0.302    -.8212985    .2564718
          s5 |  -1.961092   .9740995    -2.01   0.046    -3.888372   -.0338121
          s6 |  -.2432247   .2440066    -1.00   0.321    -.7259978    .2395484
          s7 |  -.8800836   .3818854    -2.30   0.023    -1.635653    -.124514
          s8 |  -.3033228   .2530693    -1.20   0.233    -.8040266     .197381
          s9 |   -.455816   .3028899    -1.50   0.135    -1.055091     .143459
         s10 |  -.9437514   .3921954    -2.41   0.018     -1.71972   -.1677831
         s11 |  -.5157395   .3035331    -1.70   0.092    -1.116287    .0848081
         s12 |   -.402448   .3219004    -1.25   0.213    -1.039336    .2344397
         s13 |  -1.632811   .6461697    -2.53   0.013    -2.911274   -.3543489
       _cons |  -7.394954   11.19707    -0.66   0.510    -29.54863    14.75872
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/4).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.79  Pr > z =  0.073
Arellano-Bond test for AR(2) in first differences: z =  -1.02  Pr > z =  0.309
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =  10.87  Prob > chi2 =  0.028
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   5.87  Prob > chi2 =  0.209
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(3)    =   4.51  Prob > chi2 =  0.211
    Difference (null H = exogenous): chi2(1)    =   1.36  Prob > chi2 =  0.243

. **fails instrument validity tests
```

```
. **laglimit 1 3
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 3) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 48                      Obs per group: min =         1
F(44, 129)    =     84.91                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2593845   .1906996     1.36   0.176    -.1179193    .6366884
             |
    lnsecedu |  -.3620891   1.036617    -0.35   0.727    -2.413061    1.688883
   lntertedu |  -1.686296   .7269682    -2.32   0.022     -3.12462   -.2479715
      lnwage |  -.4010693   .4452837    -0.90   0.369    -1.282074    .4799355
       lngdp |    .417495   .5622288     0.74   0.459    -.6948884    1.529878
 lntradefree |   .2101625   .2784523     0.75   0.452    -.3407623    .7610873
  lneconfree |    1.27007   .6037023     2.10   0.037     .0756301     2.46451
lntransition |   2.736017   1.265637     2.16   0.032     .2319237     5.24011
  lnictinfra |   .4430819   .2421966     1.83   0.070    -.0361101    .9222739
indprivati~n |   .4308111   .4015231     1.07   0.285    -.3636121    1.225234
       d1996 |  -.8004353   .8632162    -0.93   0.356     -2.50833     .907459
       d1997 |  -.8115697   .8355483    -0.97   0.333    -2.464722    .8415831
       d1998 |  -.7888399   .7799654    -1.01   0.314    -2.332021    .7543407
       d1999 |  -.6451104   .7211483    -0.89   0.373     -2.07192    .7816992
       d2000 |  -.9674841    .599788    -1.61   0.109    -2.154179    .2192111
       d2001 |  -.7118747   .5946116    -1.20   0.233    -1.888328    .4645789
       d2002 |  -.6735877   .5111185    -1.32   0.190    -1.684848    .3376728
       d2003 |  -.3534356   .4695859    -0.75   0.453    -1.282523    .5756517
       d2004 |  -.2873285   .2961489    -0.97   0.334    -.8732664    .2986094
       d2005 |  -.2273898    .219403    -1.04   0.302    -.6614841    .2067044
       d2006 |  -.2411724    .170931    -1.41   0.161    -.5793636    .0970189
       d2007 |  -.0749129   .1555642    -0.48   0.631    -.3827005    .2328748
          c4 |     2.0306   .9581471     2.12   0.036      .134882    3.926317
          c5 |   2.809916    1.85624     1.51   0.133    -.8626996    6.482532
          c6 |   3.090519   1.429701     2.16   0.032     .2618198    5.919218
          c7 |   3.918665   1.931981     2.03   0.045     .0961931    7.741138
          c8 |    1.99882   1.030794     1.94   0.055    -.0406307     4.03827
          c9 |   2.764141   1.378253     2.01   0.047     .0372332     5.49105
         c11 |    2.97823   2.084734     1.43   0.156    -1.146466    7.102927
         c12 |   2.996321   1.771809     1.69   0.093    -.5092456    6.501888
         c13 |   2.554047   1.252832     2.04   0.044     .0752894    5.032805
         c14 |   2.711128   1.156834     2.34   0.021     .4223027    4.999953
          s2 |  -1.122459   .4087667    -2.75   0.007    -1.931214   -.3137038
          s3 |  -3.279457   1.055774    -3.11   0.002    -5.368331   -1.190583
          s4 |  -.3142022   .2616926    -1.20   0.232    -.8319673     .203563
          s5 |  -2.026182   .8800052    -2.30   0.023    -3.767294   -.2850704
          s6 |    -.26457   .2325229    -1.14   0.257    -.7246222    .1954821
          s7 |  -.9578787   .3548387    -2.70   0.008    -1.659936   -.2558217
          s8 |  -.3378485   .2414495    -1.40   0.164    -.8155622    .1398652
          s9 |  -.4954958   .2787938    -1.78   0.078    -1.047096    .0561046
         s10 |  -1.012274   .3580359    -2.83   0.005    -1.720657   -.3038914
         s11 |   -.558062   .2804309    -1.99   0.049    -1.112901   -.0032226
         s12 |  -.4783171   .3140441    -1.52   0.130    -1.099661    .1430269
         s13 |  -1.772305   .5887121    -3.01   0.003    -2.937087   -.6075242
       _cons |  -12.17042   11.48296    -1.06   0.291    -34.88974    10.54889
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/3).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.86  Pr > z =  0.062
Arellano-Bond test for AR(2) in first differences: z =  -1.08  Pr > z =  0.279
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(3)    =  10.87  Prob > chi2 =  0.012
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(3)    =   3.81  Prob > chi2 =  0.282
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   2.91  Prob > chi2 =  0.233
    Difference (null H = exogenous): chi2(1)    =   0.90  Prob > chi2 =  0.341

. *fails instrument validity tests
```

```
. *laglimit 1 2
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 47                      Obs per group: min =         1
F(44, 129)    =     89.93                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3208334   .1117719     2.87   0.005       .09969    .5419769
             |
    lnsecedu |   -.533791   1.040238    -0.51   0.609    -2.591928    1.524346
   lntertedu |  -1.014866    .828662    -1.22   0.223    -2.654394    .6246623
      lnwage |  -.4811796   .4289389    -1.12   0.264    -1.329846    .3674865
       lngdp |   .3232995    .538482     0.60   0.549    -.7421003    1.388699
 lntradefree |  -.0156689   .2795488    -0.06   0.955     -.568763    .5374253
  lneconfree |   1.555186    .646416     2.41   0.018     .2762365    2.834136
lntransition |   2.226154   1.108879     2.01   0.047     .0322095    4.420099
  lnictinfra |   .3942821   .2317451     1.70   0.091    -.0642313    .8527956
indprivati~n |    1.30017    .692433     1.88   0.063    -.0698252    2.670166
       d1996 |  -.9040535    .744114    -1.21   0.227    -2.376301    .5681942
       d1997 |  -.9096219   .7171691    -1.27   0.207    -2.328558    .5093148
       d1998 |  -.8653015   .6743822    -1.28   0.202    -2.199583    .4689801
       d1999 |  -.7769027   .6236156    -1.25   0.215    -2.010741     .456936
       d2000 |  -1.120688    .526311    -2.13   0.035    -2.162007   -.0793687
       d2001 |  -.8396037   .5206383    -1.61   0.109    -1.869699     .190492
       d2002 |  -.7322052   .4465472    -1.64   0.104     -1.61571    .1512994
       d2003 |  -.6432739   .4242456    -1.52   0.132    -1.482654    .1961064
       d2004 |  -.2990308   .2750488    -1.09   0.279    -.8432216    .2451601
       d2005 |  -.2410968   .2048553    -1.18   0.241     -.646408    .1642143
       d2006 |  -.2709131   .1581928    -1.71   0.089    -.5839014    .0420752
       d2007 |  -.0226139   .1101029    -0.21   0.838    -.2404553    .1952274
          c4 |   2.143116   .8504812     2.52   0.013     .4604184    3.825814
          c5 |   2.861377   1.588306     1.80   0.074    -.2811263    6.003879
          c6 |   2.344773   1.332944     1.76   0.081    -.2924895    4.982035
          c7 |   3.373176   1.664154     2.03   0.045     .0806068    6.665745
          c8 |   1.515622   .9709776     1.56   0.121    -.4054807    3.436725
          c9 |   2.255235   1.217279     1.85   0.066    -.1531816    4.663652
         c11 |    2.69387    1.93081     1.40   0.165    -1.126285    6.514024
         c12 |   2.795191   1.518817     1.84   0.068    -.2098246    5.800207
         c13 |   2.459607   1.092451     2.25   0.026     .2981662    4.621048
         c14 |    2.40213   1.059094     2.27   0.025     .3066859    4.497574
          s2 |  -1.003029   .3208703    -3.13   0.002    -1.637879   -.3681792
          s3 |  -2.843619   .7675946    -3.70   0.000    -4.362324   -1.324914
          s4 |  -.2663226   .2382375    -1.12   0.266    -.7376813    .2050362
          s5 |  -2.080592   .5994255    -3.47   0.001     -3.26657   -.8946138
          s6 |  -.2634231   .2085931    -1.26   0.209    -.6761297    .1492835
          s7 |  -.8562062   .2694939    -3.18   0.002    -1.389407   -.3230059
          s8 |  -.2892621   .2128607    -1.36   0.177    -.7104123     .131888
          s9 |  -.4886417   .2366244    -2.07   0.041    -.9568088   -.0204746
         s10 |  -.9078983   .2684454    -3.38   0.001    -1.439024   -.3767725
         s11 |   -.486165   .2320611    -2.09   0.038    -.9453037   -.0270264
         s12 |  -.4438315   .2777173    -1.60   0.112     -.993302    .1056389
         s13 |  -1.586333   .3809908    -4.16   0.000    -2.340133   -.8325336
       _cons |   -9.37977    11.0529    -0.85   0.398    -31.24821    12.48867
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.289
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.89  Prob > chi2 =  0.087
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.99  Prob > chi2 =  0.609
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.26  Prob > chi2 =  0.612
    Difference (null H = exogenous): chi2(1)    =   0.73  Prob > chi2 =  0.392

*instrument validity OK
```

```
. *laglimit 1 1

. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 1) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 46                      Obs per group: min =         1
F(44, 129)    =     96.31                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3941117   .1103209     3.57   0.000      .175839    .6123844
             |
    lnsecedu |  -.6819076   1.074021    -0.63   0.527    -2.806885     1.44307
   lntertedu |  -.2879896    1.09214    -0.26   0.792    -2.448815    1.872836
      lnwage |  -.6691042   .4641303    -1.44   0.152    -1.587397     .249189
       lngdp |   .5540893   .5870941     0.94   0.347    -.6074907    1.715669
 lntradefree |  -.0415594   .2653751    -0.16   0.876    -.5666106    .4834918
  lneconfree |   1.079604   .8117343     1.33   0.186    -.5264321     2.68564
lntransition |   2.453441   1.129033     2.17   0.032     .2196205    4.687261
  lnictinfra |   .4411933   .2333615     1.89   0.061    -.0205181    .9029047
indprivati~n |   1.664574   .7451581     2.23   0.027     .1902605    3.138888
       d1996 |  -.5198179   .7594564    -0.68   0.495    -2.022421    .9827853
       d1997 |   -.461927   .7654574    -0.60   0.547    -1.976403    1.052549
       d1998 |  -.4359923   .7275555    -0.60   0.550    -1.875479    1.003494
       d1999 |   -.397477   .6635862    -0.60   0.550    -1.710399    .9154445
       d2000 |  -.8909695   .4955192    -1.80   0.075    -1.871366    .0894273
       d2001 |  -.5670213   .5325987    -1.06   0.289    -1.620781    .4867383
       d2002 |  -.4241713   .4971045    -0.85   0.395    -1.407705     .559362
       d2003 |  -.3869563   .4648622    -0.83   0.407    -1.306697    .5327849
       d2004 |  -.1443547   .2734652    -0.53   0.598    -.6854123    .3967029
       d2005 |  -.1351844   .1998528    -0.68   0.500    -.5305981    .2602293
       d2006 |  -.2179156    .140639    -1.55   0.124    -.4961732     .060342
       d2007 |  -.0885259   .1376497    -0.64   0.521    -.3608693    .1838175
          c4 |   1.572689   .9349458     1.68   0.095     -.277124    3.422502
          c5 |   1.905097   1.781897     1.07   0.287     -1.62043    5.430623
          c6 |   1.387911   1.501631     0.92   0.357    -1.583102    4.358925
          c7 |   1.910462    2.11309     0.90   0.368    -2.270338    6.091263
          c8 |   .8080908   1.115498     0.72   0.470    -1.398949     3.01513
          c9 |   1.259658   1.493367     0.84   0.401    -1.695004     4.21432
         c11 |   1.078344    2.48017     0.43   0.664    -3.828732     5.98542
         c12 |   1.686599   1.821377     0.93   0.356     -1.91704    5.290239
         c13 |   1.597011   1.313623     1.22   0.226    -1.002024    4.196047
         c14 |   1.634928   1.160712     1.41   0.161    -.6615697    3.931425
          s2 |  -.8893628   .3148124    -2.83   0.005    -1.512227   -.2664987
          s3 |  -2.529691    .726899    -3.48   0.001    -3.967878   -1.091503
          s4 |  -.2256783    .234869    -0.96   0.338    -.6903722    .2390157
          s5 |  -1.876678   .5745456    -3.27   0.001    -3.013431   -.7399258
          s6 |  -.2406225   .2060244    -1.17   0.245    -.6482468    .1670019
          s7 |  -.7453531   .2679377    -2.78   0.006    -1.275474   -.2152317
          s8 |  -.2437034   .2103172    -1.16   0.249    -.6598212    .1724143
          s9 |  -.4496206   .2326964    -1.93   0.056     -.910016    .0107749
         s10 |  -.7965863   .2663393    -2.99   0.003    -1.323545   -.2696274
         s11 |  -.4180931   .2291747    -1.82   0.070    -.8715209    .0353347
         s12 |  -.3760593   .2780088    -1.35   0.179    -.9261066    .1739879
         s13 |  -1.449896   .3484933    -4.16   0.000    -2.139399   -.7603933
```

```
       _cons |  -12.79457   11.48754    -1.11   0.267    -35.52295    9.933811
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L.L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.05  Pr > z =  0.296
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1)    =   0.69  Prob > chi2 =  0.407
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(1)    =   0.25  Prob > chi2 =  0.615
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(1)    =   0.25  Prob > chi2 =  0.615

*instrument validity OK
```

Appendix 6.5: Testing instrument validity

```
. **Model 5.4
. **FDI stock predetermined; all variables exogenous
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 47                      Obs per group: min =         1
F(44, 129)    =     89.93                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3208334   .1117719     2.87   0.005       .09969    .5419769
             |
    lnsecedu |   -.533791   1.040238    -0.51   0.609    -2.591928    1.524346
   lntertedu |  -1.014866    .828662    -1.22   0.223    -2.654394    .6246623
      lnwage |  -.4811796   .4289389    -1.12   0.264    -1.329846    .3674865
       lngdp |   .3232995    .538482     0.60   0.549    -.7421003    1.388699
 lntradefree |  -.0156689   .2795488    -0.06   0.955     -.568763    .5374253
  lneconfree |   1.555186    .646416     2.41   0.018     .2762365    2.834136
lntransition |   2.226154   1.108879     2.01   0.047     .0322095    4.420099
  lnictinfra |   .3942821   .2317451     1.70   0.091    -.0642313    .8527956
indprivati~n |    1.30017    .692433     1.88   0.063    -.0698252    2.670166
       d1996 |  -.9040535    .744114    -1.21   0.227    -2.376301    .5681942
       d1997 |  -.9096219   .7171691    -1.27   0.207    -2.328558    .5093148
       d1998 |  -.8653015   .6743822    -1.28   0.202    -2.199583    .4689801
       d1999 |  -.7769027   .6236156    -1.25   0.215    -2.010741     .456936
       d2000 |  -1.120688    .526311    -2.13   0.035    -2.162007   -.0793687
       d2001 |  -.8396037   .5206383    -1.61   0.109    -1.869699     .190492
       d2002 |  -.7322052   .4465472    -1.64   0.104     -1.61571    .1512994
       d2003 |  -.6432739   .4242456    -1.52   0.132    -1.482654    .1961064
       d2004 |  -.2990308   .2750488    -1.09   0.279    -.8432216    .2451601
       d2005 |  -.2410968   .2048553    -1.18   0.241     -.646408    .1642143
       d2006 |  -.2709131   .1581928    -1.71   0.089    -.5839014    .0420752
       d2007 |  -.0226139   .1101029    -0.21   0.838    -.2404553    .1952274
          c4 |   2.143116   .8504812     2.52   0.013     .4604184    3.825814
          c5 |   2.861377   1.588306     1.80   0.074    -.2811263    6.003879
          c6 |   2.344773   1.332944     1.76   0.081    -.2924895    4.982035
          c7 |   3.373176   1.664154     2.03   0.045     .0806068    6.665745
          c8 |   1.515622   .9709776     1.56   0.121    -.4054807    3.436725
          c9 |   2.255235   1.217279     1.85   0.066    -.1531816    4.663652
         c11 |    2.69387    1.93081     1.40   0.165    -1.126285    6.514024
         c12 |   2.795191   1.518817     1.84   0.068    -.2098246    5.800207
         c13 |   2.459607   1.092451     2.25   0.026     .2981662    4.621048
         c14 |    2.40213   1.059094     2.27   0.025     .3066859    4.497574
          s2 |  -1.003029   .3208703    -3.13   0.002    -1.637879   -.3681792
          s3 |  -2.843619   .7675946    -3.70   0.000    -4.362324   -1.324914
          s4 |  -.2663226   .2382375    -1.12   0.266    -.7376813    .2050362
          s5 |  -2.080592   .5994255    -3.47   0.001     -3.26657   -.8946138
          s6 |  -.2634231   .2085931    -1.26   0.209    -.6761297    .1492835
          s7 |  -.8562062   .2694939    -3.18   0.002    -1.389407   -.3230059
          s8 |  -.2892621   .2128607    -1.36   0.177    -.7104123     .131888
          s9 |  -.4886417   .2366244    -2.07   0.041    -.9568088   -.0204746
```

```
         s10 |  -.9078983   .2684454    -3.38   0.001    -1.439024   -.3767725
         s11 |   -.486165   .2320611    -2.09   0.038    -.9453037   -.0270264
         s12 |  -.4438315   .2777173    -1.60   0.112     -.993302    .1056389
         s13 |  -1.586333   .3809908    -4.16   0.000    -2.340133   -.8325336
       _cons |   -9.37977    11.0529    -0.85   0.398    -31.24821    12.48867
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.289
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.89  Prob > chi2 =  0.087
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.99  Prob > chi2 =  0.609
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.26  Prob > chi2 =  0.612
    Difference (null H = exogenous): chi2(1)    =   0.73  Prob > chi2 =  0.392

. *acceptable specification tests
```

```
. **FDI stock predetermined; gdp, wage, secedu & tertedu endogenous
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnsecedu l.lntertedu  l.lnwage l.lng
> dp , laglimit(1 2) collapse) iv(  lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2
> -c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 55                      Obs per group: min =         1
F(44, 129)    =     69.49                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .408263    .099017     4.12   0.000     .2123556    .6041705
             |
    lnsecedu |   1.391176   1.455805     0.96   0.341    -1.489171    4.271523
   lntertedu |  -.9098347   .5904922    -1.54   0.126    -2.078138    .2584686
      lnwage |  -.7016354   .5911914    -1.19   0.237    -1.871322    .4680513
       lngdp |   .4484304   .7376339     0.61   0.544    -1.010996    1.907857
 lntradefree |  -.0754216   .2598619    -0.29   0.772    -.5895646    .4387215
  lneconfree |   1.924799   .6668083     2.89   0.005     .6055021    3.244095
lntransition |   .3330241   1.309251     0.25   0.800    -2.257362     2.92341
  lnictinfra |   .5235513   .2693383     1.94   0.054    -.0093412    1.056444
indprivati~n |   1.456308   .6978269     2.09   0.039       .07564    2.836975
       d1996 |  -.4155657   .7724507    -0.54   0.592    -1.943878    1.112747
       d1997 |  -.4798783   .7415386    -0.65   0.519    -1.947031     .987274
       d1998 |  -.4126425   .6999137    -0.59   0.557    -1.797439    .9721538
       d1999 |  -.3497589   .6474538    -0.54   0.590    -1.630762    .9312443
       d2000 |   -.729744   .5819704    -1.25   0.212    -1.881187    .4216986
       d2001 |  -.5758382   .5708923    -1.01   0.315    -1.705363    .5536862
       d2002 |  -.4667194   .4845283    -0.96   0.337    -1.425371    .4919318
       d2003 |   -.339949   .4204956    -0.81   0.420     -1.17191    .4920118
       d2004 |  -.1875772   .3169292    -0.59   0.555    -.8146294    .4394749
       d2005 |  -.1505887   .2507848    -0.60   0.549    -.6467727    .3455953
       d2006 |   -.235003   .2023019    -1.16   0.248    -.6352622    .1652562
       d2007 |    .087015   .1384975     0.63   0.531    -.1870056    .3610356
          c4 |   2.239232   .9565589     2.34   0.021     .3466572    4.131808
          c5 |   1.176978   1.744089     0.67   0.501    -2.273744      4.6277
          c6 |   1.083336   1.348176     0.80   0.423    -1.584062    3.750735
          c7 |   2.165043   1.483499     1.46   0.147    -.7700956    5.100181
          c8 |   .8184628   .8638721     0.95   0.345    -.8907293    2.527655
          c9 |   .8667398   1.172609     0.74   0.461    -1.453295    3.186775
         c11 |   3.127626   2.179196     1.44   0.154    -1.183966    7.439218
         c12 |   1.813378   1.639201     1.11   0.271    -1.429822    5.056577
         c13 |   1.953547   1.078749     1.81   0.072    -.1807855    4.087879
         c14 |   2.793428   1.103635     2.53   0.013     .6098604    4.976996
          s2 |  -1.095121   .3688136    -2.97   0.004    -1.824828   -.3654143
          s3 |  -2.307993   .7494576    -3.08   0.003    -3.790813   -.8251729
          s4 |  -.3334904   .2908471    -1.15   0.254    -.9089386    .2419577
          s5 |  -1.831449   .7346032    -2.49   0.014    -3.284879   -.3780183
          s6 |  -.2826747   .2590987    -1.09   0.277    -.7953079    .2299584
          s7 |  -.8368899   .3115268    -2.69   0.008    -1.453253   -.2205266
          s8 |  -.3709348   .2583141    -1.44   0.153    -.8820156     .140146
          s9 |  -.4899429    .312255    -1.57   0.119    -1.107747    .1278613
         s10 |  -.9148551   .3242862    -2.82   0.006    -1.556463    -.273247
         s11 |  -.4983276   .2686603    -1.85   0.066    -1.029879    .0332234
         s12 |  -.3849729   .3322302    -1.16   0.249    -1.042299    .2723527
         s13 |  -1.547021   .4202643    -3.68   0.000    -2.378524   -.7155173
       _cons |  -18.06218   14.37927    -1.26   0.211    -46.51192    10.38755
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnsecedu L.lntertedu L.lnwage L.lngdp) collapsed
Instruments for levels equation
  Standard
    _cons
    lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock L.lnsecedu L.lntertedu L.lnwage L.lngdp) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.98  Pr > z =  0.048
Arellano-Bond test for AR(2) in first differences: z =  -0.90  Pr > z =  0.368
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(10)   =  12.53  Prob > chi2 =  0.251
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(10)   =  21.73  Prob > chi2 =  0.017
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(5)    =   3.63  Prob > chi2 =  0.604
    Difference (null H = exogenous): chi2(5)    =  18.10  Prob > chi2 =  0.003

. *fails specification tests
```

```
**FDI stock predetermined; gdp & wage endogenous; secedu & tertedu predetermined
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock lnsecedu
lntertedu  l.lnwage l.lngdp ,
>  laglimit(1 2) collapse) iv(lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s
> 2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 55                      Obs per group: min =         1
F(44, 129)    =     77.93                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .445465    .078242     5.69   0.000     .2906612    .6002688
             |
    lnsecedu |  -1.674779   .9373675    -1.79   0.076    -3.529383    .1798257
   lntertedu |  -.6521125   .5724687    -1.14   0.257    -1.784756    .4805308
      lnwage |  -.3868201   .6211391    -0.62   0.535    -1.615759    .8421188
       lngdp |   .4128716   .7227899     0.57   0.569    -1.017186    1.842929
 lntradefree |  -.1489961   .2277433    -0.65   0.514    -.5995918    .3015996
  lneconfree |    1.73191    .719143     2.41   0.017     .3090678    3.154752
lntransition |   1.464705   1.439699     1.02   0.311    -1.383775    4.313186
  lnictinfra |   .2396872    .251919     0.95   0.343    -.2587408    .7381151
indprivati~n |   1.743844   .6002286     2.91   0.004     .5562774    2.931411
       d1996 |  -.8341754   .6926759    -1.20   0.231    -2.204652    .5363008
       d1997 |  -.8080644   .6394208    -1.26   0.209    -2.073174    .4570453
       d1998 |  -.7733217   .5906585    -1.31   0.193    -1.941954    .3953107
       d1999 |  -.6903175    .555995    -1.24   0.217    -1.790367    .4097323
       d2000 |  -.8799858   .5177431    -1.70   0.092    -1.904353    .1443816
       d2001 |  -.7507007   .5071957    -1.48   0.141      -1.7542    .2527983
       d2002 |  -.5389089   .4370601    -1.23   0.220    -1.403643    .3258252
       d2003 |  -.4701205   .3685595    -1.28   0.204    -1.199324    .2590834
       d2004 |  -.1929811   .2829314    -0.68   0.496    -.7527677    .3668055
       d2005 |  -.1248883   .2267789    -0.55   0.583    -.5735758    .3237993
       d2006 |  -.2026314   .1854423    -1.09   0.277    -.5695336    .1642707
       d2007 |   .1044894   .1363047     0.77   0.445    -.1651929    .3741717
          c4 |   1.418176   .9234833     1.54   0.127    -.4089579    3.245311
          c5 |   2.950014   1.443044     2.04   0.043     .0949162    5.805111
          c6 |   2.380815    1.24303     1.92   0.058      -.07855     4.84018
          c7 |   2.914898   1.298369     2.25   0.026     .3460429    5.483752
          c8 |   1.453313   .8599233     1.69   0.093    -.2480668    3.154692
          c9 |   2.374727   .9216011     2.58   0.011     .5513161    4.198137
         c11 |   1.112987   1.912361     0.58   0.562    -2.670665    4.896639
         c12 |   2.263891   1.523748     1.49   0.140     -.750881    5.278663
         c13 |   1.941542   1.004701     1.93   0.055     -.046283    3.929366
         c14 |   1.545725   1.108712     1.39   0.166    -.6478892    3.739339
          s2 |  -.9635405   .3507542    -2.75   0.007    -1.657516   -.2695648
          s3 |  -1.988975   .5691869    -3.49   0.001    -3.115125   -.8628244
          s4 |  -.2581532   .2723978    -0.95   0.345     -.797099    .2807925
          s5 |  -1.820311   .6662035    -2.73   0.007    -3.138411   -.5022109
          s6 |  -.2415306   .2443805    -0.99   0.325    -.7250435    .2419823
          s7 |  -.7157294   .2852805    -2.51   0.013    -1.280164    -.151295
          s8 |  -.2948168   .2422679    -1.22   0.226    -.7741498    .1845163
          s9 |  -.4491089   .2857342    -1.57   0.118    -1.014441    .1162231
         s10 |  -.7782399   .2942783    -2.64   0.009    -1.360477   -.1960031
         s11 |  -.4041342    .252663    -1.60   0.112    -.9040342    .0957657
         s12 |  -.3639674    .304326    -1.20   0.234    -.9660839     .238149
         s13 |   -1.43978   .3672628    -3.92   0.000    -2.166419   -.7131416
       _cons |  -7.405741   14.05436    -0.53   0.599    -35.21263    20.40115
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock lnsecedu lntertedu L.lnwage L.lngdp) collapsed
Instruments for levels equation
  Standard
    _cons
    lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock lnsecedu lntertedu L.lnwage L.lngdp) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.00  Pr > z =  0.045
Arellano-Bond test for AR(2) in first differences: z =  -0.83  Pr > z =  0.404
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(10)   =  12.92  Prob > chi2 =  0.228
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(10)   =  20.21  Prob > chi2 =  0.027
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(5)    =   9.24  Prob > chi2 =  0.100
    Difference (null H = exogenous): chi2(5)    =  10.97  Prob > chi2 =  0.052

