University of Reading

Three essays on FDI, human capital and structural change

Doctor of Philosophy (PhD)

Henley Business School – International Business and Strategy

André Gustavo de Miranda Pineli Alves

August 2019

DECLARATION OF ORIGINAL AUTHORSHIP

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

André Gustavo de Miranda Pineli Alves

ACKNOWLEDGMENTS

Reading has been present in my dreams for the most part of my life. This is fascinating because in my country, Brazil, hardly anybody had ever heard about the town. Reading first appeared to me when I was a teenager. At that time, my dream was to attend the Reading Festival. It was the place to be if you were interested in thrilling new music, but unfortunately that dream never came true. Two decades later, Reading again crossed my path. After joining the largest think tank in Brazil, I started to study outward foreign direct investment from emerging economies and promptly came across the fundamental works of John Dunning, Peter Buckley, Mark Casson and Alan Rugman. It took me a while, however, to discover that they formed what Kiyoshi Kojima labelled *The Reading School* of international business studies. Since then, I decided that, if I would pursue a doctorate in this area, it had to be in Reading.

For this reason, I am very grateful to Professor Rajneesh Narula for accepting me as his PhD student. Over time we discovered plenty of mutual interests and initiated what I expect to be a fruitful partnership in the future. The unifying theme of this Thesis – structural change – emerged from our digressions on the challenges of economic development.

Likewise, I would like to thank my second supervisor, Professor Davide Castellani, whose critical comments were very important to strengthen the empirical parts of the Thesis.

I am also grateful to Professor Rene Belderbos, who co-authored the third chapter of this Thesis. His comments on several drafts were crucial to improve the quality of the final version.

Also, I would like to thank the other members of the programme, including the other Professors, the students and the administrative staff.

I am thankful to my employer, the Institute for Applied Economic Research (IPEA), for granting me a leave to do my PhD studies. I am also grateful for the scholarship awarded by the Capes Foundation.

Finally, I would like to thank my family. I would like to thank my parents Valmir and Beth for instigating me to look for answers to my many questions. I would like to thank my wife Natacha for encouraging me in my bad moments – you know that you changed my life! And I would like to thank my son Bart and my daughter Alicia for just being the way they are. I hope that the time spent in Reading has contributed to make us better persons.

ABSTRACT

Economic development is a complex process in which aggregate output growth is accompanied by changes in the sectoral structures of output and employment. Although scholars like Simon Kuznets and Hollis Chenery have demonstrated, from the late 1950s, the quantitative importance of structural change, the issue remained largely ignored by mainstream economists, who tended to treat structural change as a by-product of growth of lesser importance. However, over the last two decades the interest on the topic has been revigorated, fuelled by concerns about premature deindustrialisation and the viability of alternative routes to prosperity. This Thesis aims to contribute to the growing literature on the causes and consequences of structural change focusing on two issues that are still largely neglected. First, it investigates whether the effect of human capital on aggregate economic growth depends on the type of economic specialisation of the country. Most cross-country studies do not find a significant positive effect of human capital on growth. Failure in taking the demand for skilled labour into account may be the cause. The estimations suggest the existence of a complementarity between human capital endowment and economic specialisation, proxied by the Economic Complexity Index. Second, the Thesis investigates whether foreign direct investment (FDI) contributes to structural change in host economies. Inspired by stages-of-development approaches to FDI such as the Investment Development Path framework, it tests, for a group of developing countries, whether aggregate FDI affects the employment structure, whether the effect depends on the sectoral concentration of FDI and whether this vary according to the stage of development of the country. In a separate chapter, it investigates, using industry-level data of post-communist countries, whether the effect of FDI on productivity growth and structural change depends on institutional quality, human capital endowment, participation in global value chains (GVCs) and alignment to comparative advantage.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

In 1971, Simon Kuznets was awarded the Nobel Prize in Economic Sciences "for his empirically founded interpretation of economic growth which has led to new and deepened insight into the economic and social structure and process of development"[1]. Kuznets was one of the pioneers of the field that came to be known as *development economics*, with the companion of scholars like Paul Rosenstein-Rodan, Ragnar Nurkse, W. Arthur Lewis, Raul Prebisch, Hans Singer, Albert Hirschman, Walt Whitman Rostow, Gunnar Myrdal and Hollis Chenery. In the lecture delivered when receiving the Prize, Kuznets (1973) listed the six defining characteristics of modern economic growth that emerged from his analysis: two related to aggregate rates of economic growth, two related to structural transformation and two related to international spread. The third characteristic cited by Kuznets is that

> the rate of structural transformation of the economy is high. Major aspects of structural change include the shift away from agriculture to non-agricultural pursuits and, recently, away from industry to services; a change in the scale of productive units, and a related shift from personal enterprise to impersonal organization of economic firms, with a corresponding change in the occupational status of labor. Shifts in several other aspects of economic structure could be added (in the structure of consumption, in the relative shares of domestic and foreign suppliers, etc.) (Kuznets, 1973, p.248-249).

In a nutshell, the works of Kuznets (and other development economists) demonstrate that structural change is an unavoidable element of economic development. High rates of economic growth inevitably bring about rapid changes in economic structure due to the differential impact of technological innovations on different productive sectors, the differing income elasticity of domestic demand for different types of goods and services and the changing comparative advantage in foreign trade. Furthermore, structural change entails important implications. Waning economic weight tends to be accompanied by a decline in the political status of certain social groups, which see their power being grabbed by groups associated with the expanding sectors (Kuznets, 1973).

[1] Quote from the Nobel Prize's website. Retrieved from: https://www.nobelprize.org/prizes/economic-sciences/1971/summary

The origins of structural change analysis date back to the 1930s. The first landmark is Fisher's (1939) study on the labour shifts across New Zealand's primary, secondary and tertiary sectors. Using an impressive quantity of cross-national information, Clark (1940) made another great contribution linking changes in employment structure to differential productivity growth across sectors and changes in consumer demand due to rising income levels.

The first empirical study with broad coverage (both in terms of countries and length of time) that addresses the issue of structural change is Kuznets (1957). Despite the strong limitations of the data, which required major efforts to collect from numerous country sources, Kuznets concludes that structural change is an integral part of the process of economic growth: "the shift from agriculture toward higher product per worker sectors did contribute to the growth of national product per capita. In the United States, Sweden, and the Union of South Africa, in all of which growth in income per capita was quite high, the inter-sectoral shifts contributed a quarter, a third, or over a third of the total rise" (Kuznets, 1957, p. 54).

Despite the historical importance of Kuznets' (1957) study, it does not advance any explanation for the cross-country differences uncovered. The first attempt to address the causes of structural change in a cross-country setting is Chenery (1960). Using regression analysis for the period 1950-1955, he confirms Kuznets' previous findings that the share of manufacturing increases, while the share of primary production decreases when countries move from low to higher income levels. Within the manufacturing sector, consumer goods industries are increasingly displaced by investment goods industries as the income level rises. However, he estimates that only a third of industrial growth can be associated to income (demand) growth. The other two thirds are associated with supply factors – more specifically with changes in relative factor costs as income rises.

In the next three decades, the pioneer studies of Kuznets and Chenery were extended in a series of works that benefited from the increasing availability of data, both in terms of length of time and the number of countries covered (Kuznets, 1966; Chenery & Taylor, 1968; Chenery & Syrquin, 1975; Chenery & Syrquin, 1986; Syrquin & Chenery, 1989). Longitudinal data permitted the refinement of conclusions initially drawn from cross-section analyses but the central finding remained largely unaltered, which is the fact that modern economic growth is indissociable from structural change.

Despite the theoretical and practical problems of development raised by the rich empirical evidence collected by such generation of scholars, the issue of structural change remained largely ignored by mainstream economics until recently. The research agenda on economic growth, inspired by the neoclassical paradigm, devoted its efforts to the comprehension of balanced growth typical of industrialised economies. From Harrod (1939) and Domar (1946), passing by Solow (1956) and, more recently, the main endogenous growth models (Romer, 1986; 1990; Lucas, 1988), all the landmark growth models are one-sector models[2]. According to Arena (2017), structural change was neglected by mainstream growth theorists because it seemed incompatible with the balanced growth theory in which they were interested. The problems of the underdeveloped nations, many of which indissociably related to the structure of their economies, were relegated to the development economists, some of which came to be known as structuralists.

Nonetheless, it can be noted a renewed interest in structural change in recent years. Leading this movement, one can find two scholars with considerable influence beyond academic circles: Harvard's Kennedy School professor Dani Rodrik and former World Bank's chief economist Justin Lin. Their works (Lin & Chang, 2009; Lin & Monga, 2011; 2014; Lin, 2012; Rodrik, 2013; 2016; McMillan, Rodrik & Verduzco-Gallo, 2014; McMillan, Rodrik & Sepulveda, 2016) indeed acknowledge structural change as an important feature of economic development. However, as their approaches are constrained by their neoclassical backgrounds, policy recommendations tend to be quite generic, usually of the horizontal-type, instead of policies to "get the prices wrong", that is, policies that distort the incentives to increase the attractiveness of industries with potentially higher impact on long-term aggregate growth (Amsden, 1989).