. *fails specification tests
```

```
. **FDI stock predetermined; gdp & wage endogenous, secedu & tertedu exogenous
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage l.lngdp , laglimit(1 2) col
> lapse) iv( lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c
> 14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 51                      Obs per group: min =         1
F(44, 129)    =     81.79                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2841363   .1911339     1.49   0.140    -.0940267    .6622994
             |
    lnsecedu |  -.7661954   1.064209    -0.72   0.473    -2.871758    1.339367
   lntertedu |  -1.347418   .8917796    -1.51   0.133    -3.111826      .41699
      lnwage |  -.3312103   .6182998    -0.54   0.593    -1.554532    .8921109
       lngdp |   1.106128   .7529693     1.47   0.144    -.3836399    2.595896
 lntradefree |   .1611391   .3235816     0.50   0.619     -.479075    .8013532
  lneconfree |   1.191983   .6132272     1.94   0.054    -.0213022    2.405268
lntransition |   .9380517   1.273605     0.74   0.463    -1.581807     3.45791
  lnictinfra |   .3782772   .2386835     1.58   0.115    -.0939639    .8505184
indprivati~n |   .5990027   .7004031     0.86   0.394    -.7867621    1.984767
       d1996 |  -.0209897   .8247931    -0.03   0.980    -1.652863    1.610884
       d1997 |  -.0698833    .765072    -0.09   0.927    -1.583597     1.44383
       d1998 |  -.0658882   .7196098    -0.09   0.927    -1.489654    1.357877
       d1999 |   .1007959    .651045     0.15   0.877    -1.187313    1.388904
       d2000 |  -.1101001     .56721    -0.19   0.846    -1.232339    1.012139
       d2001 |   .0544375    .563866     0.10   0.923    -1.061185     1.17006
       d2002 |   .0312545   .4770982     0.07   0.948     -.912696    .9752049
       d2003 |   .1637921   .3953344     0.41   0.679    -.6183868    .9459709
       d2004 |   .1707005   .3023254     0.56   0.573    -.4274577    .7688588
       d2005 |   .1718424   .2334289     0.74   0.463    -.2900024    .6336872
       d2006 |   .0646152   .1893835     0.34   0.734    -.3100847    .4393151
       d2007 |   .0893266   .1534702     0.58   0.562     -.214318    .3929711
          c4 |   .9119244    .915345     1.00   0.321    -.8991081    2.722957
          c5 |   1.412575   1.532635     0.92   0.358    -1.619781    4.444931
          c6 |    2.98403   1.981309     1.51   0.134    -.9360388    6.904098
          c7 |   2.371756   1.644184     1.44   0.152    -.8813019    5.624813
          c8 |   1.578503   1.242833     1.27   0.206    -.8804718    4.037477
          c9 |   2.201603   1.425407     1.54   0.125    -.6186004    5.021806
         c11 |   .2772691    1.75267     0.16   0.875    -3.190432     3.74497
         c12 |   1.274501   1.388395     0.92   0.360    -1.472473    4.021475
         c13 |   1.307213   1.052586     1.24   0.217    -.7753541    3.389779
         c14 |   1.448684   1.307089     1.11   0.270    -1.137425    4.034792
          s2 |  -1.113089   .4057135    -2.74   0.007    -1.915803   -.3103746
          s3 |  -2.982445   1.039063    -2.87   0.005    -5.038257   -.9266329
          s4 |  -.3356607   .2594467    -1.29   0.198    -.8489823    .1776609
          s5 |  -2.084864   .7971638    -2.62   0.010    -3.662072    -.507656
          s6 |  -.2831985   .2161462    -1.31   0.192     -.710849     .144452
          s7 |  -.9476069   .3555574    -2.67   0.009    -1.651086   -.2441279
          s8 |  -.3594599   .2351822    -1.53   0.129    -.8247736    .1058538
          s9 |  -.5008216       .263    -1.90   0.059    -1.021174    .0195304
         s10 |   -1.00287    .356879    -2.81   0.006    -1.708963   -.2967756
         s11 |  -.5634075   .2741238    -2.06   0.042    -1.105768   -.0210468
         s12 |  -.5353741   .3020537    -1.77   0.079    -1.132995    .0622466
         s13 |  -1.767849   .5809793    -3.04   0.003    -2.917331   -.6183676
       _cons |  -24.92467   14.65162    -1.70   0.091    -53.91325    4.063914
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage L.lngdp) collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock L.lnwage L.lngdp) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.73  Pr > z =  0.084
Arellano-Bond test for AR(2) in first differences: z =  -1.08  Pr > z =  0.279
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =   6.91  Prob > chi2 =  0.329
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   4.38  Prob > chi2 =  0.625
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(3)    =   2.36  Prob > chi2 =  0.500
    Difference (null H = exogenous): chi2(3)    =   2.02  Prob > chi2 =  0.569

. *fails specification tests
```

```
. **FDI stock predetermined; gdp & wage predetermined, secedu & tertedu exogenous
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock   lnwage
lngdp , laglimit(1 2) collaps
> e) iv(lnsecedu lntertedu  lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2-
> s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 51                      Obs per group: min =         1
F(44, 129)    =     72.76                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4712474    .171904     2.74   0.007     .1311311    .8113636
             |
    lnsecedu |   -2.00676   1.104611    -1.82   0.072    -4.192259    .1787397
   lntertedu |  -.3838467   .7492899    -0.51   0.609    -1.866335    1.098642
      lnwage |  -.3846961   .9296048    -0.41   0.680    -2.223942     1.45455
       lngdp |     .67429   .9120129     0.74   0.461     -1.13015     2.47873
 lntradefree |  -.1405122   .3051392    -0.46   0.646    -.7442377    .4632132
  lneconfree |   1.515544   .8499819     1.78   0.077    -.1661658    3.197254
lntransition |   .5712668   1.414866     0.40   0.687     -2.22808    3.370613
  lnictinfra |   .1949185    .371384     0.52   0.601    -.5398738    .9297108
indprivati~n |   .9309465   .6486252     1.44   0.154    -.3523743    2.214267
       d1996 |  -.5562535   .8022728    -0.69   0.489     -2.14357    1.031063
       d1997 |  -.5221947   .7339918    -0.71   0.478    -1.974415    .9300259
       d1998 |  -.4912198    .689091    -0.71   0.477    -1.854603    .8721636
       d1999 |  -.3733414   .6222197    -0.60   0.550    -1.604418    .8577355
       d2000 |  -.2982926   .5295831    -0.56   0.574    -1.346086    .7495006
       d2001 |  -.4627244   .5466023    -0.85   0.399    -1.544191    .6187416
       d2002 |  -.3176024   .4704905    -0.68   0.501    -1.248479    .6132745
       d2003 |  -.0723652   .3671941    -0.20   0.844    -.7988677    .6541374
       d2004 |   -.027247   .3024487    -0.09   0.928    -.6256492    .5711552
       d2005 |   .0069123   .2345572     0.03   0.977    -.4571648    .4709894
       d2006 |  -.0647597   .1899046    -0.34   0.734    -.4404907    .3109712
       d2007 |   .1497612   .1640396     0.91   0.363    -.1747952    .4743176
          c4 |   1.209968   1.025457     1.18   0.240    -.8189242    3.238859
          c5 |   2.787894    1.70419     1.64   0.104    -.5838879    6.159676
          c6 |    2.58387   1.815044     1.42   0.157     -1.00724    6.174979
          c7 |   2.504487   1.591612     1.57   0.118    -.6445556     5.65353
          c8 |   1.449839   1.164428     1.25   0.215    -.8540093    3.753688
          c9 |   2.266754   1.265084     1.79   0.076    -.2362447    4.769754
         c11 |   .0477607   1.716252     0.03   0.978    -3.347886    3.443407
         c12 |   1.726206   1.636259     1.05   0.293    -1.511172    4.963584
         c13 |   1.559868   1.060106     1.47   0.144     -.537578    3.657314
         c14 |   1.051631   1.448468     0.73   0.469    -1.814198     3.91746
          s2 |   -.806122   .3769922    -2.14   0.034     -1.55201   -.0602338
          s3 |  -1.644304   .9298844    -1.77   0.079    -3.484103    .1954949
          s4 |  -.2164456   .2464394    -0.88   0.381     -.704032    .2711409
          s5 |  -1.395617   .7602147    -1.84   0.069     -2.89972    .1084865
          s6 |   -.201355   .2211817    -0.91   0.364    -.6389684    .2362585
          s7 |  -.6621646    .337679    -1.96   0.052    -1.330271    .0059416
          s8 |  -.2246446   .2263118    -0.99   0.323     -.672408    .2231188
          s9 |  -.3874048   .2716206    -1.43   0.156    -.9248129    .1500033
         s10 |  -.7100495   .3360196    -2.11   0.037    -1.374873   -.0452266
         s11 |  -.3387108   .2567434    -1.32   0.189    -.8466838    .1692622
         s12 |  -.3250991   .3048219    -1.07   0.288    -.9281967    .2779985
         s13 |  -1.192582   .5067341    -2.35   0.020    -2.195168   -.1899961
       _cons |  -10.99121   18.35569    -0.60   0.550    -47.30839    25.32597
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock lnwage lngdp) collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock lnwage lngdp) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.93  Pr > z =  0.054
Arellano-Bond test for AR(2) in first differences: z =  -0.80  Pr > z =  0.426
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  13.25  Prob > chi2 =  0.039
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =  12.27  Prob > chi2 =  0.056
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(3)    =   9.33  Prob > chi2 =  0.025
    Difference (null H = exogenous): chi2(3)    =   2.94  Prob > chi2 =  0.401

. *fails specification tests
```

```
. **FDI stock predetermined; gdp, wage, secedu & tertedu predetermined
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock lnsecedu
lntertedu  lnwage lngdp , lag
> limit(1 2) collapse) iv(  lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2-
> s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 55                      Obs per group: min =         1
F(44, 129)    =     66.13                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4758102   .0876206     5.43   0.000     .3024506    .6491698
             |
    lnsecedu |  -2.337161   1.137156    -2.06   0.042    -4.587052   -.0872693
   lntertedu |  -.4947653   .6804912    -0.73   0.469    -1.841134    .8516033
      lnwage |   .2666401   .6037543     0.44   0.659    -.9279025    1.461183
       lngdp |   -.115622   .6671488    -0.17   0.863    -1.435592    1.204348
 lntradefree |  -.0342546   .2579519    -0.13   0.895    -.5446187    .4761095
  lneconfree |   1.345314   .9738663     1.38   0.170    -.5815044    3.272132
lntransition |   2.465132   1.614752     1.53   0.129    -.7296951     5.65996
  lnictinfra |   .2875196    .286082     1.01   0.317    -.2785005    .8535398
indprivati~n |   1.452164    .577344     2.52   0.013     .3098746    2.594453
       d1996 |  -.3373079   .7353046    -0.46   0.647    -1.792126     1.11751
       d1997 |  -.3367697   .6956491    -0.48   0.629    -1.713128    1.039589
       d1998 |   -.374551   .6563238    -0.57   0.569    -1.673104    .9240017
       d1999 |  -.3439375   .6123779    -0.56   0.575    -1.555542    .8676672
       d2000 |  -.5348873   .5559036    -0.96   0.338    -1.634756    .5649816
       d2001 |  -.4607081   .5635188    -0.82   0.415    -1.575644    .6542277
       d2002 |  -.3056298   .4803922    -0.64   0.526    -1.256098     .644838
       d2003 |  -.1775218   .4042304    -0.44   0.661    -.9773016     .622258
       d2004 |  -.0187427   .3114867    -0.06   0.952    -.6350268    .5975414
       d2005 |    .006661   .2449473     0.03   0.978    -.4779733    .4912952
       d2006 |  -.0662447   .1998288    -0.33   0.741    -.4616108    .3291214
       d2007 |   .1871005     .14235     1.31   0.191    -.0945424    .4687434
          c4 |   .8383526   1.048722     0.80   0.426     -1.23657    2.913275
          c5 |   3.540452   1.792886     1.97   0.050    -.0068171    7.087722
          c6 |   1.846354    1.19116     1.55   0.124    -.5103845    4.203092
          c7 |    3.17022   1.718218     1.85   0.067    -.2293164    6.569756
          c8 |   1.182949   .9118339     1.30   0.197    -.6211366    2.987035
          c9 |   2.476949   1.135334     2.18   0.031     .2306638    4.723234
         c11 |   1.376694   2.051697     0.67   0.503    -2.682639    5.436028
         c12 |   3.088859   1.724903     1.79   0.076    -.3239049    6.501622
         c13 |   1.759105      1.223     1.44   0.153    -.6606298    4.178839
         c14 |   .6084658    1.25654     0.48   0.629     -1.87763    3.094562
          s2 |  -.8231432   .3452433    -2.38   0.019    -1.506216   -.1400709
          s3 |  -1.800518   .6572028    -2.74   0.007     -3.10081    -.500226
          s4 |  -.2172284   .2654757    -0.82   0.415    -.7424786    .3080219
          s5 |  -1.688912   .8601355    -1.96   0.052    -3.390711    .0128875
          s6 |  -.2278511    .261971    -0.87   0.386    -.7461671    .2904649
          s7 |  -.6985578   .2976832    -2.35   0.020    -1.287531   -.1095842
          s8 |  -.2535879    .239895    -1.06   0.292     -.728226    .2210501
          s9 |  -.4408976   .2817381    -1.56   0.120    -.9983233    .1165281
         s10 |  -.7242171   .3053514    -2.37   0.019    -1.328362   -.1200718
         s11 |  -.2952998   .2603379    -1.13   0.259    -.8103847    .2197851
         s12 |  -.3727299   .3418804    -1.09   0.278    -1.049149    .3036887
         s13 |   -1.28473   .3724003    -3.45   0.001    -2.021534   -.5479274
       _cons |   2.866771   14.20672     0.20   0.840    -25.24158    30.97512
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock lnsecedu lntertedu lnwage lngdp) collapsed
Instruments for levels equation
  Standard
    _cons
    lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock lnsecedu lntertedu lnwage lngdp) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.03  Pr > z =  0.043
Arellano-Bond test for AR(2) in first differences: z =  -0.79  Pr > z =  0.427
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(10)   =  19.22  Prob > chi2 =  0.038
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(10)   =  30.79  Prob > chi2 =  0.001
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(5)    =  11.82  Prob > chi2 =  0.037
    Difference (null H = exogenous): chi2(5)    =  18.97  Prob > chi2 =  0.002

. *fails specification tests
```

Appendix 6.6: Model 6.4 results

```
. **Model 6.4 System GMM
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 47                      Obs per group: min =         1
F(44, 129)    =     89.93                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3208334   .1117719     2.87   0.005       .09969    .5419769
             |
    lnsecedu |   -.533791   1.040238    -0.51   0.609    -2.591928    1.524346
   lntertedu |  -1.014866    .828662    -1.22   0.223    -2.654394    .6246623
      lnwage |  -.4811796   .4289389    -1.12   0.264    -1.329846    .3674865
       lngdp |   .3232995    .538482     0.60   0.549    -.7421003    1.388699
 lntradefree |  -.0156689   .2795488    -0.06   0.955     -.568763    .5374253
  lneconfree |   1.555186    .646416     2.41   0.018     .2762365    2.834136
lntransition |   2.226154   1.108879     2.01   0.047     .0322095    4.420099
  lnictinfra |   .3942821   .2317451     1.70   0.091    -.0642313    .8527956
indprivati~n |    1.30017    .692433     1.88   0.063    -.0698252    2.670166
       d1996 |  -.9040535    .744114    -1.21   0.227    -2.376301    .5681942
       d1997 |  -.9096219   .7171691    -1.27   0.207    -2.328558    .5093148
       d1998 |  -.8653015   .6743822    -1.28   0.202    -2.199583    .4689801
       d1999 |  -.7769027   .6236156    -1.25   0.215    -2.010741     .456936
       d2000 |  -1.120688    .526311    -2.13   0.035    -2.162007   -.0793687
       d2001 |  -.8396037   .5206383    -1.61   0.109    -1.869699     .190492
       d2002 |  -.7322052   .4465472    -1.64   0.104     -1.61571    .1512994
       d2003 |  -.6432739   .4242456    -1.52   0.132    -1.482654    .1961064
       d2004 |  -.2990308   .2750488    -1.09   0.279    -.8432216    .2451601
       d2005 |  -.2410968   .2048553    -1.18   0.241     -.646408    .1642143
       d2006 |  -.2709131   .1581928    -1.71   0.089    -.5839014    .0420752
       d2007 |  -.0226139   .1101029    -0.21   0.838    -.2404553    .1952274
          c4 |   2.143116   .8504812     2.52   0.013     .4604184    3.825814
          c5 |   2.861377   1.588306     1.80   0.074    -.2811263    6.003879
          c6 |   2.344773   1.332944     1.76   0.081    -.2924895    4.982035
          c7 |   3.373176   1.664154     2.03   0.045     .0806068    6.665745
          c8 |   1.515622   .9709776     1.56   0.121    -.4054807    3.436725
          c9 |   2.255235   1.217279     1.85   0.066    -.1531816    4.663652
         c11 |    2.69387    1.93081     1.40   0.165    -1.126285    6.514024
         c12 |   2.795191   1.518817     1.84   0.068    -.2098246    5.800207
         c13 |   2.459607   1.092451     2.25   0.026     .2981662    4.621048
         c14 |    2.40213   1.059094     2.27   0.025     .3066859    4.497574
          s2 |  -1.003029   .3208703    -3.13   0.002    -1.637879   -.3681792
          s3 |  -2.843619   .7675946    -3.70   0.000    -4.362324   -1.324914
          s4 |  -.2663226   .2382375    -1.12   0.266    -.7376813    .2050362
          s5 |  -2.080592   .5994255    -3.47   0.001     -3.26657   -.8946138
          s6 |  -.2634231   .2085931    -1.26   0.209    -.6761297    .1492835
          s7 |  -.8562062   .2694939    -3.18   0.002    -1.389407   -.3230059
          s8 |  -.2892621   .2128607    -1.36   0.177    -.7104123     .131888
          s9 |  -.4886417   .2366244    -2.07   0.041    -.9568088   -.0204746
         s10 |  -.9078983   .2684454    -3.38   0.001    -1.439024   -.3767725
```

```
         s11 |   -.486165   .2320611    -2.09   0.038    -.9453037   -.0270264
         s12 |  -.4438315   .2777173    -1.60   0.112     -.993302    .1056389
         s13 |  -1.586333   .3809908    -4.16   0.000    -2.340133   -.8325336
       _cons |   -9.37977    11.0529    -0.85   0.398    -31.24821    12.48867
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.289
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.89  Prob > chi2 =  0.087
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.99  Prob > chi2 =  0.609
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.26  Prob > chi2 =  0.612
    Difference (null H = exogenous): chi2(1)    =   0.73  Prob > chi2 =  0.392

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    -.78595   1.577803    -0.50   0.619    -3.907673    2.335773
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.494281   1.063527    -1.41   0.162    -3.598495    .6099328
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.7084854   .6471814    -1.09   0.276     -1.98895     .571979
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4760239   .8021236     0.59   0.554    -1.110997    2.063045
------------------------------------------------------------------------------


. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0230707   .4135921    -0.06   0.956    -.8413729    .7952315
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.289845   .8949541     2.56   0.012     .5191567    4.060534
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   3.277774   1.581633     2.07   0.040     .1484745    6.407073
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
```

```
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .5805382    .359881     1.61   0.109    -.1314952    1.292572
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.914362   1.189135     1.61   0.110    -.4383716    4.267095
------------------------------------------------------------------------------

.
```

```
. **Model 6.4 FE
. xtreg lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp lntradefree
lneconfree lntransition lnic
> tinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1283
Group variable: id                              Number of groups   =       130

R-sq:  within  = 0.2952                         Obs per group: min =         1
       between = 0.8341                                        avg =       9.9
       overall = 0.5743                                        max =        13

                                                F(22,1131)         =     21.54
corr(u_i, Xb)  = 0.5226                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .1934758   .0294962     6.56   0.000     .1356024    .2513491
             |
    lnsecedu |  -.6698671   1.501536    -0.45   0.656    -3.615976    2.276242
   lntertedu |  -.3828825   .7326196    -0.52   0.601    -1.820329    1.054564
      lnwage |  -.5342059   .7749431    -0.69   0.491    -2.054694    .9862818
       lngdp |   .4507245   .7466757     0.60   0.546    -1.014301     1.91575
 lntradefree |   .0347742   .6023787     0.06   0.954    -1.147131     1.21668
  lneconfree |    1.37947   .9375811     1.47   0.141    -.4601241    3.219064
lntransition |   2.662767   2.919594     0.91   0.362    -3.065661    8.391196
  lnictinfra |   .4709106   .4009703     1.17   0.240    -.3158187     1.25764
indprivati~n |   1.268965   .2994998     4.24   0.000     .6813273    1.856603
       d1996 |  (omitted)
       d1997 |   .0130319    .337859     0.04   0.969     -.649869    .6759329
       d1998 |   .0687798   .3872561     0.18   0.859    -.6910413    .8286008
       d1999 |   .1486281   .4313123     0.34   0.730     -.697634    .9948903
       d2000 |  -.2516717   .4872503    -0.52   0.606    -1.207688    .7043445
       d2001 |  -.0294384   .5631599    -0.05   0.958    -1.134394    1.075517
       d2002 |   .1530985   .6228805     0.25   0.806    -1.069033     1.37523
       d2003 |   .2521734   .6808485     0.37   0.711    -1.083695    1.588042
       d2004 |   .5290596   .7427938     0.71   0.476    -.9283491    1.986468
       d2005 |   .6040135   .8152234     0.74   0.459    -.9955066    2.203534
       d2006 |   .5468484   .8829063     0.62   0.536     -1.18547    2.279167
       d2007 |   .6100633   .9782966     0.62   0.533    -1.309417    2.529544
       d2008 |   .8098976   1.059337     0.76   0.445    -1.268589    2.888384
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
```

```
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |  -11.95249   15.26013    -0.78   0.434    -41.89383    17.98885
-------------+----------------------------------------------------------------
     sigma_u |  1.4583088
     sigma_e |  1.2182688
         rho |  .58896614   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(129, 1131) =     2.12           Prob > F = 0.0000

.
```

```
. **Model 6.4 OLS
. reg lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp lntradefree
lneconfree lntransition lnicti
> nfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1283
-------------+------------------------------           F( 44,  1238) =   75.16
       Model |  5566.62764    44  126.514265           Prob > F      =  0.0000
    Residual |  2083.96973  1238  1.68333581           R-squared     =  0.7276
-------------+------------------------------           Adj R-squared =  0.7179
       Total |  7650.59737  1282  5.96770466           Root MSE      =  1.2974

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4778515   .0250706    19.06   0.000      .428666     .527037
             |
    lnsecedu |   -.996562   1.596739    -0.62   0.533    -4.129175    2.136051
   lntertedu |  -.2239122   .7790083    -0.29   0.774    -1.752235     1.30441
      lnwage |  -.5886715   .8231173    -0.72   0.475    -2.203531    1.026188
       lngdp |   .5549401    .790297     0.70   0.483    -.9955293     2.10541
 lntradefree |  -.1448079   .6402688    -0.23   0.821     -1.40094    1.111324
  lneconfree |   .5732394   .9968057     0.58   0.565    -1.382376    2.528855
lntransition |   2.432461   3.107627     0.78   0.434    -3.664335    8.529258
  lnictinfra |   .2218436   .4265315     0.52   0.603    -.6149608    1.058648
indprivati~n |   1.655353   .3044638     5.44   0.000     1.058031    2.252675
       d1996 |  -.8193515   1.127264    -0.73   0.467     -3.03091    1.392207
       d1997 |  -.6819054   1.012083    -0.67   0.501    -2.667494    1.303683
       d1998 |  -.6334704   .9104454    -0.70   0.487    -2.419657    1.152716
       d1999 |  -.5643722   .8483348    -0.67   0.506    -2.228705    1.099961
       d2000 |  -.9730768   .8039344    -1.21   0.226    -2.550301    .6041477
       d2001 |  -.5908311   .7311608    -0.81   0.419    -2.025282    .8436201
       d2002 |  -.4850339   .6386994    -0.76   0.448    -1.738087     .768019
       d2003 |  -.4556584   .5259541    -0.87   0.386    -1.487518    .5762016
       d2004 |  -.1850777   .4443288    -0.42   0.677    -1.056799     .686643
       d2005 |  -.1870454   .3706179    -0.50   0.614    -.9141539    .5400631
       d2006 |  -.2483097   .3014798    -0.82   0.410    -.8397775    .3431581
       d2007 |  -.1869985   .2092488    -0.89   0.372      -.59752    .2235229
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |   1.244041   1.145955     1.09   0.278    -1.004188    3.492269
          c5 |   1.870444   1.793353     1.04   0.297    -1.647903     5.38879
          c6 |    1.58697   1.591961     1.00   0.319     -1.53627     4.71021
          c7 |     1.7172   1.581333     1.09   0.278    -1.385188    4.819588
          c8 |   .8826534   1.029984     0.86   0.392    -1.138054    2.903361
          c9 |   1.386442   1.298826     1.07   0.286    -1.161701    3.934585
         c10 |  (omitted)
         c11 |   .4861865   2.229463     0.22   0.827    -3.887756    4.860129
         c12 |   1.377434   1.707043     0.81   0.420    -1.971583    4.726451
         c13 |   1.339142   1.120368     1.20   0.232     -.858889    3.537172
         c14 |   1.343043   1.368146     0.98   0.326    -1.341097    4.027184
          s2 |  -.7603264   .1834158    -4.15   0.000    -1.120167   -.4004862
          s3 |  -2.140034   .2165296    -9.88   0.000     -2.56484   -1.715229
          s4 |  -.1852932    .183226    -1.01   0.312     -.544761    .1741746
          s5 |  -1.609111   .2165958    -7.43   0.000    -2.034047   -1.184176
          s6 |  -.2057085    .179393    -1.15   0.252    -.5576564    .1462395
          s7 |   -.626032    .182978    -3.42   0.001    -.9850133   -.2670507
          s8 |   -.198082   .1833286    -1.08   0.280    -.5577512    .1615871
          s9 |  -.3850523   .1817988    -2.12   0.034    -.7417201   -.0283845
         s10 |  -.6752637   .1815645    -3.72   0.000    -1.031472   -.3190555
         s11 |  -.3444126   .1782365    -1.93   0.054    -.6940915    .0052663
         s12 |   -.313625   .1779358    -1.76   0.078    -.6627141    .0354641
         s13 |  -1.287006   .1946514    -6.61   0.000    -1.668889   -.9051231
       _cons |  -8.980017   15.97736    -0.56   0.574    -40.32571    22.36568
------------------------------------------------------------------------------
```

Appendix 6.7: Different GMM estimators and options

```
. **Robustess checks: different GMM estimators/options
. **Baseline Model 6.4
. **Two-step System GMM with orthogonal deviations
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 49                      Obs per group: min =         1
F(44, 129)    =     81.64                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3118026   .1164769     2.68   0.008     .0813502    .5422551
             |
    lnsecedu |   .0468517   1.163361     0.04   0.968    -2.254886    2.348589
   lntertedu |  -1.199081   .8440154    -1.42   0.158    -2.868986    .4708243
      lnwage |  -1.589346   1.563896    -1.02   0.311    -4.683552     1.50486
       lngdp |   1.086779    1.19042     0.91   0.363    -1.268496    3.442054
 lntradefree |  -.0564319   .2832339    -0.20   0.842     -.616817    .5039533
  lneconfree |   1.684713   .6495537     2.59   0.011     .3995553    2.969871
lntransition |   .0625179   2.601038     0.02   0.981      -5.0837    5.208736
  lnictinfra |   .5968877   .2842984     2.10   0.038     .0343965    1.159379
indprivati~n |   1.238553   .5804432     2.13   0.035     .0901318    2.386974
       d1996 |  -1.418608   1.168044    -1.21   0.227    -3.729611     .892395
       d1997 |   -1.34834   1.025403    -1.31   0.191    -3.377125    .6804442
       d1998 |  -1.196141   .9190589    -1.30   0.195    -3.014521    .6222398
       d1999 |  -1.091693     .82118    -1.33   0.186    -2.716417    .5330319
       d2000 |  -1.493446   .7842617    -1.90   0.059    -3.045127    .0582345
       d2001 |  -1.183898    .745564    -1.59   0.115    -2.659015    .2912184
       d2002 |  -1.026956   .6415318    -1.60   0.112    -2.296242    .2423301
       d2003 |  -.8394947   .5380433    -1.56   0.121    -1.904027    .2250371
       d2004 |  -.5001698   .4166954    -1.20   0.232    -1.324612    .3242723
       d2005 |  -.4229228   .3409997    -1.24   0.217    -1.097599    .2517534
       d2006 |  -.4305971   .2790515    -1.54   0.125    -.9827074    .1215131
       d2007 |  -.1126247   .1930198    -0.58   0.561    -.4945192    .2692698
          c4 |   2.926609   1.394602     2.10   0.038     .1673548    5.685863
          c5 |   2.246218   1.651374     1.36   0.176    -1.021066    5.513503
          c6 |   3.638409   2.260917     1.61   0.110    -.8348701    8.111688
          c7 |   3.286725   1.585354     2.07   0.040     .1500628    6.423386
          c8 |    2.17646   1.392373     1.56   0.120    -.5783836    4.931305
          c9 |   2.467177   1.256693     1.96   0.052    -.0192217    4.953575
         c11 |   2.223938   1.934521     1.15   0.252     -1.60356    6.051435
         c12 |   1.638658   2.062934     0.79   0.428    -2.442908    5.720224
         c13 |   2.638554   1.075905     2.45   0.016     .5098484    4.767259
         c14 |   3.818521   2.165148     1.76   0.080    -.4652773    8.102318
          s2 |  -1.057647   .3289273    -3.22   0.002    -1.708438   -.4068561
          s3 |  -2.916411   .7930776    -3.68   0.000    -4.485535   -1.347288
          s4 |  -.3186784   .2456693    -1.30   0.197    -.8047412    .1673844
          s5 |  -2.022297   .6883361    -2.94   0.004    -3.384187   -.6604071
          s6 |  -.3068299   .2108101    -1.46   0.148    -.7239228     .110263
          s7 |  -.9126659   .2808676    -3.25   0.001    -1.468369   -.3569625
          s8 |  -.3390712   .2175703    -1.56   0.122    -.7695393    .0913969
```

```
         s9 |  -.5226335   .2428629    -2.15   0.033    -1.003144   -.0421234
        s10 |  -.9676882   .2799486    -3.46   0.001    -1.521573   -.4138031
        s11 |  -.5433867   .2376025    -2.29   0.024    -1.013489   -.0732842
        s12 |  -.5113618   .2790045    -1.83   0.069    -1.063379    .0406554
        s13 |  -1.671998   .3938622    -4.25   0.000    -2.451264    -.892732
      _cons |  -21.39492   19.97551    -1.07   0.286    -60.91695    18.12711
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
Instruments for levels equation
  Standard
    _cons
    lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.02  Pr > z =  0.043
Arellano-Bond test for AR(2) in first differences: z =  -1.10  Pr > z =  0.271
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =   5.74  Prob > chi2 =  0.219
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   3.43  Prob > chi2 =  0.488
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   2.19  Prob > chi2 =  0.334
    Difference (null H = exogenous): chi2(2)    =   1.24  Prob > chi2 =  0.538

.
```

```
. **Two-step System GMM with first-differences
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) two robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 49                      Obs per group: min =         1
F(44, 129)    =     66.09                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2691585   .1777997     1.51   0.133    -.0826225    .6209394
             |
    lnsecedu |  -1.396712   1.205301    -1.16   0.249    -3.781429    .9880044
   lntertedu |  -1.096964   .8487584    -1.29   0.199    -2.776254    .5823249
      lnwage |    1.60485   1.972234     0.81   0.417    -2.297263    5.506963
       lngdp |  -.9075936   1.557426    -0.58   0.561    -3.988999    2.173811
 lntradefree |   .1248105   .3399202     0.37   0.714    -.5477299    .7973509
  lneconfree |   .7273438   .7069848     1.03   0.306    -.6714429    2.126131
lntransition |   5.468454   3.124856     1.75   0.082    -.7141509    11.65106
  lnictinfra |   .0848902   .3270981     0.26   0.796    -.5622815    .7320618
indprivati~n |   .7286264   .5094052     1.43   0.155    -.2792442    1.736497
       d1996 |  -.1085934   1.900689    -0.06   0.955    -3.869153    3.651967
       d1997 |  -.1178784   1.654935    -0.07   0.943    -3.392208    3.156451
       d1998 |  -.1693992   1.464851    -0.12   0.908    -3.067642    2.728844
       d1999 |   -.125655    1.28858    -0.10   0.922    -2.675143    2.423833
       d2000 |  -.2669579   1.103164    -0.24   0.809    -2.449594    1.915678
       d2001 |  -.1212092   1.100814    -0.11   0.912    -2.299196    2.056778
       d2002 |  -.1464257   .9470683    -0.15   0.877    -2.020223    1.727372
       d2003 |  -.0178252   .8249837    -0.02   0.983    -1.650076    1.614425
       d2004 |   .0976067   .6008169     0.16   0.871    -1.091124    1.286338
       d2005 |   .1140221   .4611591     0.25   0.805    -.7983925    1.026437
       d2006 |   .0716629   .3654403     0.20   0.845    -.6513697    .7946954
       d2007 |   .1728076   .2417095     0.71   0.476    -.3054207    .6510359
          c4 |   .5889191   1.916041     0.31   0.759    -3.202015    4.379853
          c5 |   4.097405   1.976788     2.07   0.040     .1862808    8.008528
          c6 |   1.015598    3.39254     0.30   0.765    -5.696627    7.727822
          c7 |   4.071791   1.811661     2.25   0.026     .4873758    7.656207
          c8 |   .7695969   2.050836     0.38   0.708    -3.288033    4.827227
          c9 |   2.394537   1.831614     1.31   0.193    -1.229357    6.018431
         c11 |   3.804126   1.834229     2.07   0.040     .1750592    7.433193
         c12 |   5.014132   2.174466     2.31   0.023     .7118978    9.316367
         c13 |    2.32699      1.371     1.70   0.092    -.3855662    5.039547
         c14 |   .2438983   2.927808     0.08   0.934    -5.548841    6.036637
          s2 |  -1.119406   .4049832    -2.76   0.007    -1.920675   -.3181364
          s3 |  -3.014431   .8684904    -3.47   0.001     -4.73276   -1.296101
          s4 |  -.3218211   .2654138    -1.21   0.228    -.8469488    .2033067
          s5 |  -1.971264   .6775162    -2.91   0.004    -3.311747   -.6307821
          s6 |  -.2893152   .2361387    -1.23   0.223    -.7565214     .177891
          s7 |  -.9519478   .3473225    -2.74   0.007    -1.639134   -.2647619
          s8 |  -.3492682   .2486752    -1.40   0.163    -.8412782    .1427419
          s9 |  -.5305611   .2834785    -1.87   0.064     -1.09143    .0303081
         s10 |  -1.016318   .3635181    -2.80   0.006    -1.735547   -.2970883
         s11 |  -.5508828   .2827024    -1.95   0.054    -1.110216    .0084508
         s12 |  -.5117693   .3254677    -1.57   0.118    -1.155715    .1321766
         s13 |   -1.69675   .5696414    -2.98   0.003      -2.8238   -.5697009
       _cons |   11.10659   24.57156     0.45   0.652    -37.50885    59.72203
```

```
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
Instruments for levels equation
  Standard
    _cons
    lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.91  Pr > z =  0.056
Arellano-Bond test for AR(2) in first differences: z =  -1.05  Pr > z =  0.295
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =  16.43  Prob > chi2 =  0.002
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   3.81  Prob > chi2 =  0.433
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   3.30  Prob > chi2 =  0.192
    Difference (null H = exogenous): chi2(2)    =   0.51  Prob > chi2 =  0.775

.
```

```
. **One-step System GMM with orthogonal deviations
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate robust weighting matrix for Hansen test.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 49                      Obs per group: min =         1
F(44, 129)    =     82.74                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Robust
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3153918   .1697328     1.86   0.065    -.0204287    .6512124
             |
    lnsecedu |  -.5194027   1.166665    -0.45   0.657    -2.827678    1.788873
   lntertedu |   -.460752   1.127382    -0.41   0.683    -2.691305    1.769801
      lnwage |  -1.501007   1.458438    -1.03   0.305    -4.386562    1.384548
       lngdp |   1.214024   1.159024     1.05   0.297    -1.079133    3.507181
 lntradefree |  -.0916138   .2741554    -0.33   0.739    -.6340371    .4508094
  lneconfree |   1.063004   .7801689     1.36   0.175    -.4805796    2.606587
lntransition |   1.126705   2.572192     0.44   0.662    -3.962439     6.21585
  lnictinfra |    .485981   .3065339     1.59   0.115    -.1205038    1.092466
indprivati~n |   1.435112   .8615085     1.67   0.098    -.2694037    3.139628
       d1996 |  -1.259476    1.44291    -0.87   0.384     -4.11431    1.595358
       d1997 |  -1.091732   1.309633    -0.83   0.406    -3.682873    1.499409
       d1998 |  -.9788583   1.178588    -0.83   0.408    -3.310724    1.353008
       d1999 |  -.8563159   1.043498    -0.82   0.413    -2.920901     1.20827
       d2000 |  -1.292668    .859674    -1.50   0.135    -2.993555    .4082177
       d2001 |  -.9785031   .8629711    -1.13   0.259    -2.685913    .7289063
       d2002 |  -.7894262   .7944173    -0.99   0.322      -2.3612    .7823479
       d2003 |  -.6845515   .6950258    -0.98   0.327    -2.059677    .6905742
       d2004 |    -.39108    .485758    -0.81   0.422    -1.352164    .5700042
       d2005 |  -.3275378   .3778065    -0.87   0.388    -1.075037    .4199616
       d2006 |  -.3684809   .2865428    -1.29   0.201    -.9354129    .1984511
       d2007 |  -.2616755   .3099199    -0.84   0.400    -.8748596    .3515087
          c4 |   2.396354   1.546258     1.55   0.124    -.6629542    5.455663
          c5 |   1.934287   2.065667     0.94   0.351    -2.152686    6.021261
          c6 |   2.772375   2.644683     1.05   0.296    -2.460194    8.004944
          c7 |   2.242077    2.30939     0.97   0.333    -2.327108    6.811263
          c8 |   1.607855   1.681609     0.96   0.341     -1.71925    4.934961
          c9 |   1.840741   1.828238     1.01   0.316    -1.776474    5.457955
         c11 |    .760061   2.514112     0.30   0.763     -4.21417    5.734292
         c12 |   1.087094   2.261959     0.48   0.632    -3.388248    5.562435
         c13 |   1.970324   1.464224     1.35   0.181    -.9266786    4.867327
         c14 |   2.880969    2.27329     1.27   0.207    -1.616791    7.378729
          s2 |  -1.018544   .3847798    -2.65   0.009     -1.77984   -.2572477
          s3 |  -2.840602   .8704427    -3.26   0.001    -4.562794   -1.118409
          s4 |   -.276817   .2555616    -1.08   0.281    -.7824519    .2288178
          s5 |  -2.104155   .6835643    -3.08   0.003    -3.456603   -.7517059
          s6 |  -.2764831   .2183767    -1.27   0.208    -.7085468    .1555805
          s7 |  -.8701231   .3437864    -2.53   0.013    -1.550313   -.1899332
          s8 |  -.2987674   .2328451    -1.28   0.202    -.7594572    .1619224
          s9 |  -.5076782   .2556348    -1.99   0.049    -1.013458   -.0018986
         s10 |  -.9210151   .3412125    -2.70   0.008    -1.596112   -.2459179
         s11 |  -.4967885   .2688938    -1.85   0.067    -1.028801    .0352244
         s12 |  -.4557158   .3145668    -1.45   0.150    -1.078094    .1666623
         s13 |  -1.721573   .6000386    -2.87   0.005    -2.908764   -.5343816
       _cons |  -21.91064   18.88653    -1.16   0.248    -59.27811    15.45683
------------------------------------------------------------------------------
```

```
Instruments for orthogonal deviations equation
  Standard
    FOD.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
Instruments for levels equation
  Standard
    _cons
    lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.27  Pr > z =  0.023
Arellano-Bond test for AR(2) in first differences: z =  -1.31  Pr > z =  0.189
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =   5.74  Prob > chi2 =  0.219
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   3.43  Prob > chi2 =  0.488
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   2.19  Prob > chi2 =  0.334
    Difference (null H = exogenous): chi2(2)    =   1.24  Prob > chi2 =  0.538

.
```

```
. **One-step System GMM with with first-differences
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate robust weighting matrix for Hansen test.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 49                      Obs per group: min =         1
F(44, 129)    =     64.86                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Robust
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2678748    .168859     1.59   0.115    -.0662169    .6019666
             |
    lnsecedu |  -1.848736    1.35692    -1.36   0.175    -4.533435    .8359626
   lntertedu |    .287518   1.412482     0.20   0.839    -2.507112    3.082148
      lnwage |   .9234055   2.172794     0.42   0.672    -3.375521    5.222332
       lngdp |  -.2254943    1.77012    -0.13   0.899    -3.727721    3.276732
 lntradefree |   .2589226   .3950202     0.66   0.513    -.5226344     1.04048
  lneconfree |   .4624361   .7272329     0.64   0.526    -.9764121    1.901284
lntransition |   5.467928   3.469547     1.58   0.117    -1.396655    12.33251
  lnictinfra |  -.2183336   .4481527    -0.49   0.627    -1.105015    .6683474
indprivati~n |   1.925279   1.128235     1.71   0.090    -.3069619     4.15752
       d1996 |  -.3457928   2.186929    -0.16   0.875    -4.672685    3.981099
       d1997 |  -.3054397   1.925077    -0.16   0.874    -4.114252    3.503372
       d1998 |  -.3181826   1.711057    -0.19   0.853    -3.703552    3.067187
       d1999 |   -.239548   1.456781    -0.16   0.870    -3.121824    2.642728
       d2000 |  -.5104973   1.232078    -0.41   0.679    -2.948194      1.9272
       d2001 |  -.2108453   1.170733    -0.18   0.857     -2.52717     2.10548
       d2002 |  -.1156179   1.052906    -0.11   0.913    -2.198818    1.967583
       d2003 |  -.1267762    .919817    -0.14   0.891    -1.946657    1.693104
       d2004 |   .1124369   .6714873     0.17   0.867    -1.216117    1.440991
       d2005 |   .1378212   .5247565     0.26   0.793    -.9004224    1.176065
       d2006 |   .0308767   .3867978     0.08   0.936    -.7344121    .7961656
       d2007 |  -.0464679   .3485884    -0.13   0.894    -.7361585    .6432227
          c4 |   .5490344   2.036861     0.27   0.788    -3.480946    4.579015
          c5 |   3.249188   1.964979     1.65   0.101    -.6385713    7.136947
          c6 |   .2181413   4.020064     0.05   0.957    -7.735655    8.171937
          c7 |    2.21533   2.128302     1.04   0.300    -1.995568    6.426228
          c8 |   .0116391    2.40668     0.00   0.996    -4.750037    4.773315
          c9 |   1.245183   2.205259     0.56   0.573    -3.117975    5.608341
         c11 |   1.260367   2.384455     0.53   0.598    -3.457335     5.97807
         c12 |   3.409485   2.467439     1.38   0.169    -1.472403    8.291373
         c13 |   1.460009   1.423811     1.03   0.307    -1.357035    4.277054
         c14 |  -.1215297   3.308274    -0.04   0.971    -6.667031    6.423972
          s2 |  -1.083154   .3984149    -2.72   0.007    -1.871428   -.2948804
          s3 |  -3.028555   .8636083    -3.51   0.001    -4.737225   -1.319884
          s4 |  -.2940349   .2702652    -1.09   0.279    -.8287613    .2406914
          s5 |  -2.283995   .6907057    -3.31   0.001    -3.650573   -.9174165
          s6 |  -.3089412   .2298707    -1.34   0.181    -.7637461    .1458637
          s7 |  -.9315304   .3549884    -2.62   0.010    -1.633884   -.2291773
          s8 |  -.3174601   .2463212    -1.29   0.200    -.8048126    .1698925
          s9 |  -.5668607   .2689586    -2.11   0.037    -1.099002   -.0347195
         s10 |  -.9827704   .3515568    -2.80   0.006    -1.678334   -.2872066
         s11 |  -.5331315   .2824298    -1.89   0.061    -1.091926    .0256628
         s12 |   -.492113   .3328506    -1.48   0.142    -1.150666    .1664401
         s13 |  -1.839995    .619471    -2.97   0.004    -3.065633   -.6143561
       _cons |   .7169213   26.58306     0.03   0.979    -51.87831    53.31215
------------------------------------------------------------------------------
```

```
Instruments for first differences equation
  Standard
    D.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
Instruments for levels equation
  Standard
    _cons
    lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.26  Pr > z =  0.024
Arellano-Bond test for AR(2) in first differences: z =  -1.42  Pr > z =  0.155
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =  16.43  Prob > chi2 =  0.002
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   3.81  Prob > chi2 =  0.433
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   3.30  Prob > chi2 =  0.192
    Difference (null H = exogenous): chi2(2)    =   0.51  Prob > chi2 =  0.775

.
```

```
. **Two-step Difference GMM with orthogonal deviations
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) nolevel two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c5 dropped due to collinearity
c6 dropped due to collinearity
c7 dropped due to collinearity
c8 dropped due to collinearity
c9 dropped due to collinearity
c10 dropped due to collinearity
c11 dropped due to collinearity
c12 dropped due to collinearity
c13 dropped due to collinearity
c14 dropped due to collinearity
s2 dropped due to collinearity
s3 dropped due to collinearity
s4 dropped due to collinearity
s5 dropped due to collinearity
s6 dropped due to collinearity
s7 dropped due to collinearity
s8 dropped due to collinearity
s9 dropped due to collinearity
s10 dropped due to collinearity
s11 dropped due to collinearity
s12 dropped due to collinearity
s13 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1153
Time variable : year                            Number of groups   =       129
Number of instruments = 24                      Obs per group: min =         0
F(22, 129)    =     57.37                                      avg =      8.94
Prob > F      =     0.000                                      max =        12
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2930003   .1060283     2.76   0.007     .0832207    .5027798
             |
    lnsecedu |  -.4927605   1.051485    -0.47   0.640    -2.573149    1.587628
   lntertedu |  -.7563393   .7825626    -0.97   0.336    -2.304659      .79198
      lnwage |   -.988525   1.080394    -0.91   0.362    -3.126111    1.149061
       lngdp |   .7411505   .9557393     0.78   0.439    -1.149803    2.632104
 lntradefree |  -.0973139   .2387109    -0.41   0.684    -.5696091    .3749814
  lneconfree |   1.143403   .6992432     1.64   0.104    -.2400664    2.526873
lntransition |   1.264554   1.719025     0.74   0.463    -2.136579    4.665687
  lnictinfra |   .2994335   .3249365     0.92   0.359    -.3434613    .9423284
indprivati~n |   1.117634   .7609688     1.47   0.144    -.3879616    2.623229
       d1996 |  -1.520294   .9680214    -1.57   0.119    -3.435548    .3949604
       d1997 |  -1.438709   .8300253    -1.73   0.085    -3.080934    .2035167
       d1998 |  -1.305631    .761333    -1.71   0.089    -2.811947    .2006853
       d1999 |  -1.149328   .6681515    -1.72   0.088    -2.471282    .1726262
       d2000 |  -1.424333    .560782    -2.54   0.012    -2.533854   -.3148123
       d2001 |  -1.124522    .550354    -2.04   0.043    -2.213411   -.0356332
       d2002 |  -.9878034   .4750811    -2.08   0.040    -1.927763   -.0478438
       d2003 |  -.8303105    .395666    -2.10   0.038    -1.613145   -.0474755
       d2004 |  -.4831601   .3236007    -1.49   0.138    -1.123412    .1570918
       d2005 |  -.4042647   .2561911    -1.58   0.117    -.9111452    .1026158
       d2006 |  -.4005121   .2036581    -1.97   0.051    -.8034547    .0024305
       d2007 |  -.2775821   .2883635    -0.96   0.338    -.8481164    .2929522
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.07  Pr > z =  0.038
Arellano-Bond test for AR(2) in first differences: z =  -1.15  Pr > z =  0.248
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   1.02  Prob > chi2 =  0.602
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.49  Prob > chi2 =  0.783
  (Robust, but can be weakened by many instruments.)

.
```

```
. **Two-step Difference GMM with first-differences
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) nolevel two robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c5 dropped due to collinearity
c6 dropped due to collinearity
c7 dropped due to collinearity
c8 dropped due to collinearity
c9 dropped due to collinearity
c10 dropped due to collinearity
c11 dropped due to collinearity
c12 dropped due to collinearity
c13 dropped due to collinearity
c14 dropped due to collinearity
s2 dropped due to collinearity
s3 dropped due to collinearity
s4 dropped due to collinearity
s5 dropped due to collinearity
s6 dropped due to collinearity
s7 dropped due to collinearity
s8 dropped due to collinearity
s9 dropped due to collinearity
s10 dropped due to collinearity
s11 dropped due to collinearity
s12 dropped due to collinearity
s13 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1153
Time variable : year                            Number of groups   =       129
Number of instruments = 24                      Obs per group: min =         0
F(22, 129)    =     29.40                                      avg =      8.94
Prob > F      =     0.000                                      max =        12
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .1903081   .1639547     1.16   0.248    -.1340803    .5146965
             |
    lnsecedu |   1.225137   2.172029     0.56   0.574    -3.072276    5.522551
   lntertedu |  -.8779878    1.76518    -0.50   0.620     -4.37044    2.614464
      lnwage |  -.9167376   2.992441    -0.31   0.760    -6.837355    5.003879
       lngdp |   2.439099   2.683389     0.91   0.365    -2.870051     7.74825
 lntradefree |   .2860834   .5209066     0.55   0.584    -.7445431     1.31671
  lneconfree |  -.6376986   .6840691    -0.93   0.353    -1.991146     .715749
lntransition |   2.929559   3.017635     0.97   0.333    -3.040906    8.900025
  lnictinfra |  -.9664639   1.183973    -0.82   0.416    -3.308983    1.376055
indprivati~n |   1.005035   1.037093     0.97   0.334    -1.046878    3.056949
       d1996 |  -1.454939   2.399953    -0.61   0.545    -6.203306    3.293427
       d1997 |  -.9139625   2.062629    -0.44   0.658    -4.994924    3.166999
       d1998 |   -.743905   1.796452    -0.41   0.679     -4.29823     2.81042
       d1999 |   -.315584   1.491995    -0.21   0.833    -3.267533    2.636365
       d2000 |  -.2982558   1.164866    -0.26   0.798    -2.602971     2.00646
       d2001 |   .1604224   1.060155     0.15   0.880    -1.937119    2.257964
       d2002 |   .1331592   .8496524     0.16   0.876    -1.547899    1.814217
       d2003 |   .0904483   .6867668     0.13   0.895    -1.268337    1.449233
       d2004 |   .2488974   .5866864     0.42   0.672     -.911876    1.409671
       d2005 |   .2169736   .4670309     0.46   0.643    -.7070584    1.141006
       d2006 |   .1509676    .382725     0.39   0.694    -.6062632    .9081984
       d2007 |  -.0494124   .3880439    -0.13   0.899    -.8171667    .7183419
------------------------------------------------------------------------------
```

```
Instruments for first differences equation
  Standard
    D.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.79  Pr > z =  0.073
Arellano-Bond test for AR(2) in first differences: z =  -1.38  Pr > z =  0.166
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.63  Prob > chi2 =  0.099
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   2.45  Prob > chi2 =  0.294
  (Robust, but can be weakened by many instruments.)

.
```

```
. **One-step Difference GMM with orthogonal deviations
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) nolevel robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c5 dropped due to collinearity
c6 dropped due to collinearity
c7 dropped due to collinearity
c8 dropped due to collinearity
c9 dropped due to collinearity
c10 dropped due to collinearity
c11 dropped due to collinearity
c12 dropped due to collinearity
c13 dropped due to collinearity
c14 dropped due to collinearity
s2 dropped due to collinearity
s3 dropped due to collinearity
s4 dropped due to collinearity
s5 dropped due to collinearity
s6 dropped due to collinearity
s7 dropped due to collinearity
s8 dropped due to collinearity
s9 dropped due to collinearity
s10 dropped due to collinearity
s11 dropped due to collinearity
s12 dropped due to collinearity
s13 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate robust weighting matrix for Hansen test.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, one-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1153
Time variable : year                            Number of groups   =       129
Number of instruments = 24                      Obs per group: min =         0
F(22, 129)    =     59.44                                      avg =      8.94
Prob > F      =     0.000                                      max =        12
------------------------------------------------------------------------------
             |               Robust
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3742096   .1615508     2.32   0.022     .0545774    .6938418
             |
    lnsecedu |  -.5324873   1.068499    -0.50   0.619    -2.646539    1.581565
   lntertedu |  -.2691231   1.091236    -0.25   0.806    -2.428161    1.889914
      lnwage |  -1.109091   1.140859    -0.97   0.333    -3.366308    1.148127
       lngdp |   .8638822   1.005014     0.86   0.392    -1.124562    2.852326
 lntradefree |  -.0909696   .2419678    -0.38   0.708    -.5697088    .3877697
  lneconfree |   .9428296    .844571     1.12   0.266    -.7281748    2.613834
lntransition |   1.572588   1.781331     0.88   0.379    -1.951819    5.096995
  lnictinfra |   .3687599   .3374664     1.09   0.277    -.2989257    1.036445
indprivati~n |   1.539059   .9305875     1.65   0.101    -.3021316    3.380249
       d1996 |  -1.063788    1.14551    -0.93   0.355    -3.330208    1.202631
       d1997 |  -.9621468   1.056675    -0.91   0.364    -3.052804     1.12851
       d1998 |  -.8656549   .9763563    -0.89   0.377      -2.7974     1.06609
       d1999 |  -.7645111   .8507447    -0.90   0.371     -2.44773    .9187081
       d2000 |  -1.188517   .6271413    -1.90   0.060    -2.429332    .0522972
       d2001 |   -.845211   .6683859    -1.26   0.208    -2.167629    .4772069
       d2002 |  -.6832481   .6377413    -1.07   0.286    -1.945035    .5785387
       d2003 |   -.596077   .5219533    -1.14   0.256    -1.628774    .4366203
       d2004 |  -.3198882   .3898462    -0.82   0.413    -1.091208    .4514319
       d2005 |  -.2882423     .29969    -0.96   0.338    -.8811864    .3047018
       d2006 |   -.334738   .2202185    -1.52   0.131    -.7704457    .1009698
       d2007 |  -.2380554   .2992249    -0.80   0.428    -.8300792    .3539685
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
```

```
  Standard
    FOD.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.14  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.21  Pr > z =  0.225
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   1.02  Prob > chi2 =  0.602
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.49  Prob > chi2 =  0.783
  (Robust, but can be weakened by many instruments.)

.
```

```
. **Two-step Difference GMM with first-differences
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock
l.lnwage  , laglimit(1 2) collapse)
> iv(lngdp lnsecedu lntertedu   lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) nolevel robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c5 dropped due to collinearity
c6 dropped due to collinearity
c7 dropped due to collinearity
c8 dropped due to collinearity
c9 dropped due to collinearity
c10 dropped due to collinearity
c11 dropped due to collinearity
c12 dropped due to collinearity
c13 dropped due to collinearity
c14 dropped due to collinearity
s2 dropped due to collinearity
s3 dropped due to collinearity
s4 dropped due to collinearity
s5 dropped due to collinearity
s6 dropped due to collinearity
s7 dropped due to collinearity
s8 dropped due to collinearity
s9 dropped due to collinearity
s10 dropped due to collinearity
s11 dropped due to collinearity
s12 dropped due to collinearity
s13 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate robust weighting matrix for Hansen test.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, one-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1153
Time variable : year                            Number of groups   =       129
Number of instruments = 24                      Obs per group: min =         0
F(22, 129)    =     32.51                                      avg =      8.94
Prob > F      =     0.000                                      max =        12
------------------------------------------------------------------------------
             |               Robust
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4097621   .1917979     2.14   0.035     .0302852    .7892389
             |
    lnsecedu |  -.9777922   2.663254    -0.37   0.714    -6.247106    4.291522
   lntertedu |   2.635979   3.047204     0.87   0.389     -3.39299    8.664947
      lnwage |   2.896084   4.266317     0.68   0.498    -5.544928     11.3371
       lngdp |  -1.068887   3.945235    -0.27   0.787     -8.87463    6.736857
 lntradefree |   .6865883   .7136727     0.96   0.338    -.7254306    2.098607
  lneconfree |  -1.587547   1.063717    -1.49   0.138    -3.692138    .5170441
lntransition |   5.715283   3.859109     1.48   0.141    -1.920058    13.35062
  lnictinfra |  -1.163273   1.136022    -1.02   0.308    -3.410921    1.084374
indprivati~n |   2.427789    1.42494     1.70   0.091    -.3914891    5.247067
       d1996 |   .5316167   2.875291     0.18   0.854    -5.157217    6.220451
       d1997 |   .7442441   2.443995     0.30   0.761     -4.09126    5.579748
       d1998 |   .7484036   2.136189     0.35   0.727    -3.478099    4.974906
       d1999 |   .8319356   1.718803     0.48   0.629    -2.568758     4.23263
       d2000 |   .7298896   1.394292     0.52   0.602    -2.028751     3.48853
       d2001 |   1.189035   1.331886     0.89   0.374    -1.446134    3.824204
       d2002 |   1.114755   1.144752     0.97   0.332    -1.150164    3.379674
       d2003 |   .8622895   .8974387     0.96   0.338     -.913315    2.637894
       d2004 |   .9765492    .827137     1.18   0.240    -.6599617     2.61306
       d2005 |   .8222447   .6738815     1.22   0.225    -.5110463    2.155536
       d2006 |    .577263   .5079175     1.14   0.258    -.4276642     1.58219
       d2007 |   .2024043   .4380825     0.46   0.645    -.6643527    1.069161
------------------------------------------------------------------------------
Instruments for first differences equation
```

```
  Standard
    D.(lngdp lnsecedu lntertedu lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).(L.lnindfdistock L.lnwage) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.09  Pr > z =  0.036
Arellano-Bond test for AR(2) in first differences: z =  -1.20  Pr > z =  0.231
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.63  Prob > chi2 =  0.099
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   2.45  Prob > chi2 =  0.294
  (Robust, but can be weakened by many instruments.)
```

Appendix 6.8: Reducing the instrument count

```
. **Checking robustness by reducing the number of instruments
. **start with Baseline Model 6.4
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 47                      Obs per group: min =         1
F(44, 129)    =     89.93                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3208334   .1117719     2.87   0.005       .09969    .5419769
             |
    lnsecedu |   -.533791   1.040238    -0.51   0.609    -2.591928    1.524346
   lntertedu |  -1.014866    .828662    -1.22   0.223    -2.654394    .6246623
      lnwage |  -.4811796   .4289389    -1.12   0.264    -1.329846    .3674865
       lngdp |   .3232995    .538482     0.60   0.549    -.7421003    1.388699
 lntradefree |  -.0156689   .2795488    -0.06   0.955     -.568763    .5374253
  lneconfree |   1.555186    .646416     2.41   0.018     .2762365    2.834136
lntransition |   2.226154   1.108879     2.01   0.047     .0322095    4.420099
  lnictinfra |   .3942821   .2317451     1.70   0.091    -.0642313    .8527956
indprivati~n |    1.30017    .692433     1.88   0.063    -.0698252    2.670166
       d1996 |  -.9040535    .744114    -1.21   0.227    -2.376301    .5681942
       d1997 |  -.9096219   .7171691    -1.27   0.207    -2.328558    .5093148
       d1998 |  -.8653015   .6743822    -1.28   0.202    -2.199583    .4689801
       d1999 |  -.7769027   .6236156    -1.25   0.215    -2.010741     .456936
       d2000 |  -1.120688    .526311    -2.13   0.035    -2.162007   -.0793687
       d2001 |  -.8396037   .5206383    -1.61   0.109    -1.869699     .190492
       d2002 |  -.7322052   .4465472    -1.64   0.104     -1.61571    .1512994
       d2003 |  -.6432739   .4242456    -1.52   0.132    -1.482654    .1961064
       d2004 |  -.2990308   .2750488    -1.09   0.279    -.8432216    .2451601
       d2005 |  -.2410968   .2048553    -1.18   0.241     -.646408    .1642143
       d2006 |  -.2709131   .1581928    -1.71   0.089    -.5839014    .0420752
       d2007 |  -.0226139   .1101029    -0.21   0.838    -.2404553    .1952274
          c4 |   2.143116   .8504812     2.52   0.013     .4604184    3.825814
          c5 |   2.861377   1.588306     1.80   0.074    -.2811263    6.003879
          c6 |   2.344773   1.332944     1.76   0.081    -.2924895    4.982035
          c7 |   3.373176   1.664154     2.03   0.045     .0806068    6.665745
          c8 |   1.515622   .9709776     1.56   0.121    -.4054807    3.436725
          c9 |   2.255235   1.217279     1.85   0.066    -.1531816    4.663652
         c11 |    2.69387    1.93081     1.40   0.165    -1.126285    6.514024
         c12 |   2.795191   1.518817     1.84   0.068    -.2098246    5.800207
         c13 |   2.459607   1.092451     2.25   0.026     .2981662    4.621048
         c14 |    2.40213   1.059094     2.27   0.025     .3066859    4.497574
          s2 |  -1.003029   .3208703    -3.13   0.002    -1.637879   -.3681792
          s3 |  -2.843619   .7675946    -3.70   0.000    -4.362324   -1.324914
          s4 |  -.2663226   .2382375    -1.12   0.266    -.7376813    .2050362
          s5 |  -2.080592   .5994255    -3.47   0.001     -3.26657   -.8946138
          s6 |  -.2634231   .2085931    -1.26   0.209    -.6761297    .1492835
          s7 |  -.8562062   .2694939    -3.18   0.002    -1.389407   -.3230059
          s8 |  -.2892621   .2128607    -1.36   0.177    -.7104123     .131888
          s9 |  -.4886417   .2366244    -2.07   0.041    -.9568088   -.0204746
         s10 |  -.9078983   .2684454    -3.38   0.001    -1.439024   -.3767725
```

```
         s11 |   -.486165   .2320611    -2.09   0.038    -.9453037   -.0270264
         s12 |  -.4438315   .2777173    -1.60   0.112     -.993302    .1056389
         s13 |  -1.586333   .3809908    -4.16   0.000    -2.340133   -.8325336
       _cons |   -9.37977    11.0529    -0.85   0.398    -31.24821    12.48867
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.289
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.89  Prob > chi2 =  0.087
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.99  Prob > chi2 =  0.609
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.26  Prob > chi2 =  0.612
    Difference (null H = exogenous): chi2(1)    =   0.73  Prob > chi2 =  0.392

.
```

```
. **testing joint significance of dummies
. test c4=c5=c6=c7=c8=c9=c11=c12=c13=0