From a policy perspective, worries about the effects of globalisation, especially the growing evidence of premature deindustrialisation in a number of low- and middle-income countries (Palma, 2005; Dasgupta & Singh, 2006; Tregenna, 2009; 2015; Rodrik, 2016; Felipe, Mehta & Rhee, 2019), has put into question the prospects of following the historical development pattern documented by Fisher (1939), Kuznets (1957) and Chenery (1960)[3]. Leapfrogging the industrialisation phase began to be considered

---

[2] Rigorously speaking, Romer's (1990) model has an R&D sector which provides innovations to the production sector. However, from the structuralist point-of-view, it is still a one-sector model because there is no free move of factors of production between sectors.

[3] The three sector hypothesis postulates that countries follow a systematic sequence in the development of the three broad sectors of the economy. Initially, the primary sector is dominant, both in terms of employment and value added. With the advent of industrialisation, the importance of the primary sector

seriously, as the relative success of the Indian economy in offshored IT services suggested that the services sector could be an alternative route out of the primary sector (Dasgupta & Singh, 2005). Certain services have become more "tradable" and increasingly present some of the characteristics, such as economies of scale and scope and knowledge spillovers, that led Nicholas Kaldor (1966; 1967) to call the manufacturing sector "the engine of growth"[4]. However, this alternative route is not easy. The "modern" services sector is skill-intensive. Historically, low skilled workers underemployed in agriculture have been absorbed by labour intensive manufacturing. If the manufacturing sector shrinks, low skilled workers, including those who had lost jobs in manufacturing, increasingly move to low-productivity services, often in the informal sector, instead of the "modern" services sector, which will probably be underdeveloped, since the (declining) manufacturing sector constitutes one of its main sources of demand (Lavopa & Szirmai, 2012; Tregenna, 2015)[5]. As shown by Szirmai (2012), since 1950 there is no important example of economic success in the developing world that has not been driven by industrialisation. Differences in economic performances across developing nations reflect, to a large extent, differences in the trajectory of manufacturing[6].

In the real world, economic growth does not exist without structural change. Nonetheless, the latter is frequently treated as a by-product of lesser importance of the growth process. The integration of structural change to aggregate economic growth in the analysis of economic development is still in its early days. Most growth models are still one-sector models but a shift can be identified from the late 1990s, when structural change began to be incorporated into mainstream economics literature through multi-sector growth models. The study that inaugurated this new era is Echevarria (1997). Comprehensive surveys of this new literature – as well as the old one – can be found in Kruger (2008), Silva & Teixeira (2008), Herrendorf, Rogerson & Valentinyi (2014),

---

declines. In a later stage, the employment and value added shares of both the primary and the secondary sectors decline and the tertiary sector becomes dominant.

[4] Kaldor (1966, 1967) identifies three empirical regularities now known as *Kaldor's growth laws*. The first law states that industrialisation is the engine of growth: the faster the growth of manufacturing output, the higher the overall growth rate of the economy. This occurs because manufacturing has the strongest input-output linkages, offers greater opportunities for economies of scale, capital accumulation and technological innovation and generate the largest spillovers to other sectors.

[5] In a study focused on advanced nations, Guerrieri & Melanciani (2005) find that competitiveness and specialization in sophisticated producer services is associated with large manufacturing sectors, especially in knowledge intensive industries (electro-electronic and chemical).

[6] Although "premature deindustrialisation" has been documented for a number of countries, especially in Africa and Latin America, for the world at large the evidence of deindustrialisation is much weaker. Indeed, Haraguchi, Cheng & Smeets (2017) show that manufacturing's contribution to the world's GDP has not changed significantly since 1970. What happened is a concentration of manufacturing activities in a few populous countries, especially in China.

Storm (2015), Arena (2017), Gabardo, Pereima & Einloft (2017) and Van Neuss (2019)[7]. However, as stressed by Acemoglu (2009, p.853), "we are far from a satisfactory framework for understanding the process of reallocation of capital and labor across sectors, how this changes at different stages of development, and how it remains consistent with relatively balanced aggregate growth and the Kaldor facts".

1. What is structural change?

The terms structural change and structural transformation are sometimes used as synonyms, but they are not the same thing. In general, structural change refers to the shifts in the sectoral composition of an economy that accompanies the process of (aggregate) economic growth. Industrialisation is, historically, the central process of structural change (Syrquin, 1988). In turn, the term structural transformation is mostly used in reference to multiple processes related to socio-economic development that include structural change but also urbanisation and demographic transition, for example (Acemoglu, 2009). Empirical studies analyse structural change in terms of value added, employment or consumption. Given that different variables may indicate quite different patterns of structural change (Herrendorf, Rogerson & Valentinyi, 2014), the choice of the variable of study should be guided by the questions the researcher wants to address.

Structural change analysis has been historically constrained by the way economic data is collected and published by national statistical offices. Not surprisingly, empirical studies almost always use the traditional three-sector classification or a (more disaggregated) industry classification[8]. However, there is no theoretical reason to remain confined to this type of decomposition of the aggregate economy. One possibility is to decompose aggregate figures according to the skill-intensity of the activity. This is done by Buera, Kaboski & Rogerson (2015), which find that structural change is skill biased in the sense that skill-intensive industries increase their shares in value added as GDP per capita grows. Another promising avenue for future structural change analyses is to

[7] Jorgenson & Timmer (2011), McMillan, Rodrik & Verduzco-Gallo (2014), De Vries *et al.* (2015), De Vries, Timmer & De Vries (2015), Timmer, De Vries & De Vries (2015), Foster-McGregor & Verspagen (2016), Naude, Szirmai & Haraguchi (2016) and Diao, McMillan & Rodrik (2017) are recent cross-country studies on structural change that follow a largely descriptive approach.

[8] According to Buera & Kaboski (2012), the three-sector breakdown of large part of the structural change literature does not reflect the pattern of reallocation of economic activity in today's advanced economies. Their results show that the services sector is not homogeneous in terms of structural change: the share in value added of high-skill intensive services rose substantially in the period 1950-2000, while the share of the low-skill intensive group fell.

decompose the employment structure according to the nature of the tasks performed by workers. Timmer, Miroudot and De Vries (2019) is a recent study that follows this approach in the study of export structures. Novel approaches may help to attenuate one of the most serious problems of the usual statistical classification of economic activity which is its poor ability to categorise new products. Half a century ago, Kuznets (1971, p.315) lamented "that the available sectoral classifications fail to separate new industries from old, and distinguish those affected by technological innovations". Hence, "both the true rate of shift in production structure and its connection with the high rate of aggregate growth are grossly underestimated" (Kuznets, 1971, p.315). Another important issue that is not captured by standard classifications is product differentiation. As income rises, a country's production structure tends to move out from homogeneous goods in direction of differentiated ones. Treating both classes of products as a single industry tends to underestimate the shifts in production structure (Syrquin, 1988).

2. Causes of structural change

Since the pioneer contribution of Clark (1940), passing by Chenery (1960) and subsequent cross-country studies, the empirical literature has highlighted two sources of structural change: differences in income elasticities of demand and differences in productivity growth across sectors and industries. In contrast, the theoretical literature on economic growth evolved assuming homothetic preferences, what means that all goods have the same unitary income elasticity, and identical productivity growth across sectors. The models have become more tractable with such assumptions but at the expense of wiping out structural change. As emphasised by Syrquin (2010, p. 250)

> Once we abandon the fictional world of homothetic preferences, neutral productivity growth with no systematic sectoral effects, perfect mobility, and markets that adjust instantaneously, structural change emerges as a central feature of the process of development and an essential element in accounting for the rate and pattern of growth. It can retard growth if its pace is too slow or its direction inefficient, but it can contribute to growth if it improves the allocation of resources by, for example, reducing the disparity in factor returns across sectors or facilitating the exploitation of economies of scale.

Building on statistician Ernst Engel's finding that the proportion of income spent on food falls as an individual's income rises – an empirical regularity known as Engel's law – Clark (1940) links the changing structure of consumption to differences in income-elasticity of different classes of goods. This is the first explanation for structural change:

changes in aggregate expenditure structure due to increases in average national income and in income distribution ultimately lead to reallocation of labour across industries (Pasinetti, 1981; 1993)[9].

The second explanation for structural change comes from the supply-side. The original formulation, also pioneered by Clark (1940), assumes (unexplained) differential productivity growth across sectors. Salter (1960) highlights that differential impacts of technical progress across industries leads to differences in productivity growth, what leads to changes in relative prices and differential output growth rates. This hypothesis is further developed by Baumol (1967), who acknowledges that growth is necessarily unbalanced because different sectors grow at different paces due to different rates of technical progress. Assuming that technical progress is faster in manufacturing than in agriculture and services, Baumol (1967) reaches the cost disease hypothesis, which predicts declining rates of growth in advanced economies as a result of the reallocation of labour from technologically dynamic industries, with high productivity growth, towards sectors with low productivity growth.

The supply-side perspective can be also introduced if one assumes that relative prices of inputs change if sectors vary in the intensity with which they use those inputs or there are changes in relative supply of inputs. Caselli & Coleman (2001) assume that changes in relative costs of "producing a skilled worker" affects the relative prices of sectors that are more intensive in skilled labour (reduce) and non-skilled labour (agriculture, which increases), thus contributing to a movement of labour out of agriculture and towards modern industries. Alvarez-Cuadrado *et al.* (2017) identify another source of structural change, namely the cross-sector differences in the elasticity of substitution between capital and labour. Capital and labour are more easily substitutable in agriculture than in manufacturing, and in manufacturing than in services.

One of the weaknesses of the literature on the determinants of structural change is its excessive focus on internal factors, implicitly assuming no interaction between a country's economy and the rest of the world. This implies a direct correspondence between the structure of output and the structure of domestic demand. Nonetheless, a country's economic structure is unequivocally influenced by the specialisation patterns

---

[9] In Pasinetti's (1981; 1993) model, (exogenous) technical progress is the prime cause of structural change because it impacts labour productivity, which in turn impacts incomes (demand). However, the direction of structural change is determined by the demand side because, following Engel's law, demand for different goods does not increase in the same proportion when incomes grow.

induced by international trade (Rowthorn and Wells, 1987). Thus, opening up an economy inevitably leads to a process of structural change which will largely take place as a result of (static) comparative advantages – which, in turn, are driven by technology and factor endowments – unless governments act to distort the market incentives. According to McMillan, Rodrik & Verduzco-Gallo (2014), comparative advantage in primary products partially explain African and Latin American countries' deindustrialisation that followed trade liberalisation. Gollin, Jedwab & Vollrath (2016) show that in developing countries specialised in primary products, urban employment is concentrated in non-tradable services, while in the remaining developing countries manufacturing and tradable services account for a substantial part of urban employment.

The excessive emphasis on supply-side factors can be pointed out as the main reason why structural change remained largely disregarded by economic growth theorists for a long while. As noted, structural change analysis cannot waive demand factors. Indeed, despite the importance of technological progress as a driver of structural change, it seems that the demand side is crucial to determine which industries grow faster, which shrink and ultimately shapes the direction of structural change (Krueger, 2008). This fact highlights the importance of Echevarria's (1997) pioneer study, as well as Laitner (2000) and Kongsamut, Rebelo & Xie (2001), in which unbalanced growth results from the abandonment of the assumption of homothetic preferences.

3. The structuralist approach

According to Chenery (1975), the structuralist approach attempts to identify the specific characteristics of the structure of developing countries that affect economic adjustments and the choice of development policy. Key concepts and hypotheses were formulated during the 1940s and 1950s by Paul Rosenstein-Rodan, Ragnar Nurkse, W. Arthur Lewis, Raul Prebisch, Hans Singer, Albert Hirschman and Gunnar Myrdal, among others. The unifying elements are the concerns about the rigidities imposed by economic structures and the disbelief that the price system can produce steady growth and a desirable distribution of income. Among the central elements of the structuralist approach are the concept of dual economy (Lewis, 1954; Ranis & Fei, 1961) and the concept of complementarities in demand (Rosenstein-Rodan, 1943; Nurkse, 1953).

In the eyes of this generation of development economists, development is a disruptive and conflictive process of dynamic non-marginal change, of creative destruction. Inspired by his analysis of the historical experience of the United States (US), Myrdal (1957) viewed economic development as a process of circular cumulative causation, in which small one-off changes, either positive or negative, propagate and amplify over time, generating diverging patterns among regional economies. The price system was viewed as a mechanism that reinforces existing patterns of specialisation based on static comparative advantage, locking backward countries in a low development trap. For Prebisch (1949) and Singer (1950), promoting industrialisation by means of infant industry protection and import substitution was the only way to escape from the primary commodity specialisation trap. Late industrialisation would require a deliberate planning by the State. Rosenstein-Rodan (1943) and Nurkse (1953) argued that the social returns of large industrial projects exceeded the private returns of investments. Governments should invest themselves and coordinate private investment decisions, preferably in a big-push of simultaneous and complementary investments in several industries. For Gerschenkron (1962), only the State had the capacity to mobilise capital to finance the leap into modern capital-intensive manufacturing, going against comparative advantage in primary products. The catching-up effort, in terms of resource mobilisation, would exceed the capacities of private capital, and the risks involved were too big to carry for the domestic banking system and the entrepreneurial class.

Many ideas of the pioneers of structuralism, originally developed in a largely prose style, inspired formal mathematical models in latter decades: for example, Rosenstein-Rodan’s (1943) big push idea was formalised by Murphy, Shleifer & Vishny (1989) whereas Hirschman’s (1958) concept of backward and forward linkages was incorporated by Rodriguez-Clare’s (1996) modelling of the effects of multinational firms in host economies.

The dual economy models that emerged in the mid-20th century (Lewis, 1954; Jorgenson, 1961; Ranis & Fei, 1961) can be viewed as precursors of contemporary multi-sector growth models. Their central idea is that developing countries are characterised by the coexistence of two sectors that follow completely distinct economic logics. The backward or traditional sector is dominated by subsistence activities, especially in the primary sector, and is characterized by very low use of capital and technology and very low productivity. The capitalist or modern sector is characterised by higher marginal productivity, capital-intensive production process and technical progress. The existence of surplus labour in the traditional sector implies that labour can move to the modern sector without reducing output in the traditional sector. Aggregate output growth depends on the speed of transfer of labour from the traditional sector and the rate of capital accumulation in the modern sector. Assuming that the profits of the modern sector are not consumed, the transfer of labour to the modern sector leads to an increase in the economy's savings and investment rates, as the modern sector can continue paying (slightly above) subsistence wages. At some point, the marginal product of labour in the subsistence sector would equate the subsistence wage. From this point, wages will begin to rise in both sectors and further transfers of workers will depend on the capacity of the higher productivity sector to offer higher wages. Although quite simple, dual economy models played the fundamental role of highlighting the importance of moving resources from low productivity to high productivity activities along the process of development.

4. Overview of the thesis

The aim of this Thesis is to contribute to the flourishing literature on structural change, growth and development. Two chapters focus on causes of structural change whereas the other empirical chapter focuses on the effect of economic specialisation on growth rates.

Chapter Two revolves around the relationship between human capital and economic growth. Interest on the theme was stirred by the large body of cross-country studies that more often than not fail in detecting a positive effect of human capital on growth, a result that seems to contradict the well-established empirical finding that education raises personal incomes (Mincer, 1970). Some scholars – notably Eric Hanushek (Hanushek & Kimko, 2000; Hanushek & Woessmann, 2008) – argue that the cause of this apparent paradox is the inadequacy of the educational proxies used in cross-country studies, as they capture educational attainment instead of educational achievement. Weak demand for skilled labour may be another cause of the deceiving results but this hypothesis remains largely unexplored in the empirical literature.

Such an issue is addressed in Chapter Two. Its main objective is to verify whether the effect of human capital on growth depends on the demand for skilled workers which, in turn, depends on the range of productive activities developed in the country. A neo-structuralist concept – economic complexity (Hausmann *et al.*, 2011) – is used as proxy for countries' economic specialisation. To better capture the nuances of the complementarities between human capital endowment and economic specialisation, the chapter employs non-parametric regression.

The other two empirical chapters investigate the relationship between foreign direct investment (FDI) and structural change. As mentioned earlier, income and price effects generated by demand and supply factors are the proximate causes of structural change. Therefore, FDI must not be viewed as an additional cause of structural change but as a vehicle through which those factors materialise. Given its prominent role as a channel of international technological diffusion, FDI is likely to foster structural change mainly from the supply side.

Focusing on developing countries, Chapter Three makes a direct assessment of the relationship between FDI and employment structure. Its main objective is to verify the compatibility between the data and some conceptual frameworks that undertake a stages-of-development approach to FDI, such as the Investment Development Path (IDP) (Dunning, 1981; Dunning & Narula, 1996; Narula, 1996; Narula & Dunning, 2010) and Ozawa's (1992) three stages approach. More specifically, the chapter tests whether the development impact of FDI, in terms of employment structural change, depends on its sectoral concentration and whether this relationship varies according to the stage of development of the country. The chapter employs a two-step estimation procedure. In the first step, a panel-time series method is used to estimate long-run country-specific coefficients relating FDI to the employment structure. In the second step, a set of country characteristics that includes the sectoral concentration of FDI are employed to explain the heterogeneity found in the first step.

Chapter Four uses industry-level data to analyse how FDI affects productivity growth in former communist countries of Central and Eastern Europe. Drawing on conventional shift-share analysis, aggregate labour productivity growth is decomposed into the within productivity growth and the structural change terms. Next, the association between these terms and FDI is investigated. The objective of the chapter is to test whether institutional factors, human capital endowment, participation in global value chains (GVCs) and alignment to comparative advantage affect the effect of FDI on both within productivity growth and structural change.

Focusing on a relevant major issue, this Thesis adds some still neglected subtopics to the growing literature on structural change and economic development[10]. The

[10] It is worth to note that the term *foreign direct investment* is completely absent in the most popular graduate textbook on economic growth of the last ten years, Acemoglu (2009).

idiosyncrasies of economic development are taken into account: in all the empirical chapters, there is a strong preoccupation with heterogenous effects.

References

Acemoglu, D. (2009) *Introduction to modern economic growth.* Princeton: Princeton University Press.