 ( 1)  c4 - c5 = 0
 ( 2)  c4 - c6 = 0
 ( 3)  c4 - c7 = 0
 ( 4)  c4 - c8 = 0
 ( 5)  c4 - c9 = 0
 ( 6)  c4 - c11 = 0
 ( 7)  c4 - c12 = 0
 ( 8)  c4 - c13 = 0
 ( 9)  c4 = 0

       F(  9,   129) =    1.98
            Prob > F =    0.0463

. test d1996=d1997=d1998=d1999=d2000=d2001=d2002=d2003=d2004=d2005=d2006=d2007=0

 ( 1)  d1996 - d1997 = 0
 ( 2)  d1996 - d1998 = 0
 ( 3)  d1996 - d1999 = 0
 ( 4)  d1996 - d2000 = 0
 ( 5)  d1996 - d2001 = 0
 ( 6)  d1996 - d2002 = 0
 ( 7)  d1996 - d2003 = 0
 ( 8)  d1996 - d2004 = 0
 ( 9)  d1996 - d2005 = 0
 (10)  d1996 - d2006 = 0
 (11)  d1996 - d2007 = 0
 (12)  d1996 = 0

       F( 12,   129) =    3.15
            Prob > F =    0.0006

. test s2=s3=s4=s5=s6=s7=s8=s9=s10=s11=s12=s13=0

 ( 1)  s2 - s3 = 0
 ( 2)  s2 - s4 = 0
 ( 3)  s2 - s5 = 0
 ( 4)  s2 - s6 = 0
 ( 5)  s2 - s7 = 0
 ( 6)  s2 - s8 = 0
 ( 7)  s2 - s9 = 0
 ( 8)  s2 - s10 = 0
 ( 9)  s2 - s11 = 0
 (10)  s2 - s12 = 0
 (11)  s2 - s13 = 0
 (12)  s2 = 0

       F( 12,   129) =    2.10
            Prob > F =    0.0209

.
```

```
. **limit lag length to lag 1 only
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 1) collapse) iv(lnsecedu l
> ntertedu  lnwage lngdp     lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14 s2
> -s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 46                      Obs per group: min =         1
F(44, 129)    =     96.31                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3941117   .1103209     3.57   0.000      .175839    .6123844
             |
    lnsecedu |  -.6819076   1.074021    -0.63   0.527    -2.806885     1.44307
   lntertedu |  -.2879896    1.09214    -0.26   0.792    -2.448815    1.872836
      lnwage |  -.6691042   .4641303    -1.44   0.152    -1.587397     .249189
       lngdp |   .5540893   .5870941     0.94   0.347    -.6074907    1.715669
 lntradefree |  -.0415594   .2653751    -0.16   0.876    -.5666106    .4834918
  lneconfree |   1.079604   .8117343     1.33   0.186    -.5264321     2.68564
lntransition |   2.453441   1.129033     2.17   0.032     .2196205    4.687261
  lnictinfra |   .4411933   .2333615     1.89   0.061    -.0205181    .9029047
indprivati~n |   1.664574   .7451581     2.23   0.027     .1902605    3.138888
       d1996 |  -.5198179   .7594564    -0.68   0.495    -2.022421    .9827853
       d1997 |   -.461927   .7654574    -0.60   0.547    -1.976403    1.052549
       d1998 |  -.4359923   .7275555    -0.60   0.550    -1.875479    1.003494
       d1999 |   -.397477   .6635862    -0.60   0.550    -1.710399    .9154445
       d2000 |  -.8909695   .4955192    -1.80   0.075    -1.871366    .0894273
       d2001 |  -.5670213   .5325987    -1.06   0.289    -1.620781    .4867383
       d2002 |  -.4241713   .4971045    -0.85   0.395    -1.407705     .559362
       d2003 |  -.3869563   .4648622    -0.83   0.407    -1.306697    .5327849
       d2004 |  -.1443547   .2734652    -0.53   0.598    -.6854123    .3967029
       d2005 |  -.1351844   .1998528    -0.68   0.500    -.5305981    .2602293
       d2006 |  -.2179156    .140639    -1.55   0.124    -.4961732     .060342
       d2007 |  -.0885259   .1376497    -0.64   0.521    -.3608693    .1838175
          c4 |   1.572689   .9349458     1.68   0.095     -.277124    3.422502
          c5 |   1.905097   1.781897     1.07   0.287     -1.62043    5.430623
          c6 |   1.387911   1.501631     0.92   0.357    -1.583102    4.358925
          c7 |   1.910462    2.11309     0.90   0.368    -2.270338    6.091263
          c8 |   .8080908   1.115498     0.72   0.470    -1.398949     3.01513
          c9 |   1.259658   1.493367     0.84   0.401    -1.695004     4.21432
         c11 |   1.078344    2.48017     0.43   0.664    -3.828732     5.98542
         c12 |   1.686599   1.821377     0.93   0.356     -1.91704    5.290239
         c13 |   1.597011   1.313623     1.22   0.226    -1.002024    4.196047
         c14 |   1.634928   1.160712     1.41   0.161    -.6615697    3.931425
          s2 |  -.8893628   .3148124    -2.83   0.005    -1.512227   -.2664987
          s3 |  -2.529691    .726899    -3.48   0.001    -3.967878   -1.091503
          s4 |  -.2256783    .234869    -0.96   0.338    -.6903722    .2390157
          s5 |  -1.876678   .5745456    -3.27   0.001    -3.013431   -.7399258
          s6 |  -.2406225   .2060244    -1.17   0.245    -.6482468    .1670019
          s7 |  -.7453531   .2679377    -2.78   0.006    -1.275474   -.2152317
          s8 |  -.2437034   .2103172    -1.16   0.249    -.6598212    .1724143
          s9 |  -.4496206   .2326964    -1.93   0.056     -.910016    .0107749
         s10 |  -.7965863   .2663393    -2.99   0.003    -1.323545   -.2696274
         s11 |  -.4180931   .2291747    -1.82   0.070    -.8715209    .0353347
         s12 |  -.3760593   .2780088    -1.35   0.179    -.9261066    .1739879
         s13 |  -1.449896   .3484933    -4.16   0.000    -2.139399   -.7603933
       _cons |  -12.79457   11.48754    -1.11   0.267    -35.52295    9.933811
```

```
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L.L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.05  Pr > z =  0.296
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1)    =   0.69  Prob > chi2 =  0.407
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(1)    =   0.25  Prob > chi2 =  0.615
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(1)    =   0.25  Prob > chi2 =  0.615

.
```

```
. **lag 1 only + drop time dummies
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation c2-c14 s2-s13, gmm(l.lnindfdistock, laglimit(1 1)
collapse) iv(lnsecedu lntertedu  ln
> wage lngdp     lntradefree lneconfree lntransition lnictinfra indprivatisation c2-
c14 s2-s13) two robust small o
> rthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 34                      Obs per group: min =         1
F(32, 129)    =    112.29                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3764636   .1934389     1.95   0.054       -.00626    .7591871
             |
    lnsecedu |   -.171759   .9792483    -0.18   0.861    -2.109226    1.765708
   lntertedu |  -.1231369   1.318128    -0.09   0.926    -2.731086    2.484812
      lnwage |   -.250018   .4850901    -0.52   0.607    -1.209781    .7097448
       lngdp |   .7288795   .4080439     1.79   0.076    -.0784453    1.536204
 lntradefree |  -.3952729   .4040027    -0.98   0.330    -1.194602    .4040564
  lneconfree |   1.279448   .5539172     2.31   0.022     .1835093    2.375387
lntransition |    1.58898   1.014233     1.57   0.120    -.4177053    3.595664
  lnictinfra |   .3102064   .1615489     1.92   0.057     -.009422    .6298348
indprivati~n |   1.654461   .8647889     1.91   0.058    -.0565454    3.365467
          c4 |   .9965928   .5264762     1.89   0.061    -.0450533    2.038239
          c5 |   .9069865   1.088311     0.83   0.406    -1.246263    3.060236
          c6 |   .7000743   1.508338     0.46   0.643    -2.284209    3.684357
          c7 |   .9778697   1.695634     0.58   0.565    -2.376983    4.332723
          c8 |   .2989524   1.030428     0.29   0.772    -1.739774    2.337679
          c9 |   .5430532   1.322144     0.41   0.682    -2.072841    3.158948
         c11 |   .4071503   1.937629     0.21   0.834    -3.426497    4.240797
         c12 |   1.119358   1.428807     0.78   0.435    -1.707572    3.946287
         c13 |   .9620363   .8610701     1.12   0.266    -.7416119    2.665685
         c14 |   .8514235   .9148714     0.93   0.354    -.9586719    2.661519
          s2 |  -.9130881   .4007695    -2.28   0.024     -1.70602   -.1201557
          s3 |  -2.613937   1.036353    -2.52   0.013    -4.664387   -.5634869
          s4 |  -.2364176   .2567487    -0.92   0.359    -.7444012     .271566
          s5 |   -1.93409   .7408903    -2.61   0.010    -3.399959   -.4682199
          s6 |  -.2513339    .219791    -1.14   0.255    -.6861958     .183528
          s7 |   -.773169   .3655342    -2.12   0.036    -1.496387   -.0499507
          s8 |  -.2555357   .2377598    -1.07   0.284    -.7259493    .2148779
          s9 |  -.4606759   .2554996    -1.80   0.074    -.9661881    .0448362
         s10 |  -.8243677   .3645652    -2.26   0.025    -1.545669   -.1030666
         s11 |  -.4344565   .2787699    -1.56   0.122    -.9860096    .1170966
         s12 |  -.3894063   .3086802    -1.26   0.209    -1.000138     .221325
         s13 |  -1.495252   .5716175    -2.62   0.010    -2.626211   -.3642927
       _cons |  -19.10277   8.826993    -2.16   0.032    -36.56719   -1.638349
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2
    s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L.L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
```

```
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2
    s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.11  Pr > z =  0.035
Arellano-Bond test for AR(2) in first differences: z =  -1.09  Pr > z =  0.274
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1)    =   0.22  Prob > chi2 =  0.638
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(1)    =   0.31  Prob > chi2 =  0.576
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(1)    =   0.31  Prob > chi2 =  0.576

.
```

```
. **lag 1 only + drop time & sector dummies
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation c2-c14, gmm(l.lnindfdistock, laglimit(1 1) collapse)
iv(lnsecedu lntertedu  lnwage ln
> gdp     lntradefree lneconfree lntransition lnictinfra indprivatisation c2-c14 )
two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 22                      Obs per group: min =         1
F(20, 129)    =     79.94                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4028806    .195752     2.06   0.042     .0155806    .7901806
             |
    lnsecedu |  -.1311129   .9917576    -0.13   0.895     -2.09333    1.831104
   lntertedu |  -.1114431   1.305805    -0.09   0.932    -2.695011    2.472125
      lnwage |  -.3644721    .493494    -0.74   0.462    -1.340862    .6119179
       lngdp |   .8274061   .4127889     2.00   0.047     .0106932    1.644119
 lntradefree |  -.4164439   .3852922    -1.08   0.282    -1.178754    .3458662
  lneconfree |   1.282053   .5785274     2.22   0.028     .1374224    2.426684
lntransition |   1.360653   1.108516     1.23   0.222    -.8325722    3.553879
  lnictinfra |    .310408   .1509293     2.06   0.042     .0117906    .6090254
indprivati~n |   1.643025   .7464403     2.20   0.030     .1661742    3.119875
          c4 |   .8671793    .516155     1.68   0.095    -.1540461    1.888405
          c5 |   .5387926   1.114507     0.48   0.630    -1.666286    2.743871
          c6 |   .6339256   1.454935     0.44   0.664    -2.244698     3.51255
          c7 |   .6544548   1.638001     0.40   0.690    -2.586369    3.895279
          c8 |   .3308169   1.029282     0.32   0.748    -1.705643    2.367277
          c9 |   .2905566   1.340887     0.22   0.829     -2.36242    2.943534
         c11 |   .1763581   1.983485     0.09   0.929    -3.748016    4.100732
         c12 |    .990764   1.481791     0.67   0.505    -1.940995    3.922523
         c13 |   .7701365   .8206513     0.94   0.350    -.8535422    2.393815
         c14 |   .8637202   .9336956     0.93   0.357    -.9836194     2.71106
       _cons |  -21.31364   9.249435    -2.30   0.023    -39.61388    -3.01341
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L.L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.02  Pr > z =  0.310
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1)    =   0.43  Prob > chi2 =  0.512
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(1)    =   0.64  Prob > chi2 =  0.424
  (Robust, but can be weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(1)    =   0.64  Prob > chi2 =  0.424

.
. **lag 1 only + drop time, sector & year dummies
. xtabond2 lnindfdistock l.lnindfdistock     lnsecedu lntertedu lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation, gmm(l.lnindfdistock, laglimit(1 1) collapse)
iv(lnsecedu lntertedu  lnwage lngdp
>  lntradefree lneconfree lntransition lnictinfra indprivatisation) two robust small
orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 12                      Obs per group: min =         1
F(10, 129)    =     98.43                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .5061902   .1590555     3.18   0.002      .191495    .8208854
             |
    lnsecedu |  -.0957877   .2990294    -0.32   0.749    -.6874248    .4958494
   lntertedu |   -.371845   .3050338    -1.22   0.225    -.9753618    .2316719
      lnwage |  -.0998372   .1459941    -0.68   0.495    -.3886901    .1890157
       lngdp |    .566149   .1876215     3.02   0.003     .1949353    .9373627
 lntradefree |  -.6655098   .4103886    -1.62   0.107    -1.477474     .146454
  lneconfree |   .7466977   .7935578     0.94   0.348    -.8233758    2.316771
lntransition |   2.755338   1.923395     1.43   0.154    -1.050146    6.560821
  lnictinfra |    .212107   .1414691     1.50   0.136     -.067793     .492007
indprivati~n |   1.948911   .5954608     3.27   0.001     .7707773    3.127045
       _cons |  -14.18927    5.62458    -2.52   0.013    -25.31764   -3.060906
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L.L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.36  Pr > z =  0.018
Arellano-Bond test for AR(2) in first differences: z =  -0.83  Pr > z =  0.407
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1)    =   3.73  Prob > chi2 =  0.053
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(1)    =   2.18  Prob > chi2 =  0.140
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(1)    =   2.18  Prob > chi2 =  0.140
```

Appendix 6.9: Model 6.5 results

```
. **Model 6.5 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu medium high  lnsecmed
lnsechigh lntertmed lnterthigh l
> nwage lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-
d2008 c2-c14 s2-s13, gmm(l.lni
> ndfdistock, laglimit(1 2) collapse) iv(lnsecedu lntertedu medium high  lnsecmed
lnsechigh lntertmed lnterthigh l
> nwage lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-
d2008 c2-c14 s2-s13) two robus
> t small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
s9 dropped due to collinearity
s12 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 51                      Obs per group: min =         1
F(48, 129)    =     95.50                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3186341   .1155068     2.76   0.007      .090101    .5471672
             |
    lnsecedu |  -.7075837   .9959982    -0.71   0.479    -2.678191    1.263023
   lntertedu |  -.6692939   .7609879    -0.88   0.381    -2.174927    .8363393
      medium |  -.2675938   1.223482    -0.22   0.827    -2.688282    2.153095
        high |  -.0316611   1.116168    -0.03   0.977    -2.240027    2.176704
    lnsecmed |   .3302604   .3722931     0.89   0.377    -.4063306    1.066851
   lnsechigh |   .0870308   .3449474     0.25   0.801    -.5954561    .7695177
   lntertmed |   -.738955   .4530264    -1.63   0.105    -1.635279    .1573689
  lnterthigh |  -.3753829    .341706    -1.10   0.274    -1.051457    .3006907
      lnwage |  -.4806463   .4288579    -1.12   0.264    -1.329152    .3678596
       lngdp |   .3234916   .5414496     0.60   0.551    -.7477797    1.394763
 lntradefree |  -.0110028   .2828068    -0.04   0.969    -.5705429    .5485373
  lneconfree |    1.53208   .6561581     2.33   0.021      .233855    2.830305
lntransition |   2.217576   1.113234     1.99   0.048     .0150159    4.420136
  lnictinfra |   .3917369   .2374591     1.65   0.101    -.0780818    .8615556
indprivati~n |   1.300261   .7022273     1.85   0.066    -.0891128    2.689635
       d1996 |  -.9259038   .7763041    -1.19   0.235     -2.46184    .6100328
       d1997 |  -.9292165   .7489195    -1.24   0.217    -2.410972    .5525391
       d1998 |  -.8836442   .7041417    -1.25   0.212    -2.276806    .5095174
       d1999 |  -.7931488   .6494056    -1.22   0.224    -2.078014     .491716
       d2000 |  -1.132953    .546507    -2.07   0.040     -2.21423   -.0516754
       d2001 |  -.8502346   .5406804    -1.57   0.118    -1.919984    .2195147
       d2002 |  -.7419855   .4658944    -1.59   0.114    -1.663769    .1797981
       d2003 |  -.6509138   .4347867    -1.50   0.137     -1.51115    .2093223
       d2004 |  -.3050955   .2868833    -1.06   0.290    -.8727011    .2625102
       d2005 |  -.2456584   .2135151    -1.15   0.252    -.6681033    .1767865
       d2006 |  -.2744388   .1635764    -1.68   0.096    -.5980787    .0492012
       d2007 |  -.0315988   .1160358    -0.27   0.786    -.2611784    .1979809
          c4 |   2.145751    .889404     2.41   0.017     .3860436    3.905459
          c5 |   2.890242   1.639949     1.76   0.080    -.3544381    6.134922
          c6 |    2.35833   1.385946     1.70   0.091     -.383799    5.100459
          c7 |    3.38911   1.736309     1.95   0.053      -.04622    6.824439
          c8 |   1.515109   1.010399     1.50   0.136    -.4839892    3.514208
          c9 |   2.269701    1.26919     1.79   0.076    -.2414224    4.780825
         c11 |   2.674857   1.984967     1.35   0.180    -1.252449    6.602163
         c12 |   2.801168   1.559792     1.80   0.075    -.2849174    5.887254
         c13 |   2.447954   1.128848     2.17   0.032     .2145014    4.681407
         c14 |   2.379993    1.09593     2.17   0.032     .2116693    4.548318
```

```
          s2 |   -1.01171   .3109367    -3.25   0.001    -1.626906    -.396514
          s3 |  -2.841134   .7682494    -3.70   0.000    -4.361134   -1.321134
          s4 |  -.2582483   .2152177    -1.20   0.232    -.6840618    .1675652
          s5 |  -1.612347   .5246853    -3.07   0.003     -2.65045   -.5742447
          s6 |   .1820921   .2407576     0.76   0.451    -.2942527     .658437
          s7 |  -.3765197   .2185681    -1.72   0.087     -.808962    .0559226
          s8 |   .1724847   .1789014     0.96   0.337    -.1814761    .5264456
         s10 |  -.4640475   .2668551    -1.74   0.084    -.9920269    .0639319
         s11 |  -.0420604   .2473929    -0.17   0.865    -.5315334    .4474126
         s13 |  -1.596439   .3735762    -4.27   0.000    -2.335569   -.8573095
       _cons |   -9.29383   11.22656    -0.83   0.409    -31.50585    12.91819
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu medium high lnsecmed lnsechigh lntertmed
    lnterthigh lnwage lngdp lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu medium high lnsecmed lnsechigh lntertmed lnterthigh
    lnwage lngdp lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.11  Pr > z =  0.035
Arellano-Bond test for AR(2) in first differences: z =  -1.07  Pr > z =  0.286
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.69  Prob > chi2 =  0.096
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.94  Prob > chi2 =  0.624
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.27  Prob > chi2 =  0.606
    Difference (null H = exogenous): chi2(1)    =   0.68  Prob > chi2 =  0.411
```

```
. **testing the joint significance of technological dummies and their interactions
. test  lntertmed=lnterthigh=lnsecmed=lnsechigh=0

 ( 1)  lntertmed - lnterthigh = 0
 ( 2)  - lnsecmed + lntertmed = 0
 ( 3)  - lnsechigh + lntertmed = 0
 ( 4)  lntertmed = 0

       F(  4,   129) =    0.79
            Prob > F =    0.5367

. test  lntertmed=lnterthigh=0

 ( 1)  lntertmed - lnterthigh = 0
 ( 2)  lntertmed = 0

       F(  2,   129) =    1.34
            Prob > F =    0.2666

. test  lnsecmed=lnsechigh=0

 ( 1)  lnsecmed - lnsechigh = 0
 ( 2)  lnsecmed = 0

       F(  2,   129) =    0.48
            Prob > F =    0.6230

. test  lntertmed=lnterthigh=lnsecmed=lnsechigh=high=medium=0

 ( 1)  lntertmed - lnterthigh = 0
 ( 2)  - lnsecmed + lntertmed = 0
 ( 3)  - lnsechigh + lntertmed = 0
 ( 4)  - high + lntertmed = 0
 ( 5)  - medium + lntertmed = 0
 ( 6)  lntertmed = 0

       F(  6,   129) =    1.32
            Prob > F =    0.2550

. test high=medium=0

 ( 1)  - medium + high = 0
 ( 2)  high = 0

       F(  2,   129) =    0.03
            Prob > F =    0.9712
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.038478   1.511925    -0.69   0.493     -4.02986    1.952903
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.9822826   1.024879    -0.96   0.340     -3.01003    1.045465
------------------------------------------------------------------------------

. nlcom _b[medium]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[medium]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3927314   1.793787    -0.22   0.827    -3.941782     3.15632
------------------------------------------------------------------------------

. nlcom _b[high]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[high]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0464671   1.637247    -0.03   0.977    -3.285801    3.192866
------------------------------------------------------------------------------

. nlcom _b[lnsecmed]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecmed]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4847034   .5203027     0.93   0.353    -.5447283    1.514135
------------------------------------------------------------------------------

. nlcom _b[lnsechigh]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsechigh]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .1277299   .5007642     0.26   0.799    -.8630443    1.118504
------------------------------------------------------------------------------

. nlcom _b[lntertmed]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertmed]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -1.08452   .5716462    -1.90   0.060    -2.215536     .046496
------------------------------------------------------------------------------


. nlcom _b[lnterthigh]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnterthigh]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.5509271   .4697511    -1.17   0.243    -1.480341    .3784871
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.7054158   .6465677    -1.09   0.277    -1.984666    .5738342
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4747693   .8051704     0.59   0.556     -1.11828    2.067819
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0161482   .4164811    -0.04   0.969    -.8401662    .8078698
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.248542   .9122624     2.46   0.015     .4436086    4.053475
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   3.254603   1.588275     2.05   0.042     .1121617    6.397045
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .5749288   .3707886     1.55   0.123    -.1586856    1.308543
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.908315   1.210645     1.58   0.117     -.486975    4.303606
------------------------------------------------------------------------------
```

```
.

. **Model 6.4 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu medium high  lnsecmed
lnsechigh lntertmed lnterthigh lnwa
> ge lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-
d2008 c2-c14 s2-s13
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c10 omitted because of collinearity
note: s9 omitted because of collinearity
note: s12 omitted because of collinearity

Random-effects GLS regression                   Number of obs      =      1283
Group variable: id                              Number of groups   =       130

R-sq:  within  = 0.2588                         Obs per group: min =         1
       between = 0.9543                                        avg =       9.9
       overall = 0.7295                                        max =        13

                                                Wald chi2(48)      =   3327.56
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .466158   .0253451    18.39   0.000     .4164825    .5158334
             |
    lnsecedu |  -1.138928   1.601715    -0.71   0.477    -4.278231    2.000375
   lntertedu |   .1274414   .7898702     0.16   0.872    -1.420676    1.675559
      medium |   .0142298   .9590468     0.01   0.988    -1.865467    1.893927
        high |    .083502   .9127848     0.09   0.927    -1.705523    1.872527
    lnsecmed |   .2907087   .2883759     1.01   0.313    -.2744976    .8559151
   lnsechigh |    .094277   .2770552     0.34   0.734    -.4487412    .6372953
   lntertmed |  -.7559742   .2673351    -2.83   0.005    -1.279941   -.2320071
  lnterthigh |  -.3856889   .2572142    -1.50   0.134    -.8898194    .1184416
      lnwage |  -.5912116   .8216276    -0.72   0.472    -2.201572    1.019149
       lngdp |   .5555586   .7888705     0.70   0.481    -.9905992    2.101716
 lntradefree |  -.1319482   .6391154    -0.21   0.836    -1.384591    1.120695
  lneconfree |   .5943793   .9950677     0.60   0.550    -1.355918    2.544676
lntransition |   2.433742   3.101951     0.78   0.433    -3.645969    8.513454
  lnictinfra |   .2369778   .4257908     0.56   0.578    -.5975568    1.071512
indprivati~n |   1.660414   .3039669     5.46   0.000      1.06465    2.256179
       d1996 |  -.8174703   1.125214    -0.73   0.468    -3.022849    1.387909
       d1997 |  -.6837736   1.010238    -0.68   0.499    -2.663803    1.296256
       d1998 |  -.6354915   .9087861    -0.70   0.484    -2.416679    1.145696
       d1999 |  -.5663146   .8467888    -0.67   0.504     -2.22599    1.093361
       d2000 |  -.9754321   .8024712    -1.22   0.224    -2.548247    .5973826
       d2001 |  -.5980579   .7298341    -0.82   0.413    -2.028506    .8323906
       d2002 |  -.4895536   .6375395    -0.77   0.443    -1.739108    .7600008
       d2003 |  -.4571827   .5249981    -0.87   0.384     -1.48616    .5717947
       d2004 |  -.1875785   .4435201    -0.42   0.672    -1.056862    .6817048
       d2005 |  -.1862975   .3699418    -0.50   0.615    -.9113702    .5387751
       d2006 |   -.248378   .3009296    -0.83   0.409    -.8381891    .3414331
       d2007 |  -.1880241   .2088674    -0.90   0.368    -.5973967    .2213485
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |   1.275398   1.144025     1.11   0.265     -.966851    3.517646
          c5 |   1.908944   1.790133     1.07   0.286    -1.599651     5.41754
          c6 |   1.582748   1.589092     1.00   0.319    -1.531815     4.69731
          c7 |   1.752315   1.578505     1.11   0.267    -1.341497    4.846127
          c8 |   .8736985    1.02812     0.85   0.395     -1.14138    2.888777
          c9 |   1.394419   1.296467     1.08   0.282     -1.14661    3.935448
         c10 |  (omitted)
         c11 |   .5184136    2.22575     0.23   0.816    -3.843977    4.880804
         c12 |   1.416609   1.704074     0.83   0.406    -1.923314    4.756532
         c13 |   1.357486   1.118367     1.21   0.225    -.8344733    3.549444
         c14 |   1.344155   1.365675     0.98   0.325    -1.332519    4.020829
          s2 |  -.7833108   .1832545    -4.27   0.000    -1.142483   -.4241386
          s3 |  -2.181337    .217236   -10.04   0.000    -2.607112   -1.755562
          s4 |  -.1827652   .1835897    -1.00   0.319    -.5425945    .1770641
          s5 |  -1.267003   .2130915    -5.95   0.000    -1.684655   -.8493517
          s6 |     .11292   .1791926     0.63   0.529    -.2382911    .4641311
          s7 |  -.2579533   .1844614    -1.40   0.162    -.6194909    .1035844
```

```
          s8 |    .163459   .1874511     0.87   0.383    -.2039385    .5308564
          s9 |  (omitted)
         s10 |  -.3678584   .1779073    -2.07   0.039    -.7165504   -.0191664
         s11 |  -.0314497   .1762677    -0.18   0.858    -.3769279    .3140286
         s12 |  (omitted)
         s13 |  -1.309218   .1951552    -6.71   0.000    -1.691715   -.9267209
       _cons |  -9.290704   15.95644    -0.58   0.560    -40.56475    21.98335
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |    1.20442
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------

.
```

```
. **Model 6.4 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu medium high  lnsecmed
lnsechigh lntertmed lnterthigh lnwage
>  lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-d2008
c2-c14 s2-s13
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c10 omitted because of collinearity
note: s8 omitted because of collinearity
note: s10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1283
-------------+------------------------------           F( 48,  1234) =   69.32
       Model |  5580.94495    48  116.269686           Prob > F      =  0.0000
    Residual |  2069.65242  1234  1.67718997           R-squared     =  0.7295
-------------+------------------------------           Adj R-squared =  0.7190
       Total |  7650.59737  1282  5.96770466           Root MSE      =  1.2951

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .466158   .0253451    18.39   0.000     .4164338    .5158822
             |
    lnsecedu |  -1.138928   1.601715    -0.71   0.477    -4.281313    2.003457
   lntertedu |   .1274414   .7898702     0.16   0.872    -1.422196    1.677078
      medium |   .1776888   .9648926     0.18   0.854    -1.715323      2.0707
        high |  -.2843563   .9136999    -0.31   0.756    -2.076933    1.508221
    lnsecmed |   .2907087   .2883759     1.01   0.314    -.2750525      .85647
   lnsechigh |    .094277   .2770552     0.34   0.734    -.4492744    .6378284
   lntertmed |  -.7559742   .2673351    -2.83   0.005    -1.280456   -.2314926
  lnterthigh |  -.3856889   .2572142    -1.50   0.134    -.8903143    .1189365
      lnwage |  -.5912116   .8216276    -0.72   0.472    -2.203153     1.02073
       lngdp |   .5555586   .7888705     0.70   0.481    -.9921172    2.103234
 lntradefree |  -.1319482   .6391154    -0.21   0.836    -1.385821    1.121925
  lneconfree |   .5943793   .9950677     0.60   0.550    -1.357832    2.546591
lntransition |   2.433742   3.101951     0.78   0.433    -3.651938    8.519423
  lnictinfra |   .2369778   .4257908     0.56   0.578    -.5983761    1.072332
indprivati~n |   1.660414   .3039669     5.46   0.000     1.064065    2.256763
       d1996 |  -.8174703   1.125214    -0.73   0.468    -3.025014    1.390074
       d1997 |  -.6837736   1.010238    -0.68   0.499    -2.665747      1.2982
       d1998 |  -.6354915   .9087861    -0.70   0.485    -2.418428    1.147445
       d1999 |  -.5663146   .8467888    -0.67   0.504     -2.22762     1.09499
       d2000 |  -.9754321   .8024712    -1.22   0.224    -2.549791    .5989267
       d2001 |  -.5980579   .7298341    -0.82   0.413    -2.029911     .833795
       d2002 |  -.4895536   .6375395    -0.77   0.443    -1.740335    .7612276
       d2003 |  -.4571827   .5249981    -0.87   0.384     -1.48717    .5728049
       d2004 |  -.1875785   .4435201    -0.42   0.672    -1.057715    .6825583
       d2005 |  -.1862975   .3699418    -0.50   0.615    -.9120821     .539487
       d2006 |   -.248378   .3009296    -0.83   0.409    -.8387682    .3420122
       d2007 |  -.1880241   .2088674    -0.90   0.368    -.5977987    .2217504
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |   1.275398   1.144025     1.11   0.265    -.9690524    3.519848
          c5 |   1.908944   1.790133     1.07   0.286    -1.603096    5.420985
          c6 |   1.582748   1.589092     1.00   0.319    -1.534873    4.700368
          c7 |   1.752315   1.578505     1.11   0.267    -1.344535    4.849165
          c8 |   .8736985    1.02812     0.85   0.396    -1.143358    2.890755
          c9 |   1.394419   1.296467     1.08   0.282    -1.149104    3.937943
         c10 |  (omitted)
         c11 |   .5184136    2.22575     0.23   0.816     -3.84826    4.885087
         c12 |   1.416609   1.704074     0.83   0.406    -1.926593    4.759811
         c13 |   1.357486   1.118367     1.21   0.225    -.8366254    3.551596
         c14 |   1.344155   1.365675     0.98   0.325    -1.335147    4.023457
          s2 |  -.7833108   .1832545    -4.27   0.000    -1.142836    -.423786
          s3 |  -2.181337    .217236   -10.04   0.000     -2.60753   -1.755144
          s4 |  -.1827652   .1835897    -1.00   0.320    -.5429477    .1774174
          s5 |  -1.430462   .2179047    -6.56   0.000    -1.857967   -1.002958
          s6 |   .4807784   .1819445     2.64   0.008     .1238236    .8377332
          s7 |  -.4214122   .1865537    -2.26   0.024    -.7874097   -.0554148
          s8 |  (omitted)
          s9 |   -.163459   .1874511    -0.87   0.383    -.5312171    .2042992
         s10 |  (omitted)
         s11 |   .3364087   .1777271     1.89   0.059    -.0122721    .6850895
         s12 |   .3678584   .1779073     2.07   0.039      .018824    .7168927
```

```
         s13 |  -1.309218   .1951552    -6.71   0.000    -1.692091   -.9263453
       _cons |  -9.290704   15.95644    -0.58   0.561    -40.59546    22.01405
------------------------------------------------------------------------------
```

Appendix 6.10: Model 6.6 results

```
. **Model 6.6 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lngenvocratio lnwage
lngdp lntradefree lneconfree lntr
> ansition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13,
gmm(l.lnindfdistock, laglimit(1 2) collapse) iv(
> lnsecedu lntertedu lngenvocratio lnwage lngdp lntradefree lneconfree lntransition
lnictinfra indprivatisation d1
> 996-d2008 c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1283
Time variable : year                            Number of groups   =       130
Number of instruments = 47                      Obs per group: min =         1
F(44, 129)    =     89.93                                      avg =      9.87
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3208332   .1117717     2.87   0.005     .0996901    .5419763
             |
    lnsecedu |  -.5337772   1.040243    -0.51   0.609    -2.591922    1.524368
   lntertedu |  -1.014868   .8286618    -1.22   0.223    -2.654396    .6246594
lngenvocra~o |  -2.355396   1.038488    -2.27   0.025     -4.41007   -.3007219
      lnwage |  -.4811834   .4289406    -1.12   0.264    -1.329853     .367486
       lngdp |   .3233058   .5384849     0.60   0.549    -.7420997    1.388711
 lntradefree |  -.0156682   .2795487    -0.06   0.955    -.5687621    .5374258
  lneconfree |   1.555184   .6464159     2.41   0.018     .2762342    2.834134
lntransition |   2.226154   1.108879     2.01   0.047     .0322095    4.420099
  lnictinfra |   .3942835   .2317452     1.70   0.091    -.0642301    .8527971
indprivati~n |   1.300169   .6924332     1.88   0.063    -.0698275    2.670165
       d1996 |  -.9040468   .7441145    -1.21   0.227    -2.376296     .568202
       d1997 |  -.9096157   .7171694    -1.27   0.207    -2.328553    .5093216
       d1998 |  -.8652952   .6743827    -1.28   0.202    -2.199578    .4689876
       d1999 |  -.7768966   .6236162    -1.25   0.215    -2.010736    .4569434
       d2000 |  -1.120684   .5263108    -2.13   0.035    -2.162002   -.0793647
       d2001 |  -.8395985    .520639    -1.61   0.109    -1.869695    .1904984
       d2002 |  -.7322011   .4465474    -1.64   0.104    -1.615706    .1513038
       d2003 |  -.6432703   .4242457    -1.52   0.132    -1.482651    .1961103
       d2004 |  -.2990284   .2750489    -1.09   0.279    -.8432193    .2451625
       d2005 |  -.2410952   .2048553    -1.18   0.241    -.6464063     .164216
       d2006 |  -.2709119   .1581927    -1.71   0.089    -.5839001    .0420762
       d2007 |  -.0226137   .1101028    -0.21   0.838    -.2404549    .1952275
          c4 |  -.2590173    .498923    -0.52   0.605    -1.246149    .7281141
          c5 |   1.498331   1.364212     1.10   0.274    -1.200795    4.197457
          c6 |   5.769905   2.633327     2.19   0.030     .5598019    10.98001
          c7 |   2.725895   1.452534     1.88   0.063    -.1479795    5.599769
          c8 |   1.739472    1.04999     1.66   0.100    -.3379593    3.816903
          c9 |   4.388865   1.995284     2.20   0.030     .4411473    8.336582
         c11 |   1.967594   1.695636     1.16   0.248    -1.387264    5.322452
         c12 |   .3403784   1.177823     0.29   0.773    -1.989974    2.670731
         c13 |   1.138289   .6992816     1.63   0.106    -.2452572    2.521834
          s2 |  -1.003029     .32087    -3.13   0.002    -1.637878     -.36818
          s3 |  -2.843622   .7675935    -3.70   0.000    -4.362324   -1.324919
          s4 |  -.2663222   .2382374    -1.12   0.266    -.7376806    .2050363
          s5 |  -2.080591   .5994253    -3.47   0.001    -3.266569   -.8946133
          s6 |  -.2634229    .208593    -1.26   0.209    -.6761292    .1492835
          s7 |  -.8562063   .2694936    -3.18   0.002    -1.389406   -.3230066
          s8 |  -.2892617   .2128605    -1.36   0.177    -.7104115    .1318881
          s9 |  -.4886414   .2366243    -2.07   0.041    -.9568083   -.0204745
```

```
         s10 |   -.907898    .268445    -3.38   0.001    -1.439023   -.3767731
         s11 |  -.4861648   .2320609    -2.09   0.038    -.9453029   -.0270267
         s12 |  -.4438317    .277717    -1.60   0.112    -.9933017    .1056382
         s13 |  -1.586334   .3809904    -4.16   0.000    -2.340133    -.832535
       _cons |  -11.44628   10.99704    -1.04   0.300    -33.20419    10.31163
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lngenvocratio lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lngenvocratio lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.13  Pr > z =  0.033
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.289
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.89  Prob > chi2 =  0.087
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.99  Prob > chi2 =  0.609
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.26  Prob > chi2 =  0.612
    Difference (null H = exogenous): chi2(1)    =   0.73  Prob > chi2 =  0.392

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.7859294   1.577807    -0.50   0.619     -3.90766    2.335801
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.494284   1.063526    -1.41   0.162    -3.598497    .6099284
------------------------------------------------------------------------------

. nlcom _b[lngenvocratio]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngenvocratio]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -3.468067   1.185637    -2.93   0.004    -5.813879   -1.122255
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.7084907   .6471833    -1.09   0.276    -1.988959    .5719773
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    .476033   .8021273     0.59   0.554    -1.110995    2.063061
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0230697   .4135917    -0.06   0.956    -.8413711    .7952317
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.289841   .8949544     2.56   0.012     .5191516     4.06053
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   3.277772   1.581632     2.07   0.040     .1484735    6.407071
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |     .58054   .3598811     1.61   0.109    -.1314936    1.292573
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.914358   1.189135     1.61   0.110    -.4383736     4.26709
------------------------------------------------------------------------------

.
```

```
. **Model 6.6 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lngenvocratio lnwage lngdp
lntradefree lneconfree lntrans
> ition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: lngenvocratio omitted because of collinearity
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1283
Group variable: id                              Number of groups   =       130

R-sq:  within  = 0.2952                         Obs per group: min =         1
       between = 0.8341                                        avg =       9.9
       overall = 0.5743                                        max =        13

                                                F(22,1131)         =     21.54
corr(u_i, Xb)  = 0.5226                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .1934758   .0294962     6.56   0.000     .1356024    .2513491
             |
    lnsecedu |  -.6698671   1.501536    -0.45   0.656    -3.615976    2.276242
   lntertedu |  -.3828825   .7326196    -0.52   0.601    -1.820329    1.054564
lngenvocra~o |  (omitted)
      lnwage |  -.5342059   .7749431    -0.69   0.491    -2.054694    .9862818
       lngdp |   .4507245   .7466757     0.60   0.546    -1.014301     1.91575
 lntradefree |   .0347742   .6023787     0.06   0.954    -1.147131     1.21668
  lneconfree |    1.37947   .9375811     1.47   0.141    -.4601241    3.219064
lntransition |   2.662767   2.919594     0.91   0.362    -3.065661    8.391196
  lnictinfra |   .4709106   .4009703     1.17   0.240    -.3158187     1.25764
indprivati~n |   1.268965   .2994998     4.24   0.000     .6813273    1.856603
       d1996 |  (omitted)
       d1997 |   .0130319    .337859     0.04   0.969     -.649869    .6759329
       d1998 |   .0687798   .3872561     0.18   0.859    -.6910413    .8286008
       d1999 |   .1486281   .4313123     0.34   0.730     -.697634    .9948903
       d2000 |  -.2516717   .4872503    -0.52   0.606    -1.207688    .7043445
       d2001 |  -.0294384   .5631599    -0.05   0.958    -1.134394    1.075517
       d2002 |   .1530985   .6228805     0.25   0.806    -1.069033     1.37523
       d2003 |   .2521734   .6808485     0.37   0.711    -1.083695    1.588042
       d2004 |   .5290596   .7427938     0.71   0.476    -.9283491    1.986468
       d2005 |   .6040135   .8152234     0.74   0.459    -.9955066    2.203534
       d2006 |   .5468484   .8829063     0.62   0.536     -1.18547    2.279167
       d2007 |   .6100633   .9782966     0.62   0.533    -1.309417    2.529544
       d2008 |   .8098976   1.059337     0.76   0.445    -1.268589    2.888384
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
```

```
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |  -11.95249   15.26013    -0.78   0.434    -41.89383    17.98885
-------------+----------------------------------------------------------------
     sigma_u |  1.4583088
     sigma_e |  1.2182688
         rho |  .58896614   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(129, 1131) =     2.12           Prob > F = 0.0000

.
```

```
. **Model 6.6 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lngenvocratio lnwage lngdp
lntradefree lneconfree lntransit
> ion lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c6 omitted because of collinearity
note: c10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1283
-------------+------------------------------           F( 44,  1238) =   75.16
       Model |  5566.62764    44  126.514265           Prob > F      =  0.0000
    Residual |  2083.96973  1238  1.68333581           R-squared     =  0.7276
-------------+------------------------------           Adj R-squared =  0.7179
       Total |  7650.59737  1282  5.96770466           Root MSE      =  1.2974

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4778515   .0250706    19.06   0.000      .428666     .527037
             |
    lnsecedu |   -.996562   1.596739    -0.62   0.533    -4.129175    2.136051
   lntertedu |  -.2239122   .7790083    -0.29   0.774    -1.752235     1.30441
lngenvocra~o |   1.091326   1.094759     1.00   0.319    -1.056462    3.239114
      lnwage |  -.5886715   .8231173    -0.72   0.475    -2.203531    1.026188
       lngdp |   .5549401    .790297     0.70   0.483    -.9955293     2.10541
 lntradefree |  -.1448079   .6402688    -0.23   0.821     -1.40094    1.111324
  lneconfree |   .5732394   .9968057     0.58   0.565    -1.382376    2.528855
lntransition |   2.432461   3.107627     0.78   0.434    -3.664335    8.529258
  lnictinfra |   .2218436   .4265315     0.52   0.603    -.6149608    1.058648
indprivati~n |   1.655353   .3044638     5.44   0.000     1.058031    2.252675
       d1996 |  -.8193515   1.127264    -0.73   0.467     -3.03091    1.392207
       d1997 |  -.6819054   1.012083    -0.67   0.501    -2.667494    1.303683
       d1998 |  -.6334704   .9104454    -0.70   0.487    -2.419657    1.152716
       d1999 |  -.5643722   .8483348    -0.67   0.506    -2.228705    1.099961
       d2000 |  -.9730768   .8039344    -1.21   0.226    -2.550301    .6041477
       d2001 |  -.5908311   .7311608    -0.81   0.419    -2.025282    .8436201
       d2002 |  -.4850339   .6386994    -0.76   0.448    -1.738087     .768019
       d2003 |  -.4556584   .5259541    -0.87   0.386    -1.487518    .5762016
       d2004 |  -.1850777   .4443288    -0.42   0.677    -1.056799     .686643
       d2005 |  -.1870454   .3706179    -0.50   0.614    -.9141539    .5400631
       d2006 |  -.2483097   .3014798    -0.82   0.410    -.8397775    .3431581
       d2007 |  -.1869985   .2092488    -0.89   0.372      -.59752    .2235229
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |    2.35702   1.895994     1.24   0.214    -1.362696    6.076736
          c5 |   2.501974   2.100234     1.19   0.234    -1.618438    6.622385
          c6 |  (omitted)
          c7 |   2.017098   1.756841     1.15   0.251    -1.429618    5.463813
          c8 |   .7789348   .9307716     0.84   0.403    -1.047129    2.604999
          c9 |   .3978618   .7295374     0.55   0.586    -1.033405    1.829128
         c10 |  (omitted)
         c11 |   .8226872    2.21742     0.37   0.711     -3.52763    5.173004
         c12 |   2.514816   2.012654     1.25   0.212    -1.433774    6.463406
         c13 |   1.951344   1.494655     1.31   0.192    -.9809919     4.88368
         c14 |   2.456023   2.182953     1.13   0.261    -1.826674     6.73872
          s2 |  -.7603264   .1834158    -4.15   0.000    -1.120167   -.4004862
          s3 |  -2.140034   .2165296    -9.88   0.000     -2.56484   -1.715229
          s4 |  -.1852932    .183226    -1.01   0.312     -.544761    .1741746
          s5 |  -1.609111   .2165958    -7.43   0.000    -2.034047   -1.184176
          s6 |  -.2057085    .179393    -1.15   0.252    -.5576564    .1462395
          s7 |   -.626032    .182978    -3.42   0.001    -.9850133   -.2670507
          s8 |   -.198082   .1833286    -1.08   0.280    -.5577512    .1615871
          s9 |  -.3850523   .1817988    -2.12   0.034    -.7417201   -.0283845
         s10 |  -.6752637   .1815645    -3.72   0.000    -1.031472   -.3190555
         s11 |  -.3444126   .1782365    -1.93   0.054    -.6940915    .0052663
         s12 |   -.313625   .1779358    -1.76   0.078    -.6627141    .0354641
         s13 |  -1.287006   .1946514    -6.61   0.000    -1.668889   -.9051231
       _cons |   -8.02262   15.95534    -0.50   0.615    -39.32511    23.27987
------------------------------------------------------------------------------
```

Appendix 6.11: Model 6.7 results

```
. **Model 6.7 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lnedutr1 lnwage lngdp
lntradefree lneconfree lntransit
> ion lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsec
> edu lntertedu lnedutr2 lnwage lngdp lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008
> c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d1996 dropped due to collinearity
d1997 dropped due to collinearity
d1998 dropped due to collinearity
d1999 dropped due to collinearity
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1017
Time variable : year                            Number of groups   =       129
Number of instruments = 44                      Obs per group: min =         0
F(40, 128)    =     70.73                                      avg =      7.88
Prob > F      =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2549424   .1001758     2.54   0.012     .0567275    .4531573
             |
    lnsecedu |  -.6830495   3.491269    -0.20   0.845    -7.591121    6.225022
   lntertedu |   .2359653   1.481796     0.16   0.874    -2.696022    3.167953
    lnedutr1 |  -3.224424   3.169413    -1.02   0.311    -9.495648    3.046801
      lnwage |   .0504303   .7695943     0.07   0.948    -1.472343    1.573204
       lngdp |  -.3018161   1.099183    -0.27   0.784    -2.476737    1.873104
 lntradefree |  -.5602262    .382225    -1.47   0.145    -1.316524    .1960713
  lneconfree |   1.246827   .6718255     1.86   0.066    -.0824948    2.576148
lntransition |   3.905563   2.387353     1.64   0.104    -.8182222    8.629349
  lnictinfra |   .0002816   .5441693     0.00   1.000     -1.07645    1.077014
indprivati~n |   1.466513   .4590689     3.19   0.002     .5581671    2.374859
       d2000 |  -1.401019    .758449    -1.85   0.067     -2.90174    .0997016
       d2001 |  -1.098527   .7649334    -1.44   0.153    -2.612079    .4150242
       d2002 |  -.9821841    .668966    -1.47   0.144    -2.305848    .3414794
       d2003 |  -.9826175   .6106534    -1.61   0.110      -2.1909    .2256645
       d2004 |  -.4672128   .4164823    -1.12   0.264    -1.291294    .3568686
       d2005 |  -.3543014   .3108645    -1.14   0.257       -.9694    .2607972
       d2006 |   -.334569   .2284057    -1.46   0.145    -.7865087    .1173707
       d2007 |  -.0433848   .1309225    -0.33   0.741    -.3024374    .2156677
          c4 |   .7788852   .8728962     0.89   0.374    -.9482891    2.506059
          c5 |    2.15048   3.988453     0.54   0.591    -5.741355    10.04232
          c6 |  -.2718286   1.211196    -0.22   0.823    -2.668386    2.124729
          c7 |   1.520359   2.478786     0.61   0.541    -3.384343     6.42506
          c8 |  -.5059063   .9762386    -0.52   0.605    -2.437561    1.425749
          c9 |   .3668426   1.871407     0.20   0.845    -3.336055    4.069741
         c11 |   2.467365   3.546448     0.70   0.488    -4.549888    9.484618
         c12 |   2.728538   2.826551     0.97   0.336    -2.864277    8.321352
         c13 |    1.56813   1.554882     1.01   0.315    -1.508469     4.64473
          s2 |  -1.091814   .3205895    -3.41   0.001    -1.726155   -.4574725
          s3 |  -2.917215   .7118135    -4.10   0.000     -4.32566   -1.508771
          s4 |  -.2058736   .2492766    -0.83   0.410     -.69911     .2873627
          s5 |  -2.141548   .5583018    -3.84   0.000    -3.246244   -1.036853
          s6 |  -.2532607   .2376626    -1.07   0.289    -.7235168    .2169955
          s7 |  -.8301723   .2666017    -3.11   0.002    -1.357689   -.3026552
          s8 |  -.2031554   .2264517    -0.90   0.371    -.6512288     .244918
          s9 |  -.4462089   .2447109    -1.82   0.071    -.9304112    .0379934
```

```
         s10 |  -.9292377   .2630042    -3.53   0.001    -1.449636   -.4088389
         s11 |  -.4211535   .2356199    -1.79   0.076    -.8873676    .0450606
         s12 |  -.4006556    .292481    -1.37   0.173    -.9793792     .178068
         s13 |  -1.702016   .3763542    -4.52   0.000    -2.446697   -.9573351
       _cons |   2.265456    24.3354     0.09   0.926     -45.8863    50.41721
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnedutr2 lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnedutr2 lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.18  Pr > z =  0.029
Arellano-Bond test for AR(2) in first differences: z =  -1.13  Pr > z =  0.259
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(3)    =   9.84  Prob > chi2 =  0.020
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(3)    =   1.76  Prob > chi2 =  0.625
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(2)    =   1.00  Prob > chi2 =  0.608
    Difference (null H = exogenous): chi2(1)    =   0.76  Prob > chi2 =  0.383
  gmm(L.lnindfdistock, collapse lag(1 2))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(3)    =   1.76  Prob > chi2 =  0.625

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.9167742   4.753547    -0.19   0.847    -10.32248     8.48893
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3167075   2.018786     0.16   0.876    -3.677806    4.311221
------------------------------------------------------------------------------

. nlcom _b[lnedutr1]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnedutr1]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -4.327751   3.815281    -1.13   0.259    -11.87694    3.221434
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0676865   1.029851     0.07   0.948    -1.970049    2.105422
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -.405091   1.450203    -0.28   0.780    -3.274566    2.464384
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.7519233   .5095328    -1.48   0.142    -1.760121    .2562743
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.673464   .8486342     1.97   0.051    -.0057042    3.352631
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   5.241962   3.592483     1.46   0.147     -1.86638     12.3503
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    .000378   .7303502     0.00   1.000    -1.444745    1.445501
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.968322   .7891953     2.49   0.014     .4067642     3.52988
------------------------------------------------------------------------------

.
```

```
. **Model 6.7 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lnedutr1 lnwage lngdp
lntradefree lneconfree lntransition
>  lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: lnedutr1 omitted because of collinearity
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1283
Group variable: id                              Number of groups   =       130

R-sq:  within  = 0.2952                         Obs per group: min =         1
       between = 0.8341                                        avg =       9.9
       overall = 0.5743                                        max =        13

                                                F(22,1131)         =     21.54
corr(u_i, Xb)  = 0.5226                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .1934758   .0294962     6.56   0.000     .1356024    .2513491
             |
    lnsecedu |  -.6698671   1.501536    -0.45   0.656    -3.615976    2.276242
   lntertedu |  -.3828825   .7326196    -0.52   0.601    -1.820329    1.054564
    lnedutr1 |  (omitted)
      lnwage |  -.5342059   .7749431    -0.69   0.491    -2.054694    .9862818
       lngdp |   .4507245   .7466757     0.60   0.546    -1.014301     1.91575
 lntradefree |   .0347742   .6023787     0.06   0.954    -1.147131     1.21668
  lneconfree |    1.37947   .9375811     1.47   0.141    -.4601241    3.219064
lntransition |   2.662767   2.919594     0.91   0.362    -3.065661    8.391196
  lnictinfra |   .4709106   .4009703     1.17   0.240    -.3158187     1.25764
indprivati~n |   1.268965   .2994998     4.24   0.000     .6813273    1.856603
       d1996 |  (omitted)
       d1997 |   .0130319    .337859     0.04   0.969     -.649869    .6759329
       d1998 |   .0687798   .3872561     0.18   0.859    -.6910413    .8286008
       d1999 |   .1486281   .4313123     0.34   0.730     -.697634    .9948903
       d2000 |  -.2516717   .4872503    -0.52   0.606    -1.207688    .7043445
       d2001 |  -.0294384   .5631599    -0.05   0.958    -1.134394    1.075517
       d2002 |   .1530985   .6228805     0.25   0.806    -1.069033     1.37523
       d2003 |   .2521734   .6808485     0.37   0.711    -1.083695    1.588042
       d2004 |   .5290596   .7427938     0.71   0.476    -.9283491    1.986468
       d2005 |   .6040135   .8152234     0.74   0.459    -.9955066    2.203534
       d2006 |   .5468484   .8829063     0.62   0.536     -1.18547    2.279167
       d2007 |   .6100633   .9782966     0.62   0.533    -1.309417    2.529544
       d2008 |   .8098976   1.059337     0.76   0.445    -1.268589    2.888384
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
```

```
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |  -11.95249   15.26013    -0.78   0.434    -41.89383    17.98885
-------------+----------------------------------------------------------------
     sigma_u |  1.4583088
     sigma_e |  1.2182688
         rho |  .58896614   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(129, 1131) =     2.12           Prob > F = 0.0000

.
```

```
. **Model 6.7 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lnedutr1 lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: lnedutr1 omitted because of collinearity
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1283
-------------+------------------------------           F( 44,  1238) =   75.16
       Model |  5566.62764    44  126.514265           Prob > F      =  0.0000
    Residual |  2083.96973  1238  1.68333581           R-squared     =  0.7276
-------------+------------------------------           Adj R-squared =  0.7179
       Total |  7650.59737  1282  5.96770466           Root MSE      =  1.2974

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4778515   .0250706    19.06   0.000      .428666     .527037
             |
    lnsecedu |   -.996562   1.596739    -0.62   0.533    -4.129175    2.136051
   lntertedu |  -.2239122   .7790083    -0.29   0.774    -1.752235     1.30441
    lnedutr1 |  (omitted)
      lnwage |  -.5886715   .8231173    -0.72   0.475    -2.203531    1.026188
       lngdp |   .5549401    .790297     0.70   0.483    -.9955293     2.10541
 lntradefree |  -.1448079   .6402688    -0.23   0.821     -1.40094    1.111324
  lneconfree |   .5732394   .9968057     0.58   0.565    -1.382376    2.528855
lntransition |   2.432461   3.107627     0.78   0.434    -3.664335    8.529258
  lnictinfra |   .2218436   .4265315     0.52   0.603    -.6149608    1.058648
indprivati~n |   1.655353   .3044638     5.44   0.000     1.058031    2.252675
       d1996 |  -.8193515   1.127264    -0.73   0.467     -3.03091    1.392207
       d1997 |  -.6819054   1.012083    -0.67   0.501    -2.667494    1.303683
       d1998 |  -.6334704   .9104454    -0.70   0.487    -2.419657    1.152716
       d1999 |  -.5643722   .8483348    -0.67   0.506    -2.228705    1.099961
       d2000 |  -.9730768   .8039344    -1.21   0.226    -2.550301    .6041477
       d2001 |  -.5908311   .7311608    -0.81   0.419    -2.025282    .8436201
       d2002 |  -.4850339   .6386994    -0.76   0.448    -1.738087     .768019
       d2003 |  -.4556584   .5259541    -0.87   0.386    -1.487518    .5762016
       d2004 |  -.1850777   .4443288    -0.42   0.677    -1.056799     .686643
       d2005 |  -.1870454   .3706179    -0.50   0.614    -.9141539    .5400631
       d2006 |  -.2483097   .3014798    -0.82   0.410    -.8397775    .3431581
       d2007 |  -.1869985   .2092488    -0.89   0.372      -.59752    .2235229
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |   1.244041   1.145955     1.09   0.278    -1.004188    3.492269
          c5 |   1.870444   1.793353     1.04   0.297    -1.647903     5.38879
          c6 |    1.58697   1.591961     1.00   0.319     -1.53627     4.71021
          c7 |     1.7172   1.581333     1.09   0.278    -1.385188    4.819588
          c8 |   .8826534   1.029984     0.86   0.392    -1.138054    2.903361
          c9 |   1.386442   1.298826     1.07   0.286    -1.161701    3.934585
         c10 |  (omitted)
         c11 |   .4861865   2.229463     0.22   0.827    -3.887756    4.860129
         c12 |   1.377434   1.707043     0.81   0.420    -1.971583    4.726451
         c13 |   1.339142   1.120368     1.20   0.232     -.858889    3.537172
         c14 |   1.343043   1.368146     0.98   0.326    -1.341097    4.027184
          s2 |  -.7603264   .1834158    -4.15   0.000    -1.120167   -.4004862
          s3 |  -2.140034   .2165296    -9.88   0.000     -2.56484   -1.715229
          s4 |  -.1852932    .183226    -1.01   0.312     -.544761    .1741746
          s5 |  -1.609111   .2165958    -7.43   0.000    -2.034047   -1.184176
          s6 |  -.2057085    .179393    -1.15   0.252    -.5576564    .1462395
          s7 |   -.626032    .182978    -3.42   0.001    -.9850133   -.2670507
          s8 |   -.198082   .1833286    -1.08   0.280    -.5577512    .1615871
          s9 |  -.3850523   .1817988    -2.12   0.034    -.7417201   -.0283845
         s10 |  -.6752637   .1815645    -3.72   0.000    -1.031472   -.3190555
         s11 |  -.3444126   .1782365    -1.93   0.054    -.6940915    .0052663
         s12 |   -.313625   .1779358    -1.76   0.078    -.6627141    .0354641
         s13 |  -1.287006   .1946514    -6.61   0.000    -1.668889   -.9051231
       _cons |  -8.980017   15.97736    -0.56   0.574    -40.32571    22.36568
------------------------------------------------------------------------------
```

Appendix 6.12: Model 6.8 results

```
. **Model 6.8 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lnedutr2 lnwage lngdp
lntradefree lneconfree lntransit
> ion lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsec
> edu lntertedu lnedutr2 lnwage lngdp lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008
> c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d1996 dropped due to collinearity
d1997 dropped due to collinearity
d1998 dropped due to collinearity
d1999 dropped due to collinearity
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1017
Time variable : year                            Number of groups   =       129
Number of instruments = 44                      Obs per group: min =         2
F(41, 128)    =     71.09                                      avg =      7.88
Prob > F      =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2471913   .1338728     1.85   0.067    -.0176989    .5120815
             |
    lnsecedu |   .5316728    3.94001     0.13   0.893    -7.264311    8.327657
   lntertedu |  -.2888301   1.690202    -0.17   0.865    -3.633183    3.055523
    lnedutr2 |  -2.032767   2.538394    -0.80   0.425    -7.055412    2.989879
      lnwage |  -.1769181   .7841293    -0.23   0.822    -1.728452    1.374616
       lngdp |   .2387449   1.150458     0.21   0.836    -2.037632    2.515122
 lntradefree |  -.3954479   .4186803    -0.94   0.347    -1.223878    .4329826
  lneconfree |   1.130553   .6118557     1.85   0.067    -.0801082    2.341214
lntransition |   2.575986   2.957642     0.87   0.385    -3.276215    8.428186
  lnictinfra |   .2354257    .631623     0.37   0.710    -1.014348      1.4852
indprivati~n |   1.092808   .6823433     1.60   0.112    -.2573253     2.44294
       d2000 |  -2.596683   1.805602    -1.44   0.153    -6.169375    .9760097
       d2001 |  -2.006699   1.478533    -1.36   0.177    -4.932228    .9188307
       d2002 |    -1.6729   1.185281    -1.41   0.161    -4.018181    .6723822
       d2003 |  -1.387378   .8659555    -1.60   0.112    -3.100819    .3260631
       d2004 |  -.8642311   .6996054    -1.24   0.219     -2.24852    .5200577
       d2005 |  -.6093439   .4821514    -1.26   0.209    -1.563363     .344675
       d2006 |  -.4757525   .3122733    -1.52   0.130    -1.093639    .1421335
       d2007 |  -.1519571   .2176071    -0.70   0.486    -.5825299    .2786156
          c4 |    1.33198   1.630616     0.82   0.416    -1.894473    4.558433
          c5 |   1.287664   4.466655     0.29   0.774    -7.550377     10.1257
          c6 |    .264221   1.149067     0.23   0.819    -2.009405    2.537847
          c7 |   1.460366   3.042518     0.48   0.632    -4.559776    7.480509
          c8 |  -.0565919   1.098785    -0.05   0.959    -2.230726    2.117543
          c9 |   .3943886   1.917376     0.21   0.837    -3.399467    4.188244
         c11 |   2.650141   4.146407     0.64   0.524    -5.554234    10.85452
         c12 |   1.923656   3.465959     0.56   0.580    -4.934336    8.781647
         c13 |   1.717337   2.006856     0.86   0.394    -2.253571    5.688245
         c14 |   1.073528   1.843067     0.58   0.561    -2.573295     4.72035
          s2 |  -1.107974   .3492908    -3.17   0.002    -1.799106   -.4168429
          s3 |  -3.041175    .855519    -3.55   0.001    -4.733965   -1.348385
          s4 |  -.2345176   .2565837    -0.91   0.362    -.7422123     .273177
          s5 |  -2.015386   .6452471    -3.12   0.002    -3.292118   -.7386545
          s6 |  -.2603064   .2399599    -1.08   0.280    -.7351082    .2144953
          s7 |  -.8620969   .2947679    -2.92   0.004    -1.445346   -.2788484
          s8 |  -.2269404    .231945    -0.98   0.330    -.6858833    .2320024
          s9 |  -.4470334   .2469849    -1.81   0.073    -.9357352    .0416683
```