Alvarez-Cuadrado, F.; Long, N.; Poschke, M. (2017) Capital-labor substitution, structural change and growth. *Theoretical Economics*, 12(3), 1229-1266.

Amsden, A. (1989) *Asia's Next Giant: South Korea and Late Industrialization.* New York: Oxford University Press.

Arena, R. (2017) Modern structural economic dynamics in the short and long run. *Journal of the History of Economic Though*, 39(1), 101-123.

Baumol, W. (1967) Macroeconomics of unbalanced growth: The anatomy of urban crisis. *American Economic Review*, 57(3), 415-426.

Buera, F.; Kaboski, J. (2012) The rise of the service economy. *American Economic Review*, 102, 2540-2569.

Buera, F.; Kaboski, J.; Rogerson, R. (2015) Skill biased structural change. Cambridge, MA: National Bureau of Economic Research. (Working Paper no. 21165).

Caselli, F.; Coleman, W. (2001) The U.S. structural transformation and regional convergence: A reinterpretation. *Journal of Political Economy*, 109(3), 584-616.

Chenery, H. (1960) Patterns of industrial growth. *American Economic Review*, 50(4), 624-654.

Chenery, H. (1975) The structuralist approach to development policy. *American Economic Review*, 65(2), 310-316.

Chenery, H.; Syrquin, M. (1975) *Patterns of development, 1950-1970.* London: Oxford University Press.

Chenery, H.; Syrquin, M. (1986) The semi-industrial countries. In: Chenery, H.; Robinson, S.; Syrquin, M. (Eds.) *Industrialization and growth.* London: Oxford University Press.

Chenery, H.; Taylor, L. (1968) Development patters among countries and over time. *Review of Economics and Statistics*, 50, 391-416.

Clark, C. (1940) *The conditions of economic progress.* London: Macmillan.

Dasgupta, S.; Singh, A. (2005) Will services be the new engine of Indian economic growth? *Development and Change*, 36(6), 1035-1057.

Dasgupta, S.; Singh, A. (2006) Manufacturing, services and premature deindustrialization in developing countries: A Kaldorian analysis. In: Mavrotas, G.; Shorrocks, A. (Eds.)

Advancing Development: Core Themes in Global Economics. New York: Palgrave MacMillan.

De Vries, G.; Erumban, A.; Timmer, M.; Voskoboynikov, I.; Wu, H. (2015) Deconstructing the BRIC: Structural transformation and aggregate productivity growth. In: Naude, W.; Szirmai, A.; Haraguchi, N. (Eds.) *Structural change and industrial development in the BRICS.* Oxford: Oxford University Press.

De Vries, G.; Timmer, M.; De Vries, K. (2015) Structural transformation in Africa: Static gains, dynamic losses. *Journal of Development Studies*, 51(6), 674-688.

Diao, X.; McMillan, M.; Rodrik, D. (2017) The recent growth boom in developing economies: A structural change perspective. Cambridge, MA: National Bureau of Economic Research. (Working Paper no 23132).

Domar, E. (1946) Capital extension, rate of growth, and employment. *Econometrica*, 14(2), 137-147.

Dunning, J. (1981) Explaining the international direct investment position of countries: Towards a dynamic or developmental approach. *Weltwirtschaftliches Archiv*, 177, 30-64.

Dunning, J.; Narula, R. (1996) The investment development path revisited: some emerging issues. In: Dunning, J.; Narula, R. (Eds.) *Foreign Direct Investment and Governments: Catalysts for Economic Restructuring.* Basingstoke: Edward Elgar.

Echevarria, C. (1997) Changes in sectoral composition associated with economic growth. *International Economic Review*, 38, 431-452.

Felipe, J.; Mehta, A.; Rhee, C. (2019) Manufacturing matters…but it's the jobs that count. *Cambridge Journal of Economics*, 43(1), 139-168.

Fisher, A. (1939) Production, primary, secondary and tertiary. *Economic Record*, 15, 24-38.

Foster-McGregor, N.; Verspagen, B. (2016) The role of structural change in economic development of Asian economies. *Asian Development Review*, 33(2), 74-93.

Gabardo, F.; Pereima, J.; Einloft, P. (2017) The incorporation of structural change into growth theory: A historical appraisal. *EconomiA*, 18(3), 392-410.

Gerschenkron, A. (1962) *Economic backwardness in historical perspective*. Cambridge: Harvard University Press.

Gollin, D.; Jedwab, Vollrath, D. (2016) Urbanization with and without industrialisation. *Journal of Economic Growth*, 21(1), 35-70.

Guerrieri, P.; Meliciani, V. (2005) Technology and international competitiveness: The interdependence between manufacturing and producer services. *Structural Change and Economic Dynamics*, 16, 489-502.

Hanushek, E.; Kimko, D. (2000) Schooling, labor-force quality, and the growth of nations. *American Economic Review*, 90(5), 1184-1208.

Hanushek, E.; Woessmann, L. (2008) The role of cognitive skills in economic development. *Journal of Economic Literature*, 46(3), 607-668.

Haraguchi, N.; Cheng, C.; Smeets, E. (2017) The importance of manufacturing in economic development: Has this changed? *World Development*, 93, 293-315.

Harrod, R. (1939) An essay in dynamic theory. *Economic Journal*, 49(193), 14-33.

Hausmann, R.; Hidalgo, C.; Bustos, S.; Coscia, M.; Simoes, A.; Yildirim, M. (2011) *The atlas of economic complexity: Mapping paths to prosperity.* Cambridge, MA: Center for International Development/Harvard University and Media Lab/MIT.

Herrendorf, B.; Rogerson, R.; Valentinyi, A. (2014) Growth and structural transformation. In: Aghion, P.; Durlauf, S. (Eds.) *Handbook of economic growth – Volume 2.* Amsterdam: Elsevier.

Hirschman, A. (1958) *The Strategy of Economic Development*. New Haven: Yale University Press.

Jorgenson, D. (1961) The development of a dual economy. *Economic Journal*, 71(282), 309-334.

Jorgenson, D.; Timmer, M. (2011) Structural change in advanced nations: A new set of stylised facts. *Scandinavian Journal of Economics*, 113(1), 1-29.

Kaldor, N. (1966) *Causes of the slow rate of growth in the United Kingdom.* Cambridge: Cambridge University Press.

Kaldor, N. (1967) *Strategic factors in economic development.* Ithaca, NY: Cornell University Press.

Kongsamut, P.; Rebelo, S.; Xie, D. (2001) Beyond balanced growth. *Review of Economic Studies*, 68(4), 869-882.

Kruger, J. (2008) Productivity and structural change: A review of the literature. *Journal of Economic Surveys*, 22, 330-363.

Kuznets, S. (1957) Quantitative aspects of the economic growth of nations: II. Industrial distribution of national product and labor force. *Economic Development and Cultural Change*, 5(4-Supplement), 1-111.

Kuznets, S. (1966) *Modern economic growth: rate, structure and spread.* New Haven: Yale University Press.

Kuznets, S. (1971) *Economic growth of nations: Total output and production structure.* Cambridge, MA: Harvard University Press.

Kuznets, S. (1973) Modern economic growth: Findings and reflections. *American Economic Review*, 63(3), 247-258.

Laitner, J. (2000) Structural change and economic growth. *Review of Economic Studies*, 67(3), 545-561.

Lavopa, A.; Szirmai, A. (2012) Industrialization, employment and poverty. Maastricht: Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT). (Working Paper no 2012-081).

Lewis, A. (1954) Economic development with unlimited supplies of labour. *The Manchester School of Economic and Social Studies*, 22, 139-191.

Lin, J. (2012) *New structural economics: A framework for thinking development and policy*. Washington, DC: World Bank.

Lin, J.; Chang, H. (2009) DPR Debate: Should industrial policy in developing countries conform to comparative advantage or defy it? *Development Policy Review*, 27(5), 483-502.

Lin, J.; Monga, C. (2011) Growth identification and facilitation: The role of the State in the dynamics of structural change. *Development Policy Review*, 29(3), 259-310.

Lin, J. & Monga, C. (2014) The evolving paradigms of structural change. In: Currie-Alder, B.; Kanbur, R.; Malone, D.; Medhora, R. (Eds.) *International development: Ideas, experience, and prospects.* Oxford: Oxford University Press.

Lucas Jr., R. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22, 3-42.

McMillan, M.; Rodrik, D.; Sepulveda, C. (2016) *Structural change, fundamentals, and growth: A framework and case studies.* Washington, DC: International Food Policy Research Institute.

McMillan, M.; Rodrik, D.; Verduzco-Gallo, I. (2014) Globalization, structural change, and productivity growth, with an update on Africa. *World Development*, 63, 11-32.

Mincer, J. (1970) The distribution of labor incomes: A survey with special reference to the human capital approach. *Journal of Economic Literature*, 8(1), 1-26.

Murphy, K.; Shleifer, A.; Vishny, R. (1989) Industrialization and the big push. *Journal of Political Economy*, 97(5), 1003-1026.

Myrdal, G. (1957) *Economic theory and underdeveloped regions*. London: Duckworth.