```
         s10 |   -.963826   .2930736    -3.29   0.001    -1.543722   -.3839298
         s11 |  -.4478979   .2490195    -1.80   0.074    -.9406255    .0448298
         s12 |   -.420763   .2945916    -1.43   0.156    -1.003663    .1621368
         s13 |  -1.744846   .4491459    -3.88   0.000    -2.633558   -.8561344
       _cons |  -12.27674    30.0098    -0.41   0.683    -71.65625    47.10277
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnedutr2 lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnedutr2 lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.65  Pr > z =  0.098
Arellano-Bond test for AR(2) in first differences: z =  -1.20  Pr > z =  0.228
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   9.83  Prob > chi2 =  0.007
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.98  Prob > chi2 =  0.613
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.53  Prob > chi2 =  0.468
    Difference (null H = exogenous): chi2(1)    =   0.45  Prob > chi2 =  0.501

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .7062523   5.160208     0.14   0.891    -9.504101    10.91661
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.3836699   2.196171    -0.17   0.862    -4.729169    3.961829
------------------------------------------------------------------------------

. nlcom _b[lnedutr2]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnedutr2]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -2.700243   3.229872    -0.84   0.405    -9.091096    3.690609
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.2350107   1.049275    -0.22   0.823    -2.311181    1.841159
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3171389   1.540019     0.21   0.837    -2.730053     3.36433
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.5252966   .5726001    -0.92   0.361    -1.658284    .6076904
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    1.50178   .7594319     1.98   0.050    -.0008859    3.004446
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   3.421833   4.271524     0.80   0.425    -5.030108    11.87377
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3127298   .8127523     0.38   0.701    -1.295439    1.920899
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.451641   1.059848     1.37   0.173     -.645449     3.54873
------------------------------------------------------------------------------

.
```

```
. **Model 6.8 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lnedutr2 lnwage lngdp
lntradefree lneconfree lntransition
>  lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: d1996 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d2000 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1017
Group variable: id                              Number of groups   =       129

R-sq:  within  = 0.2078                         Obs per group: min =         2
       between = 0.5268                                        avg =       7.9
       overall = 0.3421                                        max =         9

                                                F(19,869)          =     12.00
corr(u_i, Xb)  = 0.0871                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .1544423   .0342326     4.51   0.000     .0872541    .2216304
             |
    lnsecedu |  -1.894348   2.840721    -0.67   0.505    -7.469826    3.681129
   lntertedu |   1.545721   1.310463     1.18   0.239    -1.026321    4.117763
    lnedutr2 |  -.0938979    3.07895    -0.03   0.976    -6.136945    5.949149
      lnwage |  -.3209078    1.49617    -0.21   0.830    -3.257438    2.615622
       lngdp |   .5656156   1.772983     0.32   0.750    -2.914213    4.045444
 lntradefree |  -.2337731   .9473249    -0.25   0.805    -2.093085    1.625539
  lneconfree |   .6178614    1.22272     0.51   0.613    -1.781968    3.017691
lntransition |   5.546141   4.305803     1.29   0.198    -2.904849    13.99713
  lnictinfra |  -.1636593   .6277883    -0.26   0.794    -1.395818    1.068499
indprivati~n |    1.23547   .3524731     3.51   0.000      .5436719    1.927268
       d1996 |  (omitted)
       d1997 |  (omitted)
       d1998 |  (omitted)
       d1999 |  (omitted)
       d2000 |  (omitted)
       d2001 |   .2822047   .5452607     0.52   0.605    -.7879773    1.352387
       d2002 |   .4452692    .933336     0.48   0.633    -1.386587    2.277125
       d2003 |   .5095087   1.267414     0.40   0.688    -1.978041    2.997059
       d2004 |   .7581084   1.573375     0.48   0.630    -2.329951    3.846168
       d2005 |   .8380035   1.857651     0.45   0.652    -2.808004    4.484011
       d2006 |   .7767722   2.080451     0.37   0.709    -3.306525    4.860069
       d2007 |   .7837934   2.280204     0.34   0.731    -3.691557    5.259144
       d2008 |   .9360274   2.462257     0.38   0.704    -3.896639    5.768694
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
```

```
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |  -11.82798   36.03991    -0.33   0.743    -82.56343    58.90747
-------------+----------------------------------------------------------------
     sigma_u |  1.5820625
     sigma_e |  1.3444254
         rho |  .58067024   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(128, 869) =     1.69            Prob > F = 0.0000

.
```

```
. **Model 6.8 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lnedutr2 lnwage lngdp
lntradefree lneconfree lntransition l
> nictinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: d1996 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1017
-------------+------------------------------           F( 41,   975) =   50.30
       Model |  4150.22348    41  101.224963           Prob > F      =  0.0000
    Residual |  1962.08077   975  2.01239053           R-squared     =  0.6790
-------------+------------------------------           Adj R-squared =  0.6655
       Total |  6112.30425  1016  6.01604749           Root MSE      =  1.4186

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4451329   .0290356    15.33   0.000     .3881533    .5021124
             |
    lnsecedu |  -2.632523   2.992398    -0.88   0.379    -8.504806     3.23976
   lntertedu |   1.531901   1.379895     1.11   0.267    -1.176006    4.239808
    lnedutr2 |   .4292342   3.246239     0.13   0.895    -5.941186    6.799655
      lnwage |  -1.107588    1.57382    -0.70   0.482    -4.196053    1.980877
       lngdp |   1.552048     1.8632     0.83   0.405    -2.104296    5.208393
 lntradefree |   -.474813   .9983665    -0.48   0.634    -2.434007    1.484381
  lneconfree |  -.1769781   1.288596    -0.14   0.891    -2.705718    2.351762
lntransition |   5.104167   4.538738     1.12   0.261    -3.802653    14.01099
  lnictinfra |  -.5899764   .6613697    -0.89   0.373    -1.887848    .7078956
indprivati~n |   1.677037   .3538831     4.74   0.000     .9825765    2.371497
       d1996 |  (omitted)
       d1997 |  (omitted)
       d1998 |  (omitted)
       d1999 |  (omitted)
       d2000 |  -.4759498   2.596141    -0.18   0.855    -5.570617    4.618717
       d2001 |  -.0688873   2.094454    -0.03   0.974    -4.179045     4.04127
       d2002 |  -.0348804   1.678215    -0.02   0.983     -3.32821    3.258449
       d2003 |  -.1123571   1.313952    -0.09   0.932    -2.690856    2.466142
       d2004 |   .0590774   .9993407     0.06   0.953    -1.902029    2.020184
       d2005 |   .0178162   .7142708     0.02   0.980    -1.383869    1.419501
       d2006 |  -.0864832    .491783    -0.18   0.860    -1.051558    .8785917
       d2007 |  -.1303724   .2851112    -0.46   0.648    -.6898746    .4291298
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |   .5814449   2.335642     0.25   0.803    -4.002018    5.164908
          c5 |   1.144971   4.223447     0.27   0.786    -7.143123    9.433064
          c6 |     .96893   2.866025     0.34   0.735    -4.655357    6.593217
          c7 |  -.7278927   3.821175    -0.19   0.849    -8.226566     6.77078
          c8 |   -.047864   2.062328    -0.02   0.981    -4.094976    3.999248
          c9 |   .2621649   2.429661     0.11   0.914    -4.505802    5.030132
         c10 |  (omitted)
         c11 |  -4.109911   5.034532    -0.82   0.415    -13.98968    5.769855
         c12 |  -.6705151   4.253893    -0.16   0.875    -9.018355    7.677325
         c13 |   .0326519   2.447407     0.01   0.989     -4.77014    4.835444
         c14 |   .2891926   3.070155     0.09   0.925     -5.73568    6.314065
          s2 |  -.7938639   .2249049    -3.53   0.000    -1.235217   -.3525104
          s3 |  -2.178962   .2611222    -8.34   0.000    -2.691388   -1.666536
          s4 |  -.1324733    .223882    -0.59   0.554    -.5718193    .3068728
          s5 |  -1.527418   .2613289    -5.84   0.000     -2.04025   -1.014586
          s6 |  -.2008726   .2204757    -0.91   0.362    -.6335342     .231789
          s7 |  -.5856399   .2238317    -2.62   0.009    -1.024887   -.1463925
          s8 |  -.1234263    .223889    -0.55   0.582    -.5627861    .3159335
          s9 |  -.3441415   .2234159    -1.54   0.124    -.7825729    .0942899
         s10 |  -.6756028   .2218567    -3.05   0.002    -1.110975   -.2402312
         s11 |   -.280944   .2178379    -1.29   0.197    -.7084291     .146541
         s12 |  -.2783651   .2174001    -1.28   0.201     -.704991    .1482608
         s13 |  -1.336615   .2361049    -5.66   0.000    -1.799947   -.8732829
       _cons |  -20.30152   36.23737    -0.56   0.575    -91.41374    50.81069
------------------------------------------------------------------------------
```

Appendix 6.13: Model 6.9 results

```
. **Model 6.9 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lnmanvacancy lnwage lngdp
lntradefree lneconfree lntra
> nsition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(l
> nsecedu lntertedu lnmanvacancy lnwage lngdp lntradefree lneconfree lntransition
lnictinfra indprivatisation d199
> 6-d2008 c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d1996 dropped due to collinearity
d1997 dropped due to collinearity
d1998 dropped due to collinearity
d1999 dropped due to collinearity
d2000 dropped due to collinearity
d2001 dropped due to collinearity
d2005 dropped due to collinearity
d2006 dropped due to collinearity
d2007 dropped due to collinearity
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c10 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =       474
Time variable : year                            Number of groups   =       129
Number of instruments = 39                      Obs per group: min =         2
F(36, 128)    =     43.04                                      avg =      3.67
Prob > F      =     0.000                                      max =         4
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .1623606   .0644369     2.52   0.013     .0348612    .2898599
             |
    lnsecedu |   -5.26953   3.904006    -1.35   0.179    -12.99427    2.455212
   lntertedu |   2.806031   2.042072     1.37   0.172    -1.234557     6.84662
lnmanvacancy |   .2430967   .4795183     0.51   0.613    -.7057121    1.191906
      lnwage |  -1.282527   2.259141    -0.57   0.571    -5.752624    3.187569
       lngdp |   2.473552   2.157266     1.15   0.254    -1.794966    6.742071
 lntradefree |  -1.476849   .7953757    -1.86   0.066    -3.050636    .0969372
  lneconfree |    .412047   1.530543     0.27   0.788    -2.616393    3.440487
lntransition |   1.482094   4.644855     0.32   0.750    -7.708545    10.67273
  lnictinfra |  -1.457939   .8655539    -1.68   0.095    -3.170585    .2547076
indprivati~n |   1.240731    .820201     1.51   0.133    -.3821771    2.863639
       d2002 |   -.612343   .5666512    -1.08   0.282    -1.733559    .5088733
       d2003 |  -.5903033   .4510315    -1.31   0.193    -1.482746    .3021396
       d2004 |  -.2538604   .1969357    -1.29   0.200    -.6435313    .1358105
          c4 |    1.18061   1.684804     0.70   0.485    -2.153061    4.514282
          c5 |    3.84144   4.307167     0.89   0.374    -4.681026    12.36391
          c6 |   3.273879   3.601662     0.91   0.365    -3.852625    10.40038
          c7 |   .3011992   3.943585     0.08   0.939    -7.501858    8.104257
          c8 |   .9411944   2.542453     0.37   0.712    -4.089483    5.971871
          c9 |    2.04759   3.260275     0.63   0.531    -4.403422    8.498602
         c11 |  -6.007371   5.815265    -1.03   0.304    -17.51387    5.499124
         c12 |  -.4962372   4.499215    -0.11   0.912    -9.398703    8.406229
         c13 |    1.18063   2.290358     0.52   0.607    -3.351234    5.712494
         c14 |   .4342362   2.743247     0.16   0.874    -4.993747    5.862219
          s2 |  -1.228538   .3167719    -3.88   0.000    -1.855326    -.601751
          s3 |   -2.79709    .414308    -6.75   0.000    -3.616869   -1.977311
          s4 |  -.2851709   .2888651    -0.99   0.325    -.8567398     .286398
          s5 |   -2.51857   .8746722    -2.88   0.005    -4.249259   -.7878822
          s6 |  -.3825483   .3030889    -1.26   0.209    -.9822616    .2171649
          s7 |  -1.003216   .2856124    -3.51   0.001    -1.568349   -.4380832
          s8 |  -.2999942   .2714149    -1.11   0.271     -.837035    .2370466
          s9 |  -.6243253   .2902699    -2.15   0.033    -1.198674   -.0499767
```

```
         s10 |  -1.092421   .2796099    -3.91   0.000    -1.645677   -.5391649
         s11 |  -.6080296   .2726269    -2.23   0.027    -1.147469   -.0685906
         s12 |  -.5401891   .3342359    -1.62   0.109    -1.201532    .1211537
         s13 |  -1.897566   .3328755    -5.70   0.000    -2.556217   -1.238915
       _cons |   -23.5394   38.46843    -0.61   0.542    -99.65576    52.57697
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lnmanvacancy lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lnmanvacancy lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.13  Pr > z =  0.259
Arellano-Bond test for AR(2) in first differences: z =   1.33  Pr > z =  0.185
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   1.77  Prob > chi2 =  0.412
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.33  Prob > chi2 =  0.514
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.73  Prob > chi2 =  0.393
    Difference (null H = exogenous): chi2(1)    =   0.60  Prob > chi2 =  0.438

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -6.290929   4.458424    -1.41   0.161    -15.11268    2.530824
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   3.349928    2.45272     1.37   0.174    -1.503198    8.203054
------------------------------------------------------------------------------

. nlcom _b[lnmanvacancy]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnmanvacancy]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .2902164   .5831119     0.50   0.620      -.86357    1.444003
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.531121   2.662295    -0.58   0.566    -6.798927    3.736685
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.953004   2.528501     1.17   0.245    -2.050068    7.956076
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.763109   .8885003    -1.98   0.049    -3.521158   -.0050591
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4919145   1.807949     0.27   0.786    -3.085421     4.06925
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    1.76937   5.487313     0.32   0.748    -9.088217    12.62696
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.740533   .9926776    -1.75   0.082    -3.704715    .2236497
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.481223   .9767697     1.52   0.132    -.4514828    3.413929
------------------------------------------------------------------------------

.
```

```
. **Model 6.9 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lnmanvacancy lnwage lngdp
lntradefree lneconfree lntransi
> tion lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: d1996 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d2000 omitted because of collinearity
note: d2001 omitted because of collinearity
note: d2005 omitted because of collinearity
note: d2006 omitted because of collinearity
note: d2007 omitted because of collinearity
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       474
Group variable: id                              Number of groups   =       129

R-sq:  within  = 0.1655                         Obs per group: min =         2
       between = 0.0292                                        avg =       3.7
       overall = 0.0200                                        max =         4

                                                F(14,331)          =      4.69
corr(u_i, Xb)  = -0.7028                        Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |  -.1317418   .0476066    -2.77   0.006    -.2253914   -.0380921
             |
    lnsecedu |   -6.46421   5.429048    -1.19   0.235      -17.144     4.21558
   lntertedu |    4.21239   4.146953     1.02   0.310    -3.945316     12.3701
lnmanvacancy |   .5487969    .643979     0.85   0.395    -.7180107    1.815605
      lnwage |  -.0080828    4.01237    -0.00   0.998    -7.901044    7.884878
       lngdp |    1.06247   3.912538     0.27   0.786    -6.634106    8.759047
 lntradefree |  -1.275542   1.119891    -1.14   0.256    -3.478544    .9274599
  lneconfree |   1.585176   3.004957     0.53   0.598    -4.326045    7.496397
lntransition |   1.319704    7.06918     0.19   0.852    -12.58648    15.22589
  lnictinfra |  -1.283302    1.38941    -0.92   0.356    -4.016488    1.449885
indprivati~n |    .256356   .4424349     0.58   0.563    -.6139829    1.126695
       d1996 |  (omitted)
       d1997 |  (omitted)
       d1998 |  (omitted)
       d1999 |  (omitted)
       d2000 |  (omitted)
       d2001 |  (omitted)
       d2002 |  -.8341406   1.128426    -0.74   0.460    -3.053931     1.38565
       d2003 |  -.7396782   .6346449    -1.17   0.245    -1.988124    .5087677
       d2004 |  -.3592856   .3091125    -1.16   0.246    -.9673583    .2487871
```

```
       d2005 |  (omitted)
       d2006 |  (omitted)
       d2007 |  (omitted)
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |  -.7130584   74.03014    -0.01   0.992     -146.342    144.9158
-------------+----------------------------------------------------------------
     sigma_u |  2.8747652
     sigma_e |  1.0125354
         rho |  .88963587   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(128, 331) =     2.55            Prob > F = 0.0000

.
```

```
. **Model 6.9 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lnmanvacancy lnwage lngdp
lntradefree lneconfree lntransiti
> on lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: d1996 omitted because of collinearity
note: d1997 omitted because of collinearity
note: d1998 omitted because of collinearity
note: d1999 omitted because of collinearity
note: d2000 omitted because of collinearity
note: d2001 omitted because of collinearity
note: d2002 omitted because of collinearity
note: d2006 omitted because of collinearity
note: d2007 omitted because of collinearity
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =     474
-------------+------------------------------           F( 36,   437) =   30.85
       Model |  1713.49929    36  47.5972025           Prob > F      =  0.0000
    Residual |  674.304541   437  1.54303099           R-squared     =  0.7176
-------------+------------------------------           Adj R-squared =  0.6943
       Total |  2387.80383   473  5.04821106           Root MSE      =  1.2422

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .3645601   .0426396     8.55   0.000     .2807559    .4483644
             |
    lnsecedu |  -5.889452   6.647576    -0.89   0.376    -18.95465    7.175743
   lntertedu |   1.690907   5.076813     0.33   0.739    -8.287098    11.66891
lnmanvacancy |   .0338434   .7881219     0.04   0.966    -1.515137    1.582824
      lnwage |  -1.712065   4.907729    -0.35   0.727    -11.35775    7.933621
       lngdp |   2.917351   4.782743     0.61   0.542    -6.482687    12.31739
 lntradefree |  -1.560958   1.370548    -1.14   0.255    -4.254642    1.132726
  lneconfree |  -.3172042   3.680971    -0.09   0.931    -7.551812    6.917403
lntransition |   1.239104   8.664374     0.14   0.886    -15.78992    18.26813
  lnictinfra |  -1.425153   1.701448    -0.84   0.403    -4.769192    1.918886
indprivati~n |   2.115254   .4673075     4.53   0.000     1.196804    3.033703
       d1996 |  (omitted)
       d1997 |  (omitted)
       d1998 |  (omitted)
       d1999 |  (omitted)
       d2000 |  (omitted)
       d2001 |  (omitted)
       d2002 |  (omitted)
       d2003 |  -.0105919   .6495215    -0.02   0.987    -1.287166    1.265982
       d2004 |   .3001285   1.061183     0.28   0.777    -1.785527    2.385784
       d2005 |   .5384806   1.383676     0.39   0.697    -2.181005    3.257967
       d2006 |  (omitted)
       d2007 |  (omitted)
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |   .5139797   4.673235     0.11   0.912    -8.670831     9.69879
          c5 |   3.113824   9.239284     0.34   0.736    -15.04513    21.27278
          c6 |   5.267948   8.217458     0.64   0.522     -10.8827     21.4186
          c7 |   .3717934    9.80899     0.04   0.970    -18.90687    19.65045
          c8 |   2.289598    5.75841     0.40   0.691    -9.028022    13.60722
          c9 |   3.491615   7.157883     0.49   0.626    -10.57654    17.55977
         c10 |  (omitted)
         c11 |  -7.677295   13.10202    -0.59   0.558     -33.4281     18.0735
         c12 |  -1.952978   10.25221    -0.19   0.849    -22.10275    18.19679
         c13 |   .7223587   5.831507     0.12   0.901    -10.73893    12.18364
         c14 |   .6273745   7.050386     0.09   0.929    -13.22951    14.48426
          s2 |  -.9030392   .2900518    -3.11   0.002    -1.473109   -.3329692
          s3 |  -2.195124   .3338397    -6.58   0.000    -2.851255   -1.538993
          s4 |  -.1530693   .2876198    -0.53   0.595    -.7183593    .4122207
          s5 |  -1.579224   .3487438    -4.53   0.000    -2.264648   -.8938006
          s6 |  -.2894123   .2826688    -1.02   0.306    -.8449717    .2661471
          s7 |  -.6909471   .2892021    -2.39   0.017    -1.259347   -.1225472
          s8 |  -.1737184   .2875436    -0.60   0.546    -.7388588    .3914219
          s9 |  -.5253628   .2879949    -1.82   0.069     -1.09139    .0406645
```

```
         s10 |  -.7666432   .2895425    -2.65   0.008    -1.335712   -.1975742
         s11 |  -.3904962   .2813401    -1.39   0.166    -.9434441    .1624517
         s12 |  -.3300268   .2809938    -1.17   0.241    -.8822941    .2222406
         s13 |  -1.363044   .3065708    -4.45   0.000     -1.96558   -.7605071
       _cons |  -25.14777   86.69812    -0.29   0.772    -195.5449    145.2493
------------------------------------------------------------------------------
```

Appendix 6.14: Model 6.10 results

```
. **Model 6.10 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive lnwage lngdp
lntradefree lneconfree lntran
> sition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(ln
> secedu lntertedu lncognitive lnwage lngdp lntradefree lneconfree lntransition
lnictinfra indprivatisation d1996-
> d2008 c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1190
Time variable : year                            Number of groups   =       118
Number of instruments = 46                      Obs per group: min =         1
F(43, 117)    =     86.33                                      avg =     10.08
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2734133   .1381996     1.98   0.050    -.0002837    .5471104
             |
    lnsecedu |  -.6301696   1.050209    -0.60   0.550    -2.710053    1.449714
   lntertedu |  -1.149708   .8957392    -1.28   0.202    -2.923672    .6242565
 lncognitive |   9.368211   3.824135     2.45   0.016     1.794712    16.94171
      lnwage |  -.3437998   .4970901    -0.69   0.491    -1.328261    .6406611
       lngdp |   .2638605   .5614964     0.47   0.639    -.8481537    1.375875
 lntradefree |   -.100903   .2775874    -0.36   0.717    -.6506502    .4488442
  lneconfree |   1.666878   .6380633     2.61   0.010     .4032275    2.930529
lntransition |   1.935826   1.116605     1.73   0.086    -.2755516    4.147203
  lnictinfra |    .339383     .25291     1.34   0.182    -.1614919    .8402579
indprivati~n |   1.284724   .8492116     1.51   0.133    -.3970955    2.966543
       d1996 |  -1.131936   .8234994    -1.37   0.172    -2.762834    .4989609
       d1997 |  -1.141214   .7948586    -1.44   0.154     -2.71539    .4329616
       d1998 |  -1.070207   .7439904    -1.44   0.153    -2.543641    .4032268
       d1999 |  -.9536596   .6820016    -1.40   0.165    -2.304328    .3970087
       d2000 |   -1.20929   .5561669    -2.17   0.032    -2.310749   -.1078301
       d2001 |  -.9418119   .5447399    -1.73   0.086    -2.020641    .1370169
       d2002 |  -.8300337   .4687773    -1.77   0.079    -1.758423    .0983552
       d2003 |  -.7541855   .4661597    -1.62   0.108     -1.67739    .1690193
       d2004 |  -.3776078   .2844143    -1.33   0.187    -.9408754    .1856598
       d2005 |  -.2919753   .2032158    -1.44   0.153    -.6944335     .110483
       d2006 |   -.315483   .1531521    -2.06   0.042    -.6187928   -.0121733
       d2007 |  -.1063216   .1067601    -1.00   0.321    -.3177544    .1051112
          c5 |   .5802203   1.390917     0.42   0.677    -2.174419    3.334859
          c6 |  -.2079396   1.060298    -0.20   0.845    -2.307804    1.891925
          c7 |   1.274691   1.293719     0.99   0.327    -1.287452    3.836834
          c8 |  -.4460709   .6871025    -0.65   0.517    -1.806841    .9146996
          c9 |   .5002541   1.012936     0.49   0.622    -1.505812     2.50632
         c11 |   .8723578   1.472593     0.59   0.555    -2.044035    3.788751
         c12 |    1.52098   1.371451     1.11   0.270    -1.195106    4.237066
         c13 |   .1058687   .6525713     0.16   0.871    -1.186515    1.398252
          s2 |  -1.038786   .3528116    -2.94   0.004    -1.737511   -.3400612
          s3 |  -3.094493   .8778612    -3.53   0.001    -4.833051   -1.355935
          s4 |  -.2505053   .2541049    -0.99   0.326    -.7537467    .2527361
          s5 |  -2.432572   .6680723    -3.64   0.000    -3.755654    -1.10949
          s6 |  -.3380133    .223451    -1.51   0.133    -.7805463    .1045196
          s7 |   -.849182   .2873255    -2.96   0.004    -1.418215   -.2801488
          s8 |  -.3749078    .229595    -1.63   0.105    -.8296087    .0797931
          s9 |  -.5279527   .2484098    -2.13   0.036    -1.019915   -.0359901
```

```
         s10 |  -.9398831    .300264    -3.13   0.002     -1.53454   -.3452259
         s11 |  -.5393753   .2573897    -2.10   0.038    -1.049122   -.0296285
         s12 |  -.3994759   .2807677    -1.42   0.157    -.9555216    .1565699
         s13 |  -1.726833   .4534426    -3.81   0.000    -2.624852   -.8288136
       _cons |  -20.10125   11.25469    -1.79   0.077    -42.39057    2.188071
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lncognitive lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lncognitive lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.03  Pr > z =  0.043
Arellano-Bond test for AR(2) in first differences: z =  -1.18  Pr > z =  0.238
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.91  Prob > chi2 =  0.086
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.08  Prob > chi2 =  0.583
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.62  Prob > chi2 =  0.430
    Difference (null H = exogenous): chi2(1)    =   0.45  Prob > chi2 =  0.500

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.8673013   1.470079    -0.59   0.556    -3.778717    2.044114
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.582341   1.024185    -1.54   0.125    -3.610686    .4460042
------------------------------------------------------------------------------

. nlcom _b[lncognitive]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lncognitive]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   12.89345   3.853078     3.35   0.001     5.262634    20.52427
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.4731711   .7223765    -0.66   0.514      -1.9038    .9574578
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3631508   .7907741     0.46   0.647    -1.202936    1.929237
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1388726   .3945465    -0.35   0.725    -.9202513     .642506
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.294122   .8257607     2.78   0.006      .658746    3.929498
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.664274   1.452349     1.83   0.069    -.2120269    5.540574
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4670922   .3853514     1.21   0.228     -.296076     1.23026
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.768163   1.387002     1.27   0.205    -.9787213    4.515047
------------------------------------------------------------------------------

.
```

```
. **Model 6.10 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive lnwage lngdp
lntradefree lneconfree lntransit
> ion lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: lncognitive omitted because of collinearity
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1190
Group variable: id                              Number of groups   =       118

R-sq:  within  = 0.2873                         Obs per group: min =         1
       between = 0.8249                                        avg =      10.1
       overall = 0.5735                                        max =        13

                                                F(22,1050)         =     19.24
corr(u_i, Xb)  = 0.5084                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .193157   .0307219     6.29   0.000     .1328738    .2534403
             |
    lnsecedu |  -.5961464   1.580211    -0.38   0.706    -3.696876    2.504584
   lntertedu |  -.3948972    .758344    -0.52   0.603    -1.882939    1.093145
 lncognitive |  (omitted)
      lnwage |  -.5827412   .8469517    -0.69   0.492    -2.244652    1.079169
       lngdp |   .5104846    .779508     0.65   0.513    -1.019086    2.040055
 lntradefree |  -.0199811   .6512587    -0.03   0.976    -1.297898    1.257936
  lneconfree |   1.436007   .9727928     1.48   0.140    -.4728324    3.344846
lntransition |   2.323538   3.052363     0.76   0.447    -3.665887    8.312963
  lnictinfra |   .4880843   .4237924     1.15   0.250    -.3434921    1.319661
indprivati~n |   1.398859   .3276367     4.27   0.000      .755962    2.041756
       d1996 |  (omitted)
       d1997 |   .0184732   .3497666     0.05   0.958    -.6678479    .7047943
       d1998 |   .0848514   .4026112     0.21   0.833    -.7051628    .8748656
       d1999 |   .1664835   .4485618     0.37   0.711    -.7136961    1.046663
       d2000 |  -.2317374   .5087994    -0.46   0.649    -1.230117    .7666419
       d2001 |  -.0122579   .5888631    -0.02   0.983     -1.16774    1.143224
       d2002 |   .1894574   .6507777     0.29   0.771    -1.087515     1.46643
       d2003 |    .267036   .7069018     0.38   0.706    -1.120065    1.654137
       d2004 |   .5404895   .7734003     0.70   0.485    -.9770965    2.058076
       d2005 |   .6194095   .8517466     0.73   0.467     -1.05191    2.290729
       d2006 |   .5497161   .9185275     0.60   0.550    -1.252642    2.352074
       d2007 |   .5786153   1.018494     0.57   0.570    -1.419899     2.57713
       d2008 |   .8586361   1.105387     0.78   0.437    -1.310382    3.027654
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
```

```
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |   -13.0252   16.02303    -0.81   0.416      -44.466    18.41559
-------------+----------------------------------------------------------------
     sigma_u |  1.4805195
     sigma_e |  1.2593186
         rho |  .58021217   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(117, 1050) =     1.97          Prob > F = 0.0000