Narula, R. (1996) *Multinational Investment and Economic Structure: Globalisation and Competitiveness.* London and New York: Routledge.

Narula, R.; Dunning, J. (2010) Multinational enterprises, development and globalization: Some clarifications and a research agenda. *Oxford Development Studies*, 38(3), 263-287.

Naude, W.; Szirmai, A.; Haraguchi, N. (2016) Structural transformation in Brazil, Russia, India, China and South Africa (BRICS). Maastricht: Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT). (Working Paper no 2016-016).

Nurkse, R. (1953) *Problems of capital formation in underdeveloped countries.* Oxford: Oxford University Press.

Ozawa, T. (1992) Foreign direct investment and economic development. *Transnational Corporations*, 1(1), 27-54.

Palma, J. (2005) Four sources of 'de-industrialisation' and a new concept of the Dutch disease. In: Ocampo, J. (Ed.) *Beyond reforms: structural dynamics and macroeconomic vulnerability.* Stanford: Stanford University Press and World Bank.

Pasinetti, L. (1981) *Structural change and economic growth: A theoretical essay of the dynamics of the wealth of nations.* Cambridge: Cambridge University Press.

Pasinetti, L. (1993) *Structural economic dynamics: A theory of the economic consequences of human learning.* Cambridge: Cambridge University Press.

Prebisch, R. (1949) O desenvolvimento econômico da América Latina e seus principais problemas. *Revista Brasileira de Economia*, 3(3), 47-111.

Ranis, G.; Fei, J. (1961) A theory of economic development. *American Economic Review*, 51(4), 533-565.

Rodriguez-Clare, A. (1996) Multinationals, linkages, and economic development. *American Economic Review*, 86(4), 852-873.

Rodrik, D. (2013) Structural change, industrialization, and convergence. In: Paus, E. (Ed.) *Getting development right: Structural transformation, inclusion and sustainability in the post-crisis era.* New York: Palgrave Macmillan.

Rodrik, D. (2016) Premature deindustrialization. *Journal of Economic Growth*, 21(1), 1-33.

Romer, P. (1986) Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.

Romer, P. (1990) Endogenous technological change. *Journal of Political Economy*, 98(5-2), S71-S102.

Rosenstein-Rodan, P. (1943) Problems of industrialisation of Eastern and South-Eastern Europe. *Economic Journal*, 53(210-211), 202-211.

Rowthorn, R.; Wells, J. (1987) *De-industrialization and foreign trade.* Cambridge: Cambridge University Press.

Salter, W. (1960) *Productivity and technical change.* Cambridge: Cambridge University Press.

Silva, E.; Teixeira, A. (2008) Surveying structural change: Seminal contributions and a bibliometric account. *Structural Change and Economic Dynamics*, 19, 273-300.

Singer, H. (1950) The distribution of gains between investing and borrowing countries. *American Economic Review*, 40(2), 473-485.

Solow, R. (1956) A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.

Storm, S. (2015) Structural change. *Development and Change*, 46(4), 666-699.

Syrquin, M. (1988) Patterns of structural change. In: Chenery, H.; Srinivasan, T. (Eds.) *Handbook of Development Economics – Volume I*. Amsterdam: Elsevier.

Syrquin, M.; Chenery, H. (1989) Patterns of development, 1950 to 1983. Washington, DC: World Bank. (Discussion Paper no 41).

Syrquin, M. (2010) Kuznets and Pasinetti on the study of structural transformation: Never the Twain shall meet? *Structural Change and Economic Dynamics*, 21, 248-257.

Szirmai, A. (2012) Industrialization as an engine of growth in developing countries, 1950-2005. *Structural Change and Economic Dynamics*, 23(4), 406-420.

Timmer, M.; De Vries, G. (2009) Structural change and growth accelerations in Asia and Latin America: A new sectoral data set. *Cliometrica*, 3(2), 165-190.

Timmer, M.; De Vries, G.; De Vries, K. (2015) Patterns of structural change in developing countries. In: Weiss, J.; Tribe, M. (Eds.) *Routledge handbook of industry and development.* London: Routledge.

Timmer, M.; Miroudot, S.; De Vries, G. (2019) Functional specialisation in trade. *Journal of Economic Geography*, 19, 1-30.

Tregenna, F. (2009) Characterizing deindustrialization: An analysis of changes in manufacturing employment and output internationally. *Cambridge Journal of Economics*, 33(3), 433-466.

Tregenna, F. (2015) Deindustrialisation, structural change and sustainable economic growth. Vienna: UNIDO, Research, Statistics and Industrial Policy Branch. (Working Paper 2/2015).

Van Neuss, L. (2019) The drivers of structural change. *Journal of Economic Surveys,* 33(1), 309-349.

CHAPTER TWO:

HUMAN CAPITAL AND ECONOMIC GROWTH: DOES ECONOMIC STRUCTURE MATTER FOR THIS RELATIONSHIP?

1. Introduction

Over the last three decades, a huge empirical literature on the determinants of economic growth across countries piled up. Although this movement was only made possible by major efforts to construct internationally comparable datasets on key variables, its intellectual propeller was the numerous theoretical endeavours to explicate the ultimate causes of economic growth put forward from the late 1980s, beginning with seminal works of Romer (1986, 1990) and Lucas (1988). A common feature of these models is the prominent role played by human capital in putting in motion the engines of endogenous growth. Since then, some proxy variable for human capital is almost always present in empirical growth studies, besides other candidates for growth determinants[11].

Studies conducted in the 1960s and 1970s had already investigated the relationship between human capital and income, at the individual level[12]. More specifically, countless studies based on the so called Mincerian equation (Mincer, 1970) provide strong evidence that formal education raises personal income[13]. Then, an immediate question is: *if an increase in schooling increases an individual's income, does an increase in a country's average level of schooling lead to an increase in its per capita income?* In other words, *does that relationship hold at the aggregate level*?

The empirical evidence on the subject has come in waves. A positive and statistically significant relationship between school enrolment rates and growth is found by early studies, such as Barro (1991), who estimates an *ad hoc* econometric model, and Mankiw, Romer & Weil (1992), whose augmented neoclassical model, in which human

---

[11] In their review of the literature, Durlauf, Johnson & Temple (2005) catalogue 145 variables which were found significant in at least one cross-country growth study, not much less than the number of countries in the world.

[12] The term "human capital" was coined by Schultz (1961) and was further popularised by Becker (1962). However, the subjacent idea is present in economic writings, in one way or another, since the works of pioneers like William Petty, Adam Smith and Jean-Baptiste Say. For an overview of early contributions to what became the concept of human capital, see Kiker (1966).

[13] The Mincerian equation is widely used to estimate the economic returns of different levels of schooling attainment. The rate of return of an additional year of schooling is quite consistent across countries, about 10%, although it is lower in high income countries than in low and middle-income countries (Psacharopoulos & Patrinos, 2004).

capital enters as an ordinary factor of production, became the workhorse of most subsequent empirical literature on growth. Nonetheless, the initial optimism soon gave place to scepticism. Using a more adequate proxy – changes in average years of schooling – Benhabib & Spiegel (1994) and Pritchett (2001) do not ratify Mankiw, Romer & Weil's (1992) findings, and conclude that growth is not related to the accumulation of human capital. However, using a different econometric specification, Benhabib & Spiegel (1994) find that initial human capital stock is a growth determinant, what suggests that endogenous growth theories could be right about the role of human capital in the development process. Since then, the empirical evidence on the theme has remained quite blurred, in such a way that a leading researcher in the field remarked that "the failure to discern this effect at the macro level is worrying (Temple, 1999b, p. 139)[14].

From the late 1990s, a few researchers began to investigate the causes of frequent failures in finding significant positive results. A relevant econometric problem that affects empirical growth studies in general is omitted variable bias. As shown very early by Levine & Renelt (1992), estimated parameters are quite sensitive to the variables included in growth regressions. To mitigate the problem, the researcher should include all the potentially relevant explanatory variables in the model, but this may be impracticable. Aside multicollinearity problems, since several variables tend to move in tandem, many potentially important variables are not available for a large number of countries, particularly the less developed ones, and for more remote periods.

Some studies have suggested that measurement errors in education indicators are a fundamental cause of the disappointing findings (Krueger & Lindahl, 2000). De la Fuente & Domenech (2006) and Cohen & Soto (2007) provide some evidence that, when data quality is improved, attenuation bias is fixed and the effects of human capital on growth shows up. Further in this line, Hanushek & Kimko (2000) assert that schooling attainment indicators are poor proxies for the actual human capital stock of the population. When using average scores in standardised math and science tests as a measure of the real cognitive skills of the population, they find very strong association with growth.

A different line of investigation has directed its focus to parameter heterogeneity. In standard growth regression, the effects of the explanatory variables are assumed to be

[14] In their meta-regression analysis of the literature linking education to economic growth, Benos & Zotou (2014) highlight that there is large variation of estimated effects even within studies. In 28 of 39 studies that provide more than 5 estimations, there is at least one coefficient with positive sign and one with negative sign.

identical for all the observations. This means that the coefficients measure average effects within the sample. However, the "true" effect may be quite heterogeneous across groups of countries with different characteristics. It can also vary with the level of the regressor itself. A few studies (Liu & Stengos, 1999; Kalaitzidakis *et al.*, 2001; Temple, 2001; Mamuneas, Savvides & Stengos, 2006) indeed confirm the existence of significant nonlinearities between human capital proxies and growth rates that go unnoticed in studies that presume parameter linearity. The heroic assumption of parameter homogeneity is also rejected by Durlauf & Johnson (1995) and Masanjala & Papageorgiou (2004), which verify that countries follow multiple growth regimes[15].

Therefore, it is not surprising that Pritchett (2006) finalises his chapter in *The Handbook of the Economics of Education* suggesting that cross-country research on the relationship between education and economic growth should concentrate their efforts on the study of the impact of different economic environments on the returns to schooling: "This alternative line of research examines cross national data, not to make inferences about a 'parameter' that is assumed constant across countries but the opposite – to use the variation across countries to identify the ways in which returns to schooling *vary* across countries".

This chapter follows Pritchett's (2006) advice and brings to the discussion the role played by economic structures in explaining cross-country growth. This is a still under-researched theme, differently from institutions, demography and geography, whose relationships with economic growth has been extensively studied.

The focus of the chapter is on comparative economic growth. Thus, it looks for factors that make some countries attain higher performance than others. The variable of interest is human capital but its relationship with growth is investigated beyond *average effects*. Building on the literature that has emphasised the importance of demand for skills to the rate of return of investments in human capital (Pritchett, 2006; Mehta *et al.*, 2009; 2011; Teixeira & Queiros, 2016), the chapter assumes that *the relationship between human capital and economic growth depends on the characteristics of labour demand and that this is associated with the pattern of specialisation of a country*.

The results of the empirical exercise indicate that countries' economic specialisation – proxied by the Economic Complexity Index (ECI) – is hardly a direct

[15] For a comprehensive review of the econometric challenges involved in the estimation of cross-country growth regressions, see Durlauf, Johnson & Temple (2005).

determinant of growth, but it matters for the relationship between human capital and growth. Basic results obtained through pooled ordinary least squares (OLS) indicate a positive association between initial human capital stock and subsequent 5-year economic growth. Nonetheless, an analogous model estimated using non-parametric regression suggests that such results are disproportionally driven by a group of observations comprised by countries with specialisation patterns that lie within a specific range of the ECI – which is labelled the *mid complexity group* in this chapter. This preliminary finding is confirmed by additional pooled OLS estimations that split the effect of human capital into three complexity groups (low, mid and high). Such results are interpreted as an evidence that the importance of human capital is not the same for every country. Human capital seems to be particularly important for countries that have already transcended the initial stages of development, when the economy is quite dependent on natural resources, but have not yet reached a high degree of sophistication in their productive structures. Within this group, countries with higher initial human capital stocks experimented higher growth rates over the period 1970-2010.

Before moving to the next section, it is important to highlight a last point. It is well known in the growth literature that proving causality is almost unattainable in a cross-country perspective. Even though the main variables of interest are observed before the period when economic growth takes place, antecedence is far from implying causality. Thus, the proposal here is more modest, just check whether some hypothetical relationships are consistent with the existing cross-country data. Terms like “effect” or “impact”, when appearing in the text, should not be understood as claiming a causal relationship, but simply jargons that facilitate the analysis of the econometric estimations.

2. Literature review

2.1. Theoretical approaches to economic growth

Three theoretical approaches to output growth stand out in the economics literature: the neoclassical model, the endogenous growth theories and the technological gap model. In each, human capital[16] plays a different role.

---

[16] Although the concept of human capital may embody several features, such as health and nutritional status, in this chapter it is viewed mainly through its educational dimension.

The neoclassical growth model is still the backbone of mainstream development economics sixty years after Solow's (1956) seminal contribution. Factor accumulation, particularly physical capital accumulation, accounts for the share of growth the model can *explain*, while the share stemming from technological progress is exogenously determined. Human capital does not belong to Solow's original formulation but was incorporated as an ordinary production factor in the augmented Solow model put forward by Mankiw, Romer & Weil (1992), which predicts that growth would be higher when human capital/physical capital ratio is higher.

Due to the assumption of decreasing returns of capital – and holding the savings rate, the population growth rate and the technical progress rate constant across countries[17] – the neoclassical growth model is usually viewed as predicting convergence of different countries to the same steady state income level. This implies that, in the long run, the rate of per capita GDP growth is inversely related to the initial level of per capita income. However, several factors may prevent convergence. If the environment, including policy, is not encouraging, critical investments in physical and human capital may not take place, for example. The degree of international mobility of capital and technology are also important factors influencing the speed of convergence.

In some endogenous growth models, human capital has a distinctive role absent in neoclassical growth models. In Lucas' (1988) model, long-term growth depends on the time devoted to increases in human capital, which enters the aggregate production function as an input in the same way as physical capital. In Romer's (1990) model, it is the key input of the research sector, which in turn is the source of technological progress to the economy. The higher the economy's human capital share employed in this sector, the higher the technological progress, which in turn influences positively the accumulation of capital, and ultimately, output growth. Therefore, initial endowment of human capital is decisive for the growth prospects of a country. Some models relax further neoclassical restrictive assumptions, allowing for increasing returns to scale[18], for example. Lucas (1988) abandons the assumption of decreasing returns on the basis that human capital externalities outweigh the detrimental consequences of increases in the

[17] In later versions of the neoclassical growth model, some restrictive assumptions are relaxed – e.g. savings rate and population growth are endogenized by Cass (1965) and Becker, Murphy & Tamura (1990), respectively.

[18] In Romer's models, technical progress is external to the firm – it comes from a specialised technological sector (Romer, 1990) or from learning-by-doing effects (Romer, 1986). For this reason, there are constant returns to scale at the firm level but increasing returns at the economy level, thus permitting the modelling of the economy as in perfect competition.

capital/labour ratio. As a result, the expected convergence implied by such an assumption is no more unavoidable. On the contrary, depending on their levels, increasing returns and externalities can make way for divergent paths as economies can continue expanding indefinitely. This aspect is reinforced by Azariadis & Drazen's (1990) model, in which two economies with relatively similar characteristics follow different development paths after one of them reaches a threshold level of human capital stock, thus giving rise to positive externalities that enhance the private rate of return of investments in human capital.

A different perspective on comparative economic growth is presented by the technological gap model. According to the catch-up hypothesis, the potential for productivity growth is larger in backward economies than in advanced ones (Gerschenkron, 1962). Backward economies not only have low capital/labour ratios, as assumed by the neoclassical perspective, but their capital stocks present high levels of technological obsolescence. For this reason, expected productivity gains from capital investments are higher for these economies. However, as far as a country reduces its distance to the technological frontier, the catch-up process tends to exhaustion. Marginal gains from the adoption of imported technologies are increasingly lower[19]. Nonetheless, catching up requires the fulfilment of certain conditions. Nelson & Phelps (1966) underline that an economy's human capital stock delimits its capacity to absorb and disseminate technologies developed elsewhere. Abramovitz (1986) advances the complex and hard to measure concept of social capability, which refers to the educational level of the workforce as well as the political, commercial, industrial and financial institutions required to run a modern economy[20]. The existence of adequate channels, as well as obstacles, for knowledge diffusion, influence the realisation of the catch-up potential (Verspagen, 1991).

In sum, different theories suggest at least three channels through which human capital might affect growth. First, it can raise labour productivity (neoclassical model). Second, it may foster innovation and induce increasing returns and positive externalities (endogenous growth models). Third, it may facilitate the adoption and diffusion of

[19] A close reasoning is incorporated by Barro & Sala-I-Martin (1997) in a typical neoclassical model, in which growth depends on the inventions in a small number of developed economies, while the other economies prefer copying to invent because the costs are lower. Follower economies tend to grow faster, because of those costs, but as long as the pool of imitable ideas decreases, their growth advantage also decreases.

[20] In the short run, a country's social capability curbs its technological options. However, in the long run, the social capability, i.e. the educational attainment and the institutions, are affected by the technological trajectories of the country (Abramovitz & David, 1996).

existing technologies and accelerate catching up (technological gap model). The way econometric models are constructed should reflect these differences, although it is not always the case.

The standard empirical approach, pioneered by Mankiw, Romer & Weil (1992), and later used by Benhabib & Spiegel (1994) and Pritchett (2001), among others, departs from the aggregate production function (equation 1), where output (Y) is a function of the stocks of physical (K) and human (H) capital, labour (L), and technology (A). Human capital sometimes enters as a separate input, as in equation 1, sometimes as an augmenting factor of labour. In any case, what determines output growth are the additions to capital stocks, not their initial levels. Equation 2 is the typical growth accounting[21] formulation, where changes in inputs, in the right-hand side, explain changes in output, in the left-hand side.

$$Y = AK^{\alpha} L^{\beta} H^{\gamma} \tag{1}$$

$$(\ln Y_t - \ln Y_0) = (\ln A_t - \ln A_0) + \alpha(\ln K_t - \ln K_0) + \beta(\ln L_t - \ln L_0) + \gamma(\ln H_t - \ln H_0) \tag{2}$$

Most empirical studies grounded on the neoclassical growth model include an additional variable in the right-hand side, the initial per capita income. This is a remnant of the early research agenda on cross-country growth, which had a strong focus on the issue of income convergence. In their pioneer study, Mankiw, Romer & Weil (1992) fail to find convergence in per capita incomes across countries. However, after controlling for the determinants of the steady states – population growth and investment in human and physical capital – they obtain a negative correlation between initial income levels and growth rates, what is interpreted by them as a signal of *conditional convergence*.

The distinctive feature of the endogenous growth literature is its effort to model technological change. As multiple factors can be associated to technical progress, the choice of the explanatory variables to be included in the econometric specifications tends to be more open-ended, particularly when they rely on *reduced-form models* instead of being derived directly from a theoretical development. Human capital may enter in terms of changes, as in the neoclassical model, but there is a compelling argument to include it as initial stocks. In Romer's (1990) model, for example, it is the existing pool of skilled workers that determines the rate at which new products and technologies are introduced

[21] As far as the empirical models include any variable other than the standard production function inputs, they are generically known as "growth regressions", in contrast to growth accounting.

in the economy, and these are the ultimate determinants of long-run growth. Therefore, human capital is not simply an input in the production process, but it is also an input in the innovation process. As these models, in general, do not have a steady state, the justification to include initial per capita income among the regressors withers. Nonetheless, it is often included, as in Hanushek & Kimko (2000) and Hanushek & Woessmann (2008). In this case, initial per capita income may partially capture the effect of variables omitted in the model, such as the investment rate (Krueger & Lindahl, 2001).

Finally, econometric models based on the technological gap model tend to be a hybrid between the neoclassical and the endogenous growth models. As in the neoclassical model, it includes initial per capita income, not to proxy for capital-labour ratios but instead to reflect the degree of technological backwardness of the countries (Fagerberg, 1994)[22]. However, when it comes to human capital, the approach is closer to the endogenous growth models, since it is assumed that the ability of an economy to absorb and disseminate technologies developed elsewhere, through the flow of ideas and equipment, is determined by its existing stocks of human capital (Nelson & Phelps, 1966).

2.2. Empirical findings on the effect of human capital on cross-country economic growth

One of the first efforts to identify the correlates of economic growth in a large cross-section of countries is Barro (1991). Initial levels of human capital, proxied by enrolment rates in primary and secondary school in 1960, is found positively correlated with growth rates over the period 1960-1985. In addition, the study concludes that part of the effects of education on economic growth operates through two channels: its negative impact on fertility rates and its positive impact on the rate of return of physical capital, which induce higher investment/GDP ratios. Another important finding of this early contribution, which became recurrent in subsequent studies, is that the weak growth performances of Latin America and Sub-Saharan Africa remain largely unexplained even after controlling for a bunch of variables.

Unlike Barro (1991), who adopts an *ad hoc* approach to select the variables entering in his regressions, Mankiw, Romer & Weil (1992) derive their empirical model

[22] If changes in factors of production are all accounted for in a neoclassical specification, the inclusion of initial per capita GDP is likely to proxy for technological advantage, so a negative coefficient should be interpreted as evidence of catching-up (Benhabib & Spiegel, 1994).

directly from a augmented version of the Solow model. According to them, not accounting for investment in human capital causes overestimation of the capital share in national incomes in cross-country growth regressions. For this reason, capital is divided between physical and human capital, and enters explicitly as increases to stocks, instead of initial stocks, in their growth model. However, due to data limitations, some adaptations were needed in their econometric specification. Average physical capital investment/GDP ratios and secondary school enrolment rates (multiplied by the fraction of population in the secondary school age) are used instead of direct measures of changes in capital stocks. They confirm Barro's (1991) previous results, finding strong effects of investments in human capital on growth. Moreover, the power of the neoclassical model to descript the growth process seems to be attested by the fact that almost 80% of cross-country variance in economic growth over the period 1960-1985 is explained by its set of only four variables.

Nonetheless, optimism soon gave place to scepticism. Levine & Renelt (1992) shows that cross-country growth regressions likely suffer from omitted variable bias as estimated parameters are quite sensitive to the inclusion of additional variables. In their study, the only variables that remain robust determinants of growth across different specifications are initial per capita GDP and investment rate. Enrolment rates in primary and secondary school are not. This is not surprising, however, since enrolment rates capture the flow of new students to the educational system, instead of changes in the stock of education of the working-age population. This distinction may be particularly problematic in developing countries that are experiencing demographic transition or fast expansion of their educational systems[23]. Mankiw, Romer & Weil's (1992) option for using only enrolment rates in secondary school is also questioned, since it disregards the evidence of higher returns from primary schooling, particularly in poorer countries (Hanushek & Kimko, 2000). Further evidence against Mankiw, Romer & Weil's (1992) results is put forward by Temple (1998), who shows that a few countries are responsible for the positive effect they found of human capital on growth.

Given the inadequacy of data on flows, some major efforts to construct internationally comparable datasets on educational attainment took place in the early 1990s. Among these, Barro & Lee's (1993) stood out, becoming the dominant source of

[23] The irrelevance of enrolment rates in secondary school as a predictor of growth is later reassured by Durlauf, Kourtellos & Tan (2008) and Henderson, Papageorgiou & Parmeter (2011) through the employment of more sophisticated model selection methods.

long-run cross-country educational data[24]. National censuses and surveys are the main sources used to construct their key stock measure, average years of schooling of the adult population. For missing years, they extrapolate those figures with the support of literacy and enrolment data[25].

Benhabib & Spiegel (1994) is one of the first studies that have used Barro and Lee's dataset. Using a cross-country Cobb-Douglas aggregate production function in differences, in which labour, physical and human capital are treated as factors of production, they find a negative, although insignificant, association between changes in the stock of human capital and changes in per capita income[26]. However, when they substitute the educational variable for its initial value, the coefficient turns positive and significant in several specifications. Such findings are interpreted as an evidence in favour of some endogenous growth models, in opposition to the neoclassical approach. Based on their empirical results, the authors conclude that human capital affects growth because it stimulates investment in physical capital, spurs innovation and facilitates the adoption of technologies from abroad.

Using a similar growth accounting framework, Pritchett (2001) finds a negative, although insignificant, relationship between increases to human capital stock and GDP per capita growth, and a significant negative association between that variable and total factor productivity growth. To explain the apparent paradox between his findings and the microeconomic literature based on the Mincerian equation, he puts forward three non-mutually excluding causes. First, better educated workers may simply end up engaged in socially unproductive activities, as suggested by Murphy, Shleifer & Vishny (1991). Second, *the return from schooling may fall substantially if the demand for skilled labour does not go along the increase in supply*. Third, due to low quality, more time spent in school may simply not raise the population's cognitive skills. Nonetheless, Pritchett underlines that while quality differences could explain heterogenous impact, it can hardly explain the insignificant average impact of education on growth[27].

---

[24] Barro & Lee's dataset has undergone a few revisions over time. The latest version is Barro & Lee (2013).

[25] The usual criticism against average years of schooling, or any measure based on it, is that it disregards the quality of education (Hanushek & Woessmann, 2008).

[26] According to the authors, one possible explanation is that many African countries began the period with extremely low stocks of human capital, thus any addition increased stocks substantially.

[27] Studies in levels using country fixed effects (OLS, panel fixed effects or GMM) generally find negative effects of schooling on growth (Islam, 1995, Caselli, Esquivel & Lefort, 1996). However, numerous problems associated with the use of panel data methods in growth regressions have led many researchers recommend extreme caution when using them (Temple, 1999, Wacziarg, 2002, Durlauf, Johnson & Temple, 2005). Furthermore, using fixed effects in cross-country data is like throwing the baby out with the bathwater: "the price of eliminating the misleading component of the between variation – namely, the

Benhabib & Spiegel's (1994) and Pritchett's (2001) studies do not go without criticism. Temple (1999) points out that a few outliers are responsible for hiding a positive association between changes in human capital stock and growth in Benhabib & Spiegel's (1994) study. Krueger & Lindahl (2001) underline the poor quality of data, which may have caused a downward bias of about 80 percent in the estimated effect of changes in schooling on growth in Benhabib & Spiegel (1994). If measurement error is attenuated, both levels and changes in human capital stock exhibit positive association with growth (Krueger & Lindahl, 2001). Besides the problem of noisy data, Cohen & Soto (2007) highlight that both studies fail to find significant positive effects of changes in schooling on growth because they use an inappropriate formulation to represent human capital.

Another point emphasised by Krueger & Lindahl (2001), that affects not only the cited but almost all empirical studies, is the possible inappropriateness of including changes in physical capital stock, or investment rate, among the regressors in a growth equation. According to them, controlling for physical capital is critical for Benhabib & Spiegel's (1994) failure in finding a significant positive coefficient for change in schooling. Indeed, there is no doubt that physical capital accumulation is an endogenous variable in a growth regression. Optimal investment level is influenced not only by growth prospects but also by technological change (Romer, 1990). Furthermore, investments in human capital and in physical capital tend to go in tandem due to the well-known capital-skill complementarity (Krueger & Lindahl, 2001; Henderson, 2009). Thus, part of the return of physical capital should indeed be attributable to human capital ((Krueger & Lindahl, 2001).