.
```

```
. **Model 6.10 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive lnwage lngdp
lntradefree lneconfree lntransitio
> n lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: lncognitive omitted because of collinearity
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1190
-------------+------------------------------           F( 43,  1146) =   70.98
       Model |  5408.44026    43   125.77768           Prob > F      =  0.0000
    Residual |  2030.60261  1146  1.77190454           R-squared     =  0.7270
-------------+------------------------------           Adj R-squared =  0.7168
       Total |  7439.04286  1189  6.25655413           Root MSE      =  1.3311

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4553395   .0264225    17.23   0.000     .4034975    .5071814
             |
    lnsecedu |  -.8482964   1.667813    -0.51   0.611    -4.120607    2.424014
   lntertedu |  -.2664939   .8003897    -0.33   0.739    -1.836887      1.3039
 lncognitive |  (omitted)
      lnwage |  -.6756286   .8930867    -0.76   0.449    -2.427897     1.07664
       lngdp |    .624709    .818834     0.76   0.446    -.9818729    2.231291
 lntradefree |  -.1647189   .6869072    -0.24   0.811    -1.512456    1.183018
  lneconfree |   .6953723   1.026627     0.68   0.498    -1.318907    2.709652
lntransition |   2.031659   3.224724     0.63   0.529    -4.295366    8.358685
  lnictinfra |   .2866624   .4476191     0.64   0.522    -.5915826    1.164907
indprivati~n |   1.845784   .3307288     5.58   0.000     1.196882    2.494686
       d1996 |  -.8688525   1.167694    -0.74   0.457    -3.159911    1.422206
       d1997 |  -.7394278   1.048316    -0.71   0.481    -2.796262    1.317406
       d1998 |  -.6802325   .9432236    -0.72   0.471    -2.530871    1.170406
       d1999 |  -.6125039   .8800233    -0.70   0.487    -2.339141    1.114134
       d2000 |  -1.026664   .8395791    -1.22   0.222    -2.673948    .6206207
       d2001 |  -.6557408   .7716987    -0.85   0.396    -2.169842    .8583601
       d2002 |  -.5263284   .6750865    -0.78   0.436    -1.850872    .7982156
       d2003 |  -.5156825   .5568241    -0.93   0.355    -1.608192    .5768265
       d2004 |  -.2574877   .4721513    -0.55   0.586    -1.183866    .6688903
       d2005 |  -.2449832    .396573    -0.62   0.537    -1.023074    .5331074
       d2006 |  -.3215086   .3281966    -0.98   0.327    -.9654423    .3224251
       d2007 |   -.290166   .2302025    -1.26   0.208    -.7418316    .1614996
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |   1.863221   1.857155     1.00   0.316    -1.780584    5.507027
          c6 |   1.703414   1.639006     1.04   0.299    -1.512374    4.919202
          c7 |   1.814879   1.630983     1.11   0.266    -1.385169    5.014927
          c8 |   .9619516   1.061126     0.91   0.365    -1.120015    3.043919
          c9 |   1.421234   1.344774     1.06   0.291    -1.217261    4.059728
         c10 |  (omitted)
         c11 |   .6367845   2.290316     0.28   0.781    -3.856898    5.130467
         c12 |      1.371    1.77139     0.77   0.439    -2.104532    4.846531
         c13 |   1.450388   1.152977     1.26   0.209    -.8117953    3.712572
         c14 |   1.541986   1.450846     1.06   0.288    -1.304627    4.388598
          s2 |  -.7770235   .1950266    -3.98   0.000    -1.159673   -.3943743
          s3 |  -2.307871   .2316629    -9.96   0.000    -2.762402    -1.85334
          s4 |  -.1664077   .1957271    -0.85   0.395    -.5504313    .2176159
          s5 |  -1.849678   .2333013    -7.93   0.000    -2.307424   -1.391933
          s6 |  -.2609348   .1915905    -1.36   0.173    -.6368423    .1149728
          s7 |  -.6039828   .1944849    -3.11   0.002    -.9855691   -.2223964
          s8 |  -.2568096   .1961128    -1.31   0.191      -.64159    .1279707
          s9 |  -.4184957   .1899437    -2.20   0.028     -.791172   -.0458194
         s10 |  -.6799648    .193197    -3.52   0.000    -1.059024   -.3009053
         s11 |  -.3733324   .1899565    -1.97   0.050     -.746034   -.0006308
         s12 |  -.2659208   .1892543    -1.41   0.160    -.6372446    .1054029
         s13 |  -1.352761   .2078075    -6.51   0.000    -1.760486   -.9450348
       _cons |  -10.72006   16.60593    -0.65   0.519    -43.30148    21.86137
------------------------------------------------------------------------------
```

Appendix 6.15: Model 6.11 results

```
. **Model 6.11 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop lnwage lngdp
lntradefree lneconfree lntransition
>  lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, gmm(l.lnindfdistock,
laglimit(1 2) collapse) iv(lnsecedu
>  lntertedu lntop lnwage lngdp lntradefree lneconfree lntransition lnictinfra
indprivatisation d1996-d2008 c2-c14
>  s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1190
Time variable : year                            Number of groups   =       118
Number of instruments = 46                      Obs per group: min =         1
F(43, 117)    =     86.33                                      avg =     10.08
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .273413   .1381993     1.98   0.050    -.0002834    .5471095
             |
    lnsecedu |  -.6301561   1.050211    -0.60   0.550    -2.710044    1.449732
   lntertedu |  -1.149711   .8957391    -1.28   0.202    -2.923676    .6242529
       lntop |   1.678539   .6851836     2.45   0.016     .3215685    3.035509
      lnwage |  -.3438097   .4970922    -0.69   0.491    -1.328275    .6406552
       lngdp |   .2638738   .5614991     0.47   0.639    -.8481457    1.375893
 lntradefree |  -.1009019   .2775873    -0.36   0.717    -.6506491    .4488452
  lneconfree |   1.666877   .6380634     2.61   0.010     .4032261    2.930529
lntransition |   1.935819   1.116605     1.73   0.086    -.2755584    4.147197
  lnictinfra |   .3393839     .25291     1.34   0.182    -.1614912     .840259
indprivati~n |   1.284721   .8492123     1.51   0.133    -.3970998    2.966541
       d1996 |  -1.131931   .8234982    -1.37   0.172    -2.762826    .4989641
       d1997 |  -1.141209   .7948574    -1.44   0.154    -2.715383    .4329643
       d1998 |  -1.070202   .7439895    -1.44   0.153    -2.543634    .4032306
       d1999 |   -.953654   .6820005    -1.40   0.165     -2.30432    .3970123
       d2000 |  -1.209285   .5561651    -2.17   0.032    -2.310741   -.1078292
       d2001 |   -.941807   .5447392    -1.73   0.086    -2.020634    .1370204
       d2002 |  -.8300299   .4687764    -1.77   0.079    -1.758417    .0983571
       d2003 |  -.7541816   .4661584    -1.62   0.108    -1.677384    .1690208
       d2004 |  -.3776055   .2844137    -1.33   0.187     -.940872     .185661
       d2005 |  -.2919736   .2032154    -1.44   0.153     -.694431    .1104838
       d2006 |   -.315482   .1531518    -2.06   0.042     -.618791   -.0121729
       d2007 |  -.1063217     .10676    -1.00   0.321    -.3177542    .1051109
          c5 |   -.369976   1.434863    -0.26   0.797    -3.211647    2.471695
          c6 |  -.5854218   1.088117    -0.54   0.592    -2.740381    1.569537
          c7 |   .4924199   1.213011     0.41   0.686    -1.909884    2.894724
          c8 |  -.4757835   .6881803    -0.69   0.491    -1.838689    .8871216
          c9 |   1.281046   1.113783     1.15   0.252    -.9247429    3.486834
         c11 |  -.2205169   1.310681    -0.17   0.867    -2.816252    2.375218
         c12 |   1.148921   1.318583     0.87   0.385    -1.462463    3.760305
         c13 |  -.8040778   .7812519    -1.03   0.306    -2.351306    .7431507
          s2 |  -1.038786   .3528113    -2.94   0.004     -1.73751   -.3400616
          s3 |  -3.094495   .8778592    -3.53   0.001    -4.833049   -1.355941
          s4 |  -.2505042   .2541047    -0.99   0.326    -.7537452    .2527367
          s5 |  -2.432569   .6680709    -3.64   0.000    -3.755649    -1.10949
          s6 |  -.3380128   .2234509    -1.51   0.133    -.7805455      .10452
          s7 |  -.8491818   .2873251    -2.96   0.004    -1.418214   -.2801494
          s8 |  -.3749067   .2295947    -1.63   0.105    -.8296071    .0797936
          s9 |  -.5279517   .2484097    -2.13   0.036    -1.019914   -.0359893
```

```
         s10 |   -.939882   .3002634    -3.13   0.002    -1.534538    -.345226
         s11 |  -.5393744   .2573894    -2.10   0.038    -1.049121   -.0296283
         s12 |  -.3994754   .2807674    -1.42   0.157    -.9555205    .1565697
         s13 |  -1.726834   .4534419    -3.81   0.000    -2.624852   -.8288157
       _cons |  -.3424096   12.53785    -0.03   0.978    -25.17297    24.48815
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lntop lnwage lngdp lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lntop lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.03  Pr > z =  0.043
Arellano-Bond test for AR(2) in first differences: z =  -1.18  Pr > z =  0.238
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   4.91  Prob > chi2 =  0.086
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.08  Prob > chi2 =  0.583
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.62  Prob > chi2 =  0.430
    Difference (null H = exogenous): chi2(1)    =   0.45  Prob > chi2 =  0.500

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.8672823   1.470082    -0.59   0.556    -3.778702    2.044137
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.582345   1.024185    -1.54   0.125    -3.610689    .4459988
------------------------------------------------------------------------------

. nlcom _b[lntop]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntop]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.310169   .6903694     3.35   0.001     .9429284    3.677409
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.4731846   .7223794    -0.66   0.514    -1.903819    .9574501
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3631688   .7907777     0.46   0.647    -1.202925    1.929263
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1388711   .3945461    -0.35   0.725     -.920249    .6425068
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.294119   .8257604     2.78   0.006     .6587444    3.929495
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.664264    1.45235     1.83   0.069     -.212039    5.540566
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4670932   .3853514     1.21   0.228    -.2960749    1.230261
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.768158   1.387001     1.27   0.205    -.9787249    4.515041
------------------------------------------------------------------------------

.
```

```
. **Model 6.11 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop lnwage lngdp
lntradefree lneconfree lntransition ln
> ictinfra indprivatisation d1996-d2008 c2-c14 s2-s13, fe
note: lntop omitted because of collinearity
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1190
Group variable: id                              Number of groups   =       118

R-sq:  within  = 0.2873                         Obs per group: min =         1
       between = 0.8249                                        avg =      10.1
       overall = 0.5735                                        max =        13

                                                F(22,1050)         =     19.24
corr(u_i, Xb)  = 0.5084                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .193157   .0307219     6.29   0.000     .1328738    .2534403
             |
    lnsecedu |  -.5961464   1.580211    -0.38   0.706    -3.696876    2.504584
   lntertedu |  -.3948972    .758344    -0.52   0.603    -1.882939    1.093145
       lntop |  (omitted)
      lnwage |  -.5827412   .8469517    -0.69   0.492    -2.244652    1.079169
       lngdp |   .5104846    .779508     0.65   0.513    -1.019086    2.040055
 lntradefree |  -.0199811   .6512587    -0.03   0.976    -1.297898    1.257936
  lneconfree |   1.436007   .9727928     1.48   0.140    -.4728324    3.344846
lntransition |   2.323538   3.052363     0.76   0.447    -3.665887    8.312963
  lnictinfra |   .4880843   .4237924     1.15   0.250    -.3434921    1.319661
indprivati~n |   1.398859   .3276367     4.27   0.000      .755962    2.041756
       d1996 |  (omitted)
       d1997 |   .0184732   .3497666     0.05   0.958    -.6678479    .7047943
       d1998 |   .0848514   .4026112     0.21   0.833    -.7051628    .8748656
       d1999 |   .1664835   .4485618     0.37   0.711    -.7136961    1.046663
       d2000 |  -.2317374   .5087994    -0.46   0.649    -1.230117    .7666419
       d2001 |  -.0122579   .5888631    -0.02   0.983     -1.16774    1.143224
       d2002 |   .1894574   .6507777     0.29   0.771    -1.087515     1.46643
       d2003 |    .267036   .7069018     0.38   0.706    -1.120065    1.654137
       d2004 |   .5404895   .7734003     0.70   0.485    -.9770965    2.058076
       d2005 |   .6194095   .8517466     0.73   0.467     -1.05191    2.290729
       d2006 |   .5497161   .9185275     0.60   0.550    -1.252642    2.352074
       d2007 |   .5786153   1.018494     0.57   0.570    -1.419899     2.57713
       d2008 |   .8586361   1.105387     0.78   0.437    -1.310382    3.027654
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
```

```
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |   -13.0252   16.02303    -0.81   0.416      -44.466    18.41559
-------------+----------------------------------------------------------------
     sigma_u |  1.4805195
     sigma_e |  1.2593186
         rho |  .58021217   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(117, 1050) =     1.97           Prob > F = 0.0000

.
```

```
. **Model 6.11 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop lnwage lngdp lntradefree
lneconfree lntransition lnic
> tinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: d2008 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1190
-------------+------------------------------           F( 43,  1146) =   70.98
       Model |  5408.44026    43  125.77768           Prob > F      =  0.0000
    Residual |  2030.60261  1146  1.77190454           R-squared     =  0.7270
-------------+------------------------------           Adj R-squared =  0.7168
       Total |  7439.04286  1189  6.25655413           Root MSE      =  1.3311

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4553395   .0264225    17.23   0.000     .4034975    .5071814
             |
    lnsecedu |  -.8482964   1.667813    -0.51   0.611    -4.120607    2.424014
   lntertedu |  -.2664939   .8003897    -0.33   0.739    -1.836887      1.3039
       lntop |   .3136591   1.128134     0.28   0.781    -1.899781      2.5271
      lnwage |  -.6756286   .8930867    -0.76   0.449    -2.427897     1.07664
       lngdp |    .624709    .818834     0.76   0.446    -.9818729    2.231291
 lntradefree |  -.1647189   .6869072    -0.24   0.811    -1.512456    1.183018
  lneconfree |   .6953723   1.026627     0.68   0.498    -1.318907    2.709652
lntransition |   2.031659   3.224724     0.63   0.529    -4.295366    8.358685
  lnictinfra |   .2866624   .4476191     0.64   0.522    -.5915826    1.164907
indprivati~n |   1.845784   .3307288     5.58   0.000     1.196882    2.494686
       d1996 |  -.8688525   1.167694    -0.74   0.457    -3.159911    1.422206
       d1997 |  -.7394278   1.048316    -0.71   0.481    -2.796262    1.317406
       d1998 |  -.6802325   .9432236    -0.72   0.471    -2.530871    1.170406
       d1999 |  -.6125039   .8800233    -0.70   0.487    -2.339141    1.114134
       d2000 |  -1.026664   .8395791    -1.22   0.222    -2.673948    .6206207
       d2001 |  -.6557408   .7716987    -0.85   0.396    -2.169842    .8583601
       d2002 |  -.5263284   .6750865    -0.78   0.436    -1.850872    .7982156
       d2003 |  -.5156825   .5568241    -0.93   0.355    -1.608192    .5768265
       d2004 |  -.2574877   .4721513    -0.55   0.586    -1.183866    .6688903
       d2005 |  -.2449832    .396573    -0.62   0.537    -1.023074    .5331074
       d2006 |  -.3215086   .3281966    -0.98   0.327    -.9654423    .3224251
       d2007 |   -.290166   .2302025    -1.26   0.208    -.7418316    .1614996
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |   1.160913   2.297914     0.51   0.614    -3.347676    5.669503
          c6 |   1.079568   2.919758     0.37   0.712    -4.649103    6.808239
          c7 |   1.165673   1.734713     0.67   0.502    -2.237896    4.569243
          c8 |   .5394276   1.731556     0.31   0.755    -2.857948    3.936803
          c9 |   1.158936   1.485655     0.78   0.436    -1.755972    4.073844
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |   .9746285   1.157894     0.84   0.400    -1.297201    3.246458
         c13 |   .7749077   1.726931     0.45   0.654    -2.613394    4.163209
         c14 |   1.057091   1.647483     0.64   0.521    -2.175331    4.289512
          s2 |  -.7770235   .1950266    -3.98   0.000    -1.159673   -.3943743
          s3 |  -2.307871   .2316629    -9.96   0.000    -2.762402    -1.85334
          s4 |  -.1664077   .1957271    -0.85   0.395    -.5504313    .2176159
          s5 |  -1.849678   .2333013    -7.93   0.000    -2.307424   -1.391933
          s6 |  -.2609348   .1915905    -1.36   0.173    -.6368423    .1149728
          s7 |  -.6039828   .1944849    -3.11   0.002    -.9855691   -.2223964
          s8 |  -.2568096   .1961128    -1.31   0.191      -.64159    .1279707
          s9 |  -.4184957   .1899437    -2.20   0.028     -.791172   -.0458194
         s10 |  -.6799648    .193197    -3.52   0.000    -1.059024   -.3009053
         s11 |  -.3733324   .1899565    -1.97   0.050     -.746034   -.0006308
         s12 |  -.2659208   .1892543    -1.41   0.160    -.6372446    .1054029
         s13 |  -1.352761   .2078075    -6.51   0.000    -1.760486   -.9450348
       _cons |  -9.357895   19.72994    -0.47   0.635    -48.06876    29.35297
------------------------------------------------------------------------------
```

Appendix 6.16: Model 6.12 results

```
. **Model 6.12 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive medium high
lncognitivemed lncognitivehigh
>  lnwage lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation
d1996-d2008 c2-c14 s2-s13, gmm(l.l
> nindfdistock, laglimit(1 2) collapse) iv(lnsecedu lntertedu lncognitive  medium
high lncognitivemed lncognitiveh
> igh lnwage lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation
d1996-d2008 c2-c14 s2-s13) two
> robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
s9 dropped due to collinearity
s12 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1190
Time variable : year                            Number of groups   =       118
Number of instruments = 48                      Obs per group: min =         1
F(45, 117)    =     87.85                                      avg =     10.08
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2740962   .1376079     1.99   0.049      .001571    .5466214
             |
    lnsecedu |  -.6185799   1.052515    -0.59   0.558    -2.703031    1.465871
   lntertedu |  -1.146813   .8958742    -1.28   0.203    -2.921045    .6274184
 lncognitive |   7.105769   3.727214     1.91   0.059    -.2757837    14.48732
      medium |  -4.393903   3.517494    -1.25   0.214    -11.36012    2.572311
        high |  -9.843935   3.941758    -2.50   0.014    -17.65038   -2.037489
lncognitiv~d |   2.427065   2.193241     1.11   0.271    -1.916533    6.770663
lncognitiv~h |   5.928285   2.452042     2.42   0.017     1.072144    10.78443
      lnwage |  -.3508278   .4964165    -0.71   0.481    -1.333955    .6322991
       lngdp |   .2701066   .5623839     0.48   0.632    -.8436652    1.383878
 lntradefree |  -.1003206    .277724    -0.36   0.719    -.6503384    .4496971
  lneconfree |   1.667732   .6407266     2.60   0.010      .398806    2.936657
lntransition |   1.922088   1.117154     1.72   0.088    -.2903764    4.134552
  lnictinfra |   .3415843   .2527238     1.35   0.179    -.1589219    .8420905
indprivati~n |   1.274273   .8507842     1.50   0.137    -.4106609    2.959206
       d1996 |  -1.127069   .8241885    -1.37   0.174    -2.759331    .5051932
       d1997 |  -1.136049   .7957171    -1.43   0.156    -2.711925     .439827
       d1998 |  -1.065003   .7450535    -1.43   0.156    -2.540542    .4105367
       d1999 |  -.9486019   .6830488    -1.39   0.168    -2.301344    .4041405
       d2000 |  -1.205569    .557278    -2.16   0.033    -2.309228   -.1019087
       d2001 |  -.9385927   .5466196    -1.72   0.089    -2.021144    .1439588
       d2002 |  -.8267224   .4700724    -1.76   0.081    -1.757676    .1042315
       d2003 |  -.7515406   .4670339    -1.61   0.110    -1.676477    .1733956
       d2004 |  -.3754701   .2852928    -1.32   0.191    -.9404775    .1895374
       d2005 |  -.2906699   .2040867    -1.42   0.157    -.6948529    .1135131
       d2006 |  -.3145917    .153965    -2.04   0.043    -.6195113   -.0096722
       d2007 |  -.1037174   .1060224    -0.98   0.330    -.3136892    .1062543
          c5 |   .5516408   1.394756     0.40   0.693    -2.210599    3.313881
          c6 |  -.2282548    1.06118    -0.22   0.830    -2.329867    1.873357
          c7 |    1.25241   1.289792     0.97   0.334    -1.301956    3.806777
          c8 |  -.4371925   .6823942    -0.64   0.523    -1.788638    .9142535
          c9 |   .4984923   1.007512     0.49   0.622    -1.496831    2.493816
         c11 |   .8848306   1.475147     0.60   0.550    -2.036621    3.806282
         c12 |   1.550041   1.373342     1.13   0.261     -1.16979    4.269873
         c13 |   .0898292   .6553447     0.14   0.891    -1.208047    1.387705
```

```
          s2 |  -1.026616   .3407383    -3.01   0.003     -1.70143   -.3518015
          s3 |  -3.066186   .8668811    -3.54   0.001    -4.782999   -1.349374
          s4 |  -.2424927   .2483548    -0.98   0.331    -.7343465     .249361
          s5 |  -1.902161   .6082298    -3.13   0.002    -3.106728   -.6975938
          s6 |   .0489277   .2395554     0.20   0.839    -.4254992    .5233546
          s7 |  -.3198982   .2225223    -1.44   0.153    -.7605921    .1207956
          s8 |   .1547029   .1843405     0.84   0.403    -.2103739    .5197796
         s10 |  -.5604123   .2771262    -2.02   0.045    -1.109246   -.0115783
         s11 |  -.1420308   .2413577    -0.59   0.557     -.620027    .3359655
         s13 |  -1.721273   .4476254    -3.85   0.000    -2.607771   -.8347738
       _cons |  -16.65516   11.12534    -1.50   0.137    -38.68832    5.377996
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lncognitive medium high lncognitivemed
    lncognitivehigh lnwage lngdp lntradefree lneconfree lntransition
    lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002
    d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12
    c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lncognitive medium high lncognitivemed lncognitivehigh
    lnwage lngdp lntradefree lneconfree lntransition lnictinfra
    indprivatisation d1996 d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004
    d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3
    s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.03  Pr > z =  0.043
Arellano-Bond test for AR(2) in first differences: z =  -1.18  Pr > z =  0.239
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   5.00  Prob > chi2 =  0.082
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.09  Prob > chi2 =  0.581
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.62  Prob > chi2 =  0.432
    Difference (null H = exogenous): chi2(1)    =   0.47  Prob > chi2 =  0.494

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.8521514   1.474776    -0.58   0.564    -3.772868    2.068565
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.579842   1.026869    -1.54   0.127    -3.613502    .4538177
------------------------------------------------------------------------------

. nlcom _b[lncognitive]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lncognitive]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   9.788858   4.250107     2.30   0.023     1.371744    18.20597
------------------------------------------------------------------------------

. nlcom _b[medium]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[medium]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -6.05301   4.610773    -1.31   0.192     -15.1844    3.078385
------------------------------------------------------------------------------

. nlcom _b[high]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[high]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -13.56094   4.586779    -2.96   0.004    -22.64481    -4.47706
------------------------------------------------------------------------------

. nlcom _b[lncognitivemed]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lncognitivemed]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   3.343508    2.89519     1.15   0.251    -2.390263    9.077279
------------------------------------------------------------------------------

. nlcom _b[lncognitivehigh]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lncognitivehigh]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   8.166764    2.87414     2.84   0.005     2.474681    13.85885
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])
```

```
------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -.483298   .7220237    -0.67   0.505    -1.913228    .9466321
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3720969   .7927868     0.47   0.640    -1.197976     1.94217
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -.138201   .3950025    -0.35   0.727    -.9204828    .6440808
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.297455   .8284946     2.77   0.006     .6566652    3.938246
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.647855    1.45707     1.82   0.072    -.2377953    5.533505
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4705642   .3852191     1.22   0.224     -.292342     1.23347
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.755429   1.388093     1.26   0.209    -.9936154    4.504474
------------------------------------------------------------------------------

.
```

```
. **Model 6.12 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive medium high
lncognitivemed lncognitivehigh ln
> wage lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-
d2008 c2-c14 s2-s13, fe
note: lncognitive omitted because of collinearity
note: medium omitted because of collinearity
note: high omitted because of collinearity
note: lncognitivemed omitted because of collinearity
note: lncognitivehigh omitted because of collinearity
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1190
Group variable: id                              Number of groups   =       118

R-sq:  within  = 0.2873                         Obs per group: min =         1
       between = 0.8249                                        avg =      10.1
       overall = 0.5735                                        max =        13

                                                F(22,1050)         =     19.24
corr(u_i, Xb)  = 0.5084                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .193157   .0307219     6.29   0.000     .1328738    .2534403
             |
    lnsecedu |  -.5961464   1.580211    -0.38   0.706    -3.696876    2.504584
   lntertedu |  -.3948972    .758344    -0.52   0.603    -1.882939    1.093145
 lncognitive |  (omitted)
      medium |  (omitted)
        high |  (omitted)
lncognitiv~d |  (omitted)
lncognitiv~h |  (omitted)
      lnwage |  -.5827412   .8469517    -0.69   0.492    -2.244652    1.079169
       lngdp |   .5104846    .779508     0.65   0.513    -1.019086    2.040055
 lntradefree |  -.0199811   .6512587    -0.03   0.976    -1.297898    1.257936
  lneconfree |   1.436007   .9727928     1.48   0.140    -.4728324    3.344846
lntransition |   2.323538   3.052363     0.76   0.447    -3.665887    8.312963
  lnictinfra |   .4880843   .4237924     1.15   0.250    -.3434921    1.319661
indprivati~n |   1.398859   .3276367     4.27   0.000      .755962    2.041756
       d1996 |  (omitted)
       d1997 |   .0184732   .3497666     0.05   0.958    -.6678479    .7047943
       d1998 |   .0848514   .4026112     0.21   0.833    -.7051628    .8748656
       d1999 |   .1664835   .4485618     0.37   0.711    -.7136961    1.046663
       d2000 |  -.2317374   .5087994    -0.46   0.649    -1.230117    .7666419
       d2001 |  -.0122579   .5888631    -0.02   0.983     -1.16774    1.143224
       d2002 |   .1894574   .6507777     0.29   0.771    -1.087515     1.46643
       d2003 |    .267036   .7069018     0.38   0.706    -1.120065    1.654137
       d2004 |   .5404895   .7734003     0.70   0.485    -.9770965    2.058076
       d2005 |   .6194095   .8517466     0.73   0.467     -1.05191    2.290729
```

```
       d2006 |   .5497161   .9185275     0.60   0.550    -1.252642    2.352074
       d2007 |   .5786153   1.018494     0.57   0.570    -1.419899     2.57713
       d2008 |   .8586361   1.105387     0.78   0.437    -1.310382    3.027654
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |   -13.0252   16.02303    -0.81   0.416      -44.466    18.41559
-------------+----------------------------------------------------------------
     sigma_u |  1.4805195
     sigma_e |  1.2593186
         rho |  .58021217   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(117, 1050) =     1.92           Prob > F = 0.0000

.
```

```
. **Model 6.12 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive medium high
lncognitivemed lncognitivehigh lnwa
> ge lngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-
d2008 c2-c14 s2-s13
note: lncognitive omitted because of collinearity
note: medium omitted because of collinearity
note: c4 omitted because of collinearity
note: c10 omitted because of collinearity
note: s10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1190
-------------+------------------------------           F( 45,  1144) =   68.14
       Model |  5417.70408    45  120.393424           Prob > F      =  0.0000
    Residual |  2021.33878  1144  1.76690453           R-squared     =  0.7283
-------------+------------------------------           Adj R-squared =  0.7176
       Total |  7439.04286  1189  6.25655413           Root MSE      =  1.3292

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4472093   .0266232    16.80   0.000     .3949736     .499445
             |
    lnsecedu |  -.8417746   1.665477    -0.51   0.613    -4.109507    2.425958
   lntertedu |  -.2712395   .7992626    -0.34   0.734    -1.839425    1.296946
 lncognitive |  (omitted)
      medium |  (omitted)
        high |  -7.734266   3.087944    -2.50   0.012    -13.79294   -1.675596
lncognitiv~d |   1.940997   1.952861     0.99   0.320    -1.890594    5.772589
lncognitiv~h |    4.41077   1.926957     2.29   0.022     .6300038    8.191536
      lnwage |  -.6772831   .8918312    -0.76   0.448    -2.427091    1.072525
       lngdp |   .6331922   .8176863     0.77   0.439    -.9711409    2.237525
 lntradefree |  -.1633381   .6859588    -0.24   0.812    -1.509217     1.18254
  lneconfree |   .7112104   1.025201     0.69   0.488    -1.300275    2.722696
lntransition |    2.02372   3.220173     0.63   0.530    -4.294388    8.341828
  lnictinfra |   .2932105   .4469963     0.66   0.512     -.583814    1.170235
indprivati~n |   1.816172   .3305208     5.49   0.000     1.167677    2.464667
       d1996 |    -.86738   1.166047    -0.74   0.457    -3.155211    1.420451
       d1997 |  -.7379134   1.046836    -0.70   0.481    -2.791848    1.316021
       d1998 |  -.6781001   .9418927    -0.72   0.472    -2.526131    1.169931
       d1999 |  -.6090569   .8787825    -0.69   0.488    -2.333263    1.115149
       d2000 |   -1.02247   .8383968    -1.22   0.223    -2.667438    .6224982
       d2001 |  -.6561624   .7706106    -0.85   0.395    -2.168131    .8558063
       d2002 |  -.5251843   .6741347    -0.78   0.436    -1.847863    .7974948
       d2003 |   -.514148   .5560385    -0.92   0.355    -1.605118    .5768218
       d2004 |  -.2560552   .4714853    -0.54   0.587    -1.181128    .6690176
       d2005 |  -.2416745   .3960171    -0.61   0.542    -1.018676    .5353268
       d2006 |  -.3183027    .327738    -0.97   0.332    -.9613376    .3247323
       d2007 |   -.288655   .2298796    -1.26   0.209    -.7396879    .1623778
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |   1.351072   1.873072     0.72   0.471    -2.323969    5.026114
          c6 |   1.159314   1.660048     0.70   0.485    -2.097765    4.416394
          c7 |   1.333946   1.647505     0.81   0.418    -1.898523    4.566416
          c8 |   .5653086   1.079234     0.52   0.601    -1.552192    2.682809
          c9 |   1.035051   1.357203     0.76   0.446    -1.627835    3.697937
         c10 |  (omitted)
         c11 |   .2471034   2.296415     0.11   0.914    -4.258555    4.752761
         c12 |    1.09896   1.775168     0.62   0.536    -2.383991    4.581911
         c13 |   .9625966   1.178752     0.82   0.414    -1.350162    3.275355
         c14 |   1.078748   1.469038     0.73   0.463    -1.803563    3.961059
          s2 |  -.7807437   .1947639    -4.01   0.000    -1.162878   -.3986091
          s3 |  -2.324189   .2314764   -10.04   0.000    -2.778355   -1.870023
          s4 |  -.1649878   .1954564    -0.84   0.399    -.5484812    .2185055
          s5 |  -4.967644   3.140565    -1.58   0.114    -11.12956    1.194271
          s6 |   .4327556   .1938232     2.23   0.026     .0524667    .8130444
          s7 |  -3.707247   3.124558    -1.19   0.236    -9.837755    2.423261
          s8 |  -3.353586   3.120582    -1.07   0.283    -9.476293    2.769121
          s9 |  -3.516236   3.118283    -1.13   0.260    -9.634433     2.60196
         s10 |  (omitted)
         s11 |   .3251242    .189685     1.71   0.087    -.0470454    .6972938
         s12 |   .4344696    .190237     2.28   0.023     .0612171    .8077222
         s13 |  -1.369156    .207641    -6.59   0.000    -1.776556   -.9617558
       _cons |  -10.53859   16.58337    -0.64   0.525    -43.07582    21.99864
```

Appendix 6.17: Model 6.13 results