Despite the problems raised, Benhabib & Spiegel (1994) and Pritchett (2001) were very influential[28]. After them, most empirical studies ditched variables that measure within period human capital variation and focused on initial stocks. However, this practice was later criticised by Pritchett (2006), which claims that developing countries' extremely volatile output growth could not be explained by a relatively stable trend in schooling level. Therefore, according to him, endogenous growth models that rely upon initial levels of human capital are not acceptable as they cannot propose a stable relationship between human capital stock and output growth. However, if this criticism

---

variation due to unobserved heterogeneity – is that all the between variation is lost" (Durlauf, Johnson & Temple, 2005). As underlined by Wacziarg (2002), it is better to examine the partial correlation of meaningful variables, even in *ad hoc* specifications, rather than use dummies to eliminate unknown sources of variation across countries.

[28] Early working paper versions of Pritchett (2001) began to circulate in 1996.

may be valid for single-country analysis, it loses meaning when it comes to cross-country comparison.

Frequent failures in finding a significant positive association between human capital and growth brought the standard growth regression into question. To solve the inconsistency with microeconomic studies that suggest a log-linear relationship between personal income and education, Bils & Klenow (2000) develop a theoretical growth model in which human capital is an exponential function of years of schooling. Using a similar approach, Cohen & Soto (2007) find a significant positive relationship between changes in human capital stocks and growth. According to them, conventional measures of years of schooling overestimates the improvement in poorer countries' human capital.

The underlying assumption of linearity in parameters began to be contested in broader terms from the late 1990s. Using simple interaction terms between initial education and country dummies, Krueger & Lindahl (2001, p.1128) conclude that the assumption of a constant slope of initial education across countries is rejected by the data and claim that "these results cast doubt on the interpretation of initial education in the constrained macro growth equation common in the literature".

A clearer picture of the nonlinearities involved in cross-country growth began to emerge from the use of nonparametric methods of estimation. In a pioneer study, Liu & Stengos (1999) employ a semiparametric regression allowing for non-linear effects of initial output and human capital. Their findings indicate that, in the period 1960-1990, per capita income convergence took place only among middle to upper income countries, while among poorer countries growth was directly associated to initial income. Nonetheless, the relationship between their human capital measure – enrolment rates in secondary school – and growth seems to be almost linear even in the semiparametric specification. Kalaitzidakis et *al.* (2001) extend Liu & Stengos' (1999) semiparametric approach for a set of proxies for human capital that includes flow (enrolment rates) and stock (average years of schooling) measures. Their main conclusion is that the effect of human capital on growth depends on the country's level of human capital. Another important finding is that post-primary education is more important to growth than primary education, what is consistent with the idea of education as a complement for new technologies. However, their estimations are quite sensitive to the human capital measure utilised. The relationship between mean years of schooling and per capita GDP growth is nonlinear. The benefits of human capital to growth seem to be limited to middle human capital economies, while for low human capital economies the effect is negative. For countries with average years of schooling above 4.4, their semiparametric model shows that marginal increases in education did not affect growth rates in the period 1960-1990.

Such findings, however, are contradicted by Mamuneas, Savvides & Stengos (2006). Using annual data of 51 countries for the period 1971-1987, they find that the elasticity of output in respect to human capital was high at very low and at high levels of human capital stocks but was close to zero for a considerable number of developing countries. For countries with low levels of human capital, it presents decreasing returns. The lowest elasticity is found around 4-5 years of schooling. According to their estimates, elasticity is higher for high-income countries, followed by low-income countries, while the lowest elasticity is for middle-income countries. They suggest that this finding may reveal structural obstacles to the efficient usage of human capital in developing countries, such as the lack of complimentary advanced technologies.

Most of the literature’s previous findings are put into question by Delgado, Henderson & Parmeter (2014), possibly the most relevant nonparametric study on the relationship between human capital and growth published in recent years. Using five different datasets on international comparison of educational attainment, including Barro & Lee’s and Cohen & Soto’s (2007), their estimations suggest that mean years of schooling is irrelevant to explain growth rates across countries. Even in the few cases in which statistical tests indicate that this variable is relevant to the model, the estimated partial effects are neither statistically nor economically significant. Their failure in finding significant effects of schooling persists within several different subsamples, when considering lagged effects (5, 10 and 20 years) and are robust to the presence of outliers.

Why human capital is irrelevant in Delgado, Henderson & Parmeter (2014)? One possibility is that average years of schooling is a poor measure of the populations’ cognitive skills. Hanushek & Kimko (2000) and Hanushek & Woessmann (2008) propose its substitution in growth regressions by an indicator of labour quality based on average scores of students in internationally comparable tests in science and math. Hanushek & Woessmann (2008) point out that, controlling for initial income, models which directly include a measure of cognitive skills explain almost 3 times (73% vs. 25%) the cross-country variation in growth explained by a model containing only years of schooling. Moreover, including the former pushes the coefficient of the later to zero. When they control for the level of property rights protection, the fertility rate and the openness of the economy, the effect of years of schooling on growth is almost zero, in the period 1960-2000.[29]

Another possibility is omitted variable bias. Nonparametric regression is robust to functional form misspecification, but it does not account for heterogeneous effects derived from possible interactions with variables not included in the model. In traditional economic growth models, the channels through which human capital affects growth are not dependent on the structure of the economic activity. However, industries differ in terms of technological and product life cycles, competition, profit rates and technological opportunities, what means different potentials for technological catch-up, innovation, product differentiation, economies of scale, backward and forward linkages and knowledge spillovers. This chapter investigates whether the economic specialisation of countries could be one of the causes of heterogeneous effects of human capital on growth. However, before doing that, it must be asked if economic structure or economic specialisation could not be a direct determinant of output growth.

Since growth rates differ across sectors or industries, it is widely acknowledged that aggregate growth is irremediably related to structural change. However, formal models of economic growth typically disregard economic structure, implicitly assuming that economic structure does not affect growth and vice-versa. One of the few exceptions is Echevarria (1997), whose simulations on a calibrated three sector model are suggestive of mutual effects between sectoral composition and aggregate growth.

Nonetheless, several theoretical and empirical contributions do suggest the existence of a feedback relationship between economic structure and growth. On the supply-side, technological progress does not turn up and spread uniformly across industries, what leads to differential productivity gains, shifts in relative prices and differential rates of output growth, which ultimately affects aggregate growth. On the demand-side, rising incomes shift the structure of demand. Different industries face

[29] Breton (2011) alleges that Hanushek & Woessmann's (2008) findings are flawed as their growth model is misspecified due to the non-inclusion of a physical capital variable, and their education quality data are not representative of the workforce during the period under analysis. Indeed, it is not clear to what extent their results depend on the strong assumption that countries' average test scores remained constant over the period 1960-2000. In addition, Breton (2011) regards as unfair to compare the effect of student's scores obtained, to a large extent, from the last years of the period under analysis, to adults' schooling attainment observed in the beginning of the period. According to Breton (2015), average test scores do not explain growth rates (in the period 1985-2005) in countries with more than 8 years of schooling or relatively high test scores, thus suggesting that Hanushek & Woessmann's (2008) findings are driven basically by countries with lower educational levels, whatever the measure used. In the dataset used by Breton (2015), test scores and schooling attainment tend to increase together up to 9 years of schooling, but after this point there is no clear association between these variables.

different income elasticities of demand, with services in general presenting income elasticities above unity. This change in consumption patterns leads to adjustments in supply, with corresponding shifts of factors of production among different industries (Pasinetti, 1981; 1993). If demand expands faster in industries with low productivity growth, aggregate economic growth will decelerate (Baumol, 1967).

To this date, empirical studies about the relationship between economic structure and growth has focused on advanced economies, due to lack of appropriate disaggregated data for developing economies. In general, they ratify the theoretical predictions. Silva and Teixeira (2011) verify that increases in the GDP shares of high-skill industries, ICT manufacturing industries and science-based industries resulted in higher growth rates within a group of ten (not so much) advanced economies[30]. Peneder (2003), Dietrich (2012) and Hartwig (2012) provide evidence in favour of Baumol's (1967) cost disease hypothesis[31], confirming that services' share in GDP increases with per capita income, but higher shares of services leads to subsequent lower growth rates.

To remedy the restriction imposed by the lack of industry-level data, international trade data has been used in many studies to approximate productive structures in developing countries, but this procedure comes with pros and cons. The main advantages of using these data are their high level of disaggregation using a standard classification and their availability for almost all economies for a long period. Lack of information about trade in services is their main shortcoming, besides their intrinsic incapacity of mapping domestically-oriented economic activity.

Empirical studies have confirmed that what a country exports matter for growth. Aditya & Acharyya (2013) find that higher concentration of exports in high technology products is associated with higher growth rates within a sample of 65 countries over the period 1965-2005. Similar results are found by Peneder (2003) for a sample of OECD countries only. According to Hausmann, Hwang & Rodrik (2007), middle-income

[30] The group includes economies relatively far from world technological frontier, such as Portugal and Taiwan.

[31] Baumol's (1967) cost disease hypothesis refers to the need of prices increasing faster in the technologically stagnant sector (services), to meet the increases in overall wage level caused by productivity gains in the technologically progressive