```
. **Model 6.13 System GMM
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop medium high
lntopmed lntophigh lnwage lngdp lntr
> adefree lneconfree lntransition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-
s13, gmm(l.lnindfdistock, lagl
> imit(1 2) collapse) iv(lnsecedu lntertedu lntop  medium high lntopmed lntophigh
lnwage lngdp lntradefree lneconf
> ree lntransition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13) two robust
small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
s9 dropped due to collinearity
s12 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1190
Time variable : year                            Number of groups   =       118
Number of instruments = 48                      Obs per group: min =         1
F(45, 117)    =     94.09                                      avg =     10.08
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2747524   .1374544     2.00   0.048     .0025313    .5469736
             |
    lnsecedu |  -.6192496   1.055669    -0.59   0.559    -2.709946    1.471447
   lntertedu |  -1.140739   .8949205    -1.27   0.205    -2.913082    .6316046
       lntop |   1.353072   .6591961     2.05   0.042      .047569    2.658576
      medium |   .8872834   .6441342     1.38   0.171    -.3883906    2.162957
        high |   1.375217   .6848358     2.01   0.047     .0189352    2.731498
    lntopmed |   .5341413   .2488251     2.15   0.034     .0413563    1.026926
   lntophigh |   .6702641    .255963     2.62   0.010     .1633428    1.177185
      lnwage |  -.3520658   .4958906    -0.71   0.479    -1.334151    .6300196
       lngdp |   .2718977   .5630781     0.48   0.630     -.843249    1.387044
 lntradefree |  -.1041962   .2782747    -0.37   0.709    -.6553047    .4469124
  lneconfree |   1.665476   .6426724     2.59   0.011     .3926971    2.938255
lntransition |   1.915387   1.115326     1.72   0.089    -.2934581    4.124232
  lnictinfra |   .3414675   .2524592     1.35   0.179    -.1585148    .8414497
indprivati~n |   1.263367   .8569906     1.47   0.143    -.4338579    2.960592
       d1996 |  -1.124484   .8256096    -1.36   0.176    -2.759561    .5105924
       d1997 |  -1.135456   .7974377    -1.42   0.157     -2.71474    .4438272
       d1998 |  -1.063377   .7471081    -1.42   0.157    -2.542985    .4162317
       d1999 |  -.9468323   .6850767    -1.38   0.170    -2.303591    .4099262
       d2000 |  -1.203742   .5584418    -2.16   0.033    -2.309707   -.0977776
       d2001 |  -.9372839    .548921    -1.71   0.090    -2.024393    .1498253
       d2002 |  -.8249611   .4717734    -1.75   0.083    -1.759284    .1093614
       d2003 |  -.7502088   .4677077    -1.60   0.111    -1.676479    .1760619
       d2004 |  -.3745764   .2860981    -1.31   0.193    -.9411787    .1920259
       d2005 |  -.2901108   .2048857    -1.42   0.159    -.6958763    .1156546
       d2006 |  -.3140316   .1546016    -2.03   0.044    -.6202121   -.0078512
       d2007 |  -.1028822    .105242    -0.98   0.330    -.3113084    .1055441
          c5 |  -.4176129   1.442499    -0.29   0.773    -3.274407    2.439181
          c6 |  -.6082816   1.093475    -0.56   0.579    -2.773851    1.557288
          c7 |   .4498709   1.210034     0.37   0.711    -1.946538     2.84628
          c8 |   -.469632    .683442    -0.69   0.493    -1.823153    .8838891
          c9 |   1.292147   1.095302     1.18   0.241      -.87704    3.461335
         c11 |  -.2930605    1.30604    -0.22   0.823    -2.879605    2.293484
         c12 |   1.148692   1.320234     0.87   0.386    -1.465962    3.763347
         c13 |  -.8446192   .7944675    -1.06   0.290     -2.41802    .7287821
          s2 |  -1.027942   .3222811    -3.19   0.002    -1.666203   -.3896815
```

```
          s3 |  -3.091186    .879531    -3.51   0.001    -4.833051    -1.34932
          s4 |  -.2699002   .2437889    -1.11   0.271    -.7527113    .2129108
          s5 |  -1.949007   .6034988    -3.23   0.002    -3.144205   -.7538089
          s6 |   .0554885   .2407395     0.23   0.818    -.4212835    .5322605
          s7 |  -.3246613   .2146717    -1.51   0.133    -.7498074    .1004848
          s8 |   .1555045   .1753087     0.89   0.377    -.1916852    .5026942
         s10 |  -.5523456   .2634429    -2.10   0.038     -1.07408   -.0306108
         s11 |  -.1409758   .2355489    -0.60   0.551    -.6074681    .3255164
         s13 |  -1.759596   .4560392    -3.86   0.000    -2.662757   -.8564338
       _cons |  -1.359993   12.58258    -0.11   0.914    -26.27914    23.55915
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lntop medium high lntopmed lntophigh lnwage lngdp
    lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lntop medium high lntopmed lntophigh lnwage lngdp
    lntradefree lneconfree lntransition lnictinfra indprivatisation d1996
    d1997 d1998 d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2
    c3 c4 c5 c6 c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11
    s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.02  Pr > z =  0.043
Arellano-Bond test for AR(2) in first differences: z =  -1.17  Pr > z =  0.240
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   5.07  Prob > chi2 =  0.079
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.08  Prob > chi2 =  0.581
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.61  Prob > chi2 =  0.433
    Difference (null H = exogenous): chi2(1)    =   0.47  Prob > chi2 =  0.493

.
```

```
. **Calculating long-run coefficients
. nlcom _b[lnsecedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnsecedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.8538458   1.480284    -0.58   0.565    -3.785471     2.07778
------------------------------------------------------------------------------

. nlcom _b[lntertedu]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntertedu]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -1.572895   1.027491    -1.53   0.129    -3.607787    .4619965
------------------------------------------------------------------------------

. nlcom _b[lntop]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntop]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    1.86567   .7219291     2.58   0.011     .4359268    3.295412
------------------------------------------------------------------------------

. nlcom _b[medium]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[medium]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.223421   .8327944     1.47   0.145    -.4258842    2.872727
------------------------------------------------------------------------------

. nlcom _b[high]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[high]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   1.896203   .8525542     2.22   0.028     .2077639    3.584642
------------------------------------------------------------------------------

. nlcom _b[lntopmed]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntopmed]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .7364951   .3042183     2.42   0.017     .1340067    1.338984
------------------------------------------------------------------------------

. nlcom _b[lntophigh]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntophigh]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .9241866   .3008574     3.07   0.003     .3283544    1.520019
------------------------------------------------------------------------------

. nlcom _b[lnwage]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnwage]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
```

```
-------------+----------------------------------------------------------------
        _nl_1 |  -.4854422   .7216971    -0.67   0.503    -1.914725    .9438411
------------------------------------------------------------------------------

. nlcom _b[lngdp]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lngdp]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3749033   .7945243     0.47   0.638     -1.19861    1.948417
------------------------------------------------------------------------------

. nlcom _b[lntradefree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntradefree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.1436698    .396652    -0.36   0.718    -.9292183    .6418788
------------------------------------------------------------------------------

. nlcom _b[lneconfree]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lneconfree]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.296424   .8298805     2.77   0.007     .6528895    3.939959
------------------------------------------------------------------------------

. nlcom _b[lntransition]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lntransition]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   2.641011   1.458867     1.81   0.073    -.2481989    5.530221
------------------------------------------------------------------------------

. nlcom _b[lnictinfra]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[lnictinfra]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .4708289   .3849539     1.22   0.224    -.2915522     1.23321
------------------------------------------------------------------------------

. nlcom _b[indprivatisation]/(1-_b[l.lnindfdistock])

       _nl_1:  _b[indprivatisation]/(1-_b[l.lnindfdistock])

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    1.74198   1.396775     1.25   0.215    -1.024259     4.50822
------------------------------------------------------------------------------

.
```

```
. **Model 6.13 FE
. xtreg lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop medium high
lncognitivemed lncognitivehigh lnwage l
> ngdp lntradefree lneconfree lntransition lnictinfra indprivatisation d1996-d2008
c2-c14 s2-s13, fe
note: lntop omitted because of collinearity
note: medium omitted because of collinearity
note: high omitted because of collinearity
note: lncognitivemed omitted because of collinearity
note: lncognitivehigh omitted because of collinearity
note: d1996 omitted because of collinearity
note: c2 omitted because of collinearity
note: c3 omitted because of collinearity
note: c4 omitted because of collinearity
note: c5 omitted because of collinearity
note: c6 omitted because of collinearity
note: c7 omitted because of collinearity
note: c8 omitted because of collinearity
note: c9 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: c12 omitted because of collinearity
note: c13 omitted because of collinearity
note: c14 omitted because of collinearity
note: s2 omitted because of collinearity
note: s3 omitted because of collinearity
note: s4 omitted because of collinearity
note: s5 omitted because of collinearity
note: s6 omitted because of collinearity
note: s7 omitted because of collinearity
note: s8 omitted because of collinearity
note: s9 omitted because of collinearity
note: s10 omitted because of collinearity
note: s11 omitted because of collinearity
note: s12 omitted because of collinearity
note: s13 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =      1190
Group variable: id                              Number of groups   =       118

R-sq:  within  = 0.2873                         Obs per group: min =         1
       between = 0.8249                                        avg =      10.1
       overall = 0.5735                                        max =        13

                                                F(22,1050)         =     19.24
corr(u_i, Xb)  = 0.5084                         Prob > F           =    0.0000

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |    .193157   .0307219     6.29   0.000     .1328738    .2534403
             |
    lnsecedu |  -.5961464   1.580211    -0.38   0.706    -3.696876    2.504584
   lntertedu |  -.3948972    .758344    -0.52   0.603    -1.882939    1.093145
       lntop |  (omitted)
      medium |  (omitted)
        high |  (omitted)
lncognitiv~d |  (omitted)
lncognitiv~h |  (omitted)
      lnwage |  -.5827412   .8469517    -0.69   0.492    -2.244652    1.079169
       lngdp |   .5104846    .779508     0.65   0.513    -1.019086    2.040055
 lntradefree |  -.0199811   .6512587    -0.03   0.976    -1.297898    1.257936
  lneconfree |   1.436007   .9727928     1.48   0.140    -.4728324    3.344846
lntransition |   2.323538   3.052363     0.76   0.447    -3.665887    8.312963
  lnictinfra |   .4880843   .4237924     1.15   0.250    -.3434921    1.319661
indprivati~n |   1.398859   .3276367     4.27   0.000      .755962    2.041756
       d1996 |  (omitted)
       d1997 |   .0184732   .3497666     0.05   0.958    -.6678479    .7047943
       d1998 |   .0848514   .4026112     0.21   0.833    -.7051628    .8748656
       d1999 |   .1664835   .4485618     0.37   0.711    -.7136961    1.046663
       d2000 |  -.2317374   .5087994    -0.46   0.649    -1.230117    .7666419
       d2001 |  -.0122579   .5888631    -0.02   0.983     -1.16774    1.143224
       d2002 |   .1894574   .6507777     0.29   0.771    -1.087515     1.46643
       d2003 |    .267036   .7069018     0.38   0.706    -1.120065    1.654137
       d2004 |   .5404895   .7734003     0.70   0.485    -.9770965    2.058076
       d2005 |   .6194095   .8517466     0.73   0.467     -1.05191    2.290729
```

```
       d2006 |   .5497161   .9185275     0.60   0.550    -1.252642    2.352074
       d2007 |   .5786153   1.018494     0.57   0.570    -1.419899     2.57713
       d2008 |   .8586361   1.105387     0.78   0.437    -1.310382    3.027654
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |  (omitted)
          c6 |  (omitted)
          c7 |  (omitted)
          c8 |  (omitted)
          c9 |  (omitted)
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |  (omitted)
         c13 |  (omitted)
         c14 |  (omitted)
          s2 |  (omitted)
          s3 |  (omitted)
          s4 |  (omitted)
          s5 |  (omitted)
          s6 |  (omitted)
          s7 |  (omitted)
          s8 |  (omitted)
          s9 |  (omitted)
         s10 |  (omitted)
         s11 |  (omitted)
         s12 |  (omitted)
         s13 |  (omitted)
       _cons |   -13.0252   16.02303    -0.81   0.416      -44.466    18.41559
-------------+----------------------------------------------------------------
     sigma_u |  1.4805195
     sigma_e |  1.2593186
         rho |  .58021217   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(117, 1050) =     1.92           Prob > F = 0.0000

.
```

```
. **Model 6.13 OLS
. reg lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop medium high
lncognitivemed lncognitivehigh lnwage lngdp lntradefree lneconfree lntransition
lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13
note: medium omitted because of collinearity
note: d2008 omitted because of collinearity
note: c10 omitted because of collinearity
note: c11 omitted because of collinearity
note: s10 omitted because of collinearity

      Source |       SS       df       MS              Number of obs =    1190
-------------+------------------------------           F( 45,  1144) =   68.14
       Model |  5417.70408    45  120.393424           Prob > F      =  0.0000
    Residual |  2021.33878  1144  1.76690453           R-squared     =  0.7283
-------------+------------------------------           Adj R-squared =  0.7176
       Total |  7439.04286  1189  6.25655413           Root MSE      =  1.3292

------------------------------------------------------------------------------
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .4472093   .0266232    16.80   0.000     .3949736     .499445
             |
    lnsecedu |  -.8417746   1.665477    -0.51   0.613    -4.109507    2.425958
   lntertedu |  -.2712395   .7992626    -0.34   0.734    -1.839425    1.296946
       lntop |    .121715   1.131139     0.11   0.914    -2.097624    2.341054
      medium |  (omitted)
        high |  -7.734266   3.087944    -2.50   0.012    -13.79294   -1.675596
lncognitiv~d |   1.940997   1.952861     0.99   0.320    -1.890594    5.772589
lncognitiv~h |    4.41077   1.926957     2.29   0.022     .6300038    8.191536
      lnwage |  -.6772831   .8918312    -0.76   0.448    -2.427091    1.072525
       lngdp |   .6331922   .8176863     0.77   0.439    -.9711409    2.237525
 lntradefree |  -.1633381   .6859588    -0.24   0.812    -1.509217     1.18254
  lneconfree |   .7112104   1.025201     0.69   0.488    -1.300275    2.722696
lntransition |    2.02372   3.220173     0.63   0.530    -4.294388    8.341828
  lnictinfra |   .2932105   .4469963     0.66   0.512     -.583814    1.170235
indprivati~n |   1.816172   .3305208     5.49   0.000     1.167677    2.464667
       d1996 |    -.86738   1.166047    -0.74   0.457    -3.155211    1.420451
       d1997 |  -.7379134   1.046836    -0.70   0.481    -2.791848    1.316021
       d1998 |  -.6781001   .9418927    -0.72   0.472    -2.526131    1.169931
       d1999 |  -.6090569   .8787825    -0.69   0.488    -2.333263    1.115149
       d2000 |   -1.02247   .8383968    -1.22   0.223    -2.667438    .6224982
       d2001 |  -.6561624   .7706106    -0.85   0.395    -2.168131    .8558063
       d2002 |  -.5251843   .6741347    -0.78   0.436    -1.847863    .7974948
       d2003 |   -.514148   .5560385    -0.92   0.355    -1.605118    .5768218
       d2004 |  -.2560552   .4714853    -0.54   0.587    -1.181128    .6690176
       d2005 |  -.2416745   .3960171    -0.61   0.542    -1.018676    .5353268
       d2006 |  -.3183027    .327738    -0.97   0.332    -.9613376    .3247323
       d2007 |   -.288655   .2298796    -1.26   0.209    -.7396879    .1623778
       d2008 |  (omitted)
          c2 |  (omitted)
          c3 |  (omitted)
          c4 |  (omitted)
          c5 |   1.078543   2.294967     0.47   0.638    -3.424274    5.581359
          c6 |   .9172318   2.916634     0.31   0.753    -4.805319    6.639783
          c7 |   1.082023   1.732695     0.62   0.532    -2.317594     4.48164
          c8 |   .4013487   1.730444     0.23   0.817    -2.993852    3.796549
          c9 |   .9332671   1.487764     0.63   0.531    -1.985785    3.852319
         c10 |  (omitted)
         c11 |  (omitted)
         c12 |   .9451489   1.156457     0.82   0.414    -1.323865    3.214163
         c13 |   .7004772   1.724836     0.41   0.685    -2.683719    4.084673
         c14 |   .8905846   1.647382     0.54   0.589    -2.341645    4.122814
          s2 |  -.7807437   .1947639    -4.01   0.000    -1.162878   -.3986091
          s3 |  -2.324189   .2314764   -10.04   0.000    -2.778355   -1.870023
          s4 |  -.1649878   .1954564    -0.84   0.399    -.5484812    .2185055
          s5 |  -4.967644   3.140565    -1.58   0.114    -11.12956    1.194271
          s6 |   .4327556   .1938232     2.23   0.026     .0524667    .8130444
          s7 |  -3.707247   3.124558    -1.19   0.236    -9.837755    2.423261
          s8 |  -3.353586   3.120582    -1.07   0.283    -9.476293    2.769121
          s9 |  -3.516236   3.118283    -1.13   0.260    -9.634433     2.60196
         s10 |  (omitted)
         s11 |   .3251242    .189685     1.71   0.087    -.0470454    .6972938
         s12 |   .4344696    .190237     2.28   0.023     .0612171    .8077222
         s13 |  -1.369156    .207641    -6.59   0.000    -1.776556   -.9617558
       _cons |     -10.01   19.70439    -0.51   0.612    -48.67081     28.6508
```

Appendix 6.18: Adding GDP per capita to Models 6.10-6.11

```
. **Model 6.10 System GMM; gdppc added
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lncognitive lngdppc
lnwage lngdp lntradefree lneconfre
> e lntransition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13,
gmm(l.lnindfdistock, laglimit(1 2) collaps
> e) iv(lnsecedu lntertedu lncognitive lnwage lngdp lngdppc lntradefree lneconfree
lntransition lnictinfra indpriv
> atisation d1996-d2008 c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1190
Time variable : year                            Number of groups   =       118
Number of instruments = 47                      Obs per group: min =         1
F(44, 117)     =     87.83                                     avg =     10.08
Prob > F       =     0.000                                     max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2826773   .1358295     2.08   0.040     .0136742    .5516805
             |
    lnsecedu |   -1.03974   1.060562    -0.98   0.329    -3.140126    1.060647
   lntertedu |   -1.02306   .8876349    -1.15   0.251    -2.780975    .7348542
 lncognitive |    12.5763   4.572086     2.75   0.007     3.521526    21.63108
     lngdppc |  -3.062678   1.023764    -2.99   0.003    -5.090188   -1.035168
      lnwage |  -.5801907   .4832202    -1.20   0.232    -1.537183    .3768016
       lngdp |   3.766369   1.161199     3.24   0.002     1.466676    6.066062
 lntradefree |  -.1789883   .2700003    -0.66   0.509    -.7137098    .3557332
  lneconfree |    1.51049   .6259208     2.41   0.017     .2708868    2.750093
lntransition |   2.062604   1.130506     1.82   0.071    -.1763042    4.301512
  lnictinfra |   .3396273   .2500229     1.36   0.177      -.15553    .8347845
indprivati~n |   1.274932   .8536178     1.49   0.138    -.4156129    2.965478
       d1996 |  -1.102014   .8185308    -1.35   0.181    -2.723072     .519043
       d1997 |  -1.046441   .7823572    -1.34   0.184    -2.595858    .5029766
       d1998 |  -.9592046   .7288974    -1.32   0.191    -2.402748    .4843386
       d1999 |  -.8014993   .6641724    -1.21   0.230    -2.116858    .5138593
       d2000 |  -1.058805   .5430723    -1.95   0.054    -2.134332    .0167208
       d2001 |  -.8021465   .5337963    -1.50   0.136    -1.859302     .255009
       d2002 |  -.6835965   .4528925    -1.51   0.134    -1.580526    .2133334
       d2003 |  -.6553299   .4614872    -1.42   0.158    -1.569281    .2586213
       d2004 |  -.2694524   .2737047    -0.98   0.327    -.8115101    .2726054
       d2005 |  -.2059684   .1972161    -1.04   0.298    -.5965445    .1846077
       d2006 |  -.2869199    .154115    -1.86   0.065    -.5921365    .0182968
       d2007 |  -.0981813    .105829    -0.93   0.355    -.3077701    .1114075
          c5 |  -4.704319   2.125326    -2.21   0.029    -8.913415   -.4952219
          c6 |     1.4346   1.260854     1.14   0.258    -1.062456    3.931656
          c7 |  -4.094824   1.683057    -2.43   0.016     -7.42803   -.7616188
          c8 |  -.4661012   .6776927    -0.69   0.493    -1.808236    .8760336
          c9 |  -.8197154   .9414271    -0.87   0.386    -2.684162    1.044732
         c11 |  -9.281254   3.102999    -2.99   0.003    -15.42658   -3.135927
         c12 |  -6.169702   2.405264    -2.57   0.012     -10.9332   -1.406202
         c13 |  -3.157996   1.202051    -2.63   0.010    -5.538596   -.7773959
          s2 |  -1.024433   .3508764    -2.92   0.004    -1.719326    -.329541
          s3 |  -3.058937   .8756762    -3.49   0.001    -4.793167   -1.324706
          s4 |  -.2436914   .2536934    -0.96   0.339     -.746118    .2587351
          s5 |  -2.409922   .6681235    -3.61   0.000    -3.733105   -1.086738
          s6 |  -.3309459   .2230735    -1.48   0.141    -.7727312    .1108395
          s7 |  -.8346848   .2840781    -2.94   0.004    -1.397287    -.272083
          s8 |  -.3674799   .2291647    -1.60   0.112    -.8213285    .0863687
```

```
          s9 |  -.5185608   .2479504    -2.09   0.039    -1.009614    -.027508
         s10 |  -.9252697   .2971595    -3.11   0.002    -1.513779   -.3367608
         s11 |  -.5291376   .2559413    -2.07   0.041    -1.036016   -.0222594
         s12 |  -.3899874   .2800385    -1.39   0.166    -.9445889    .1646141
         s13 |  -1.684515   .4414265    -3.82   0.000    -2.558737   -.8102929
       _cons |  -76.82609   22.79317    -3.37   0.001    -121.9668   -31.68542
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lncognitive lnwage lngdp lngdppc lntradefree
    lneconfree lntransition lnictinfra indprivatisation d1996 d1997 d1998
    d1999 d2000 d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6
    c7 c8 c9 c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lncognitive lnwage lngdp lngdppc lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.05  Pr > z =  0.041
Arellano-Bond test for AR(2) in first differences: z =  -1.15  Pr > z =  0.250
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   5.82  Prob > chi2 =  0.055
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.26  Prob > chi2 =  0.533
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.64  Prob > chi2 =  0.422
    Difference (null H = exogenous): chi2(1)    =   0.62  Prob > chi2 =  0.433

.
.
.
```

```
. **Model 6.11 System GMM; gdppc added
. xtabond2 lnindfdistock l.lnindfdistock lnsecedu lntertedu lntop lngdppc  lnwage
lngdp lntradefree lneconfree lnt
> ransition lnictinfra indprivatisation d1996-d2008 c2-c14 s2-s13,
gmm(l.lnindfdistock, laglimit(1 2) collapse) iv
> (lnsecedu lntertedu lntop lnwage lngdp lngdppc lntradefree lneconfree lntransition
lnictinfra indprivatisation d
> 1996-d2008 c2-c14 s2-s13) two robust small orthog
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
d2008 dropped due to collinearity
c2 dropped due to collinearity
c3 dropped due to collinearity
c4 dropped due to collinearity
c10 dropped due to collinearity
c14 dropped due to collinearity
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      1190
Time variable : year                            Number of groups   =       118
Number of instruments = 47                      Obs per group: min =         1
F(44, 117)    =     87.83                                      avg =     10.08
Prob > F      =     0.000                                      max =        13
------------------------------------------------------------------------------
             |              Corrected
lnindfdist~k |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnindfdist~k |
         L1. |   .2827064   .1358113     2.08   0.040     .0137392    .5516735
             |
    lnsecedu |  -1.039978    1.06058    -0.98   0.329    -3.140402    1.060445
   lntertedu |  -1.022812   .8874795    -1.15   0.251    -2.780419    .7347944
       lntop |     2.2532   .8191878     2.75   0.007     .6308419    3.875559
     lngdppc |  -3.062019     1.0236    -2.99   0.003    -5.089205   -1.034833
      lnwage |  -.5799838   .4831941    -1.20   0.232    -1.536924    .3769568
       lngdp |   3.765335   1.160897     3.24   0.002     1.466239    6.064431
 lntradefree |  -.1790447   .2699853    -0.66   0.509    -.7137365     .355647
  lneconfree |   1.510521   .6259936     2.41   0.017     .2707737    2.750269
lntransition |   2.062467   1.130488     1.82   0.071    -.1764051    4.301338
  lnictinfra |   .3395753   .2500216     1.36   0.177    -.1555794      .83473
indprivati~n |   1.275116   .8534632     1.49   0.138    -.4151233    2.965355
       d1996 |  -1.102221   .8186037    -1.35   0.181    -2.723423    .5189804
       d1997 |  -1.046644   .7824268    -1.34   0.184    -2.596199    .5029116
       d1998 |  -.9593982   .7289661    -1.32   0.191    -2.403077     .484281
       d1999 |  -.8017089    .664245    -1.21   0.230    -2.117211    .5137935
       d2000 |  -1.058963     .54316    -1.95   0.054    -2.134663    .0167368
       d2001 |   -.802337   .5338567    -1.50   0.136    -1.859612    .2549382
       d2002 |  -.6837383   .4529507    -1.51   0.134    -1.580783    .2133068
       d2003 |  -.6554832   .4615597    -1.42   0.158    -1.569578    .2586116
       d2004 |  -.2695419   .2737409    -0.98   0.327    -.8116715    .2725877
       d2005 |  -.2060397    .197243    -1.04   0.298    -.5966692    .1845899
       d2006 |  -.2869638    .154138    -1.86   0.065     -.592226    .0182984
       d2007 |  -.0981683   .1058275    -0.93   0.356    -.3077541    .1114176
          c5 |  -5.977929   2.414348    -2.48   0.015    -10.75942    -1.19644
          c6 |   .9273838   1.226012     0.76   0.451    -1.500669    3.355436
          c7 |  -5.143368   1.873839    -2.74   0.007    -8.854409   -1.432327
          c8 |  -.5060019   .6783128    -0.75   0.457    -1.849365    .8373611
          c9 |   .2288126   .9881429     0.23   0.817    -1.728153    2.185778
         c11 |  -10.74563   3.406038    -3.15   0.002    -17.49111   -4.000148
         c12 |  -6.666898   2.500745    -2.67   0.009    -11.61949   -1.714305
         c13 |  -4.378461   1.533492    -2.86   0.005    -7.415462   -1.341459
          s2 |  -1.024422   .3508728    -2.92   0.004    -1.719307   -.3295366
          s3 |  -3.058751   .8756045    -3.49   0.001     -4.79284   -1.324663
          s4 |  -.2437071   .2537033    -0.96   0.339    -.7461532    .2587389
          s5 |  -2.409998   .6681375    -3.61   0.000    -3.733209   -1.086786
          s6 |  -.3309558   .2230802    -1.48   0.141    -.7727545    .1108429
          s7 |  -.8346567    .284077    -2.94   0.004    -1.397256   -.2720571
          s8 |  -.3675132   .2291768    -1.60   0.111    -.8213859    .0863595
          s9 |  -.5185871   .2479621    -2.09   0.039    -1.009663   -.0275112
         s10 |  -.9252718   .2971667    -3.11   0.002    -1.513795   -.3367487
```

```
         s11 |  -.5291518   .2559487    -2.07   0.041    -1.036045   -.0222588
         s12 |  -.3899766   .2800521    -1.39   0.166    -.9446052    .1646519
         s13 |  -1.684461   .4414049    -3.82   0.000     -2.55864   -.8102816
       _cons |   -50.2829   17.74709    -2.83   0.005    -85.43007   -15.13572
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnsecedu lntertedu lntop lnwage lngdp lngdppc lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/2).L.lnindfdistock collapsed
Instruments for levels equation
  Standard
    _cons
    lnsecedu lntertedu lntop lnwage lngdp lngdppc lntradefree lneconfree
    lntransition lnictinfra indprivatisation d1996 d1997 d1998 d1999 d2000
    d2001 d2002 d2003 d2004 d2005 d2006 d2007 d2008 c2 c3 c4 c5 c6 c7 c8 c9
    c10 c11 c12 c13 c14 s2 s3 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnindfdistock collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.05  Pr > z =  0.041
Arellano-Bond test for AR(2) in first differences: z =  -1.15  Pr > z =  0.250
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   5.82  Prob > chi2 =  0.055
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   1.26  Prob > chi2 =  0.533
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(1)    =   0.64  Prob > chi2 =  0.422
    Difference (null H = exogenous): chi2(1)    =   0.62  Prob > chi2 =  0.433
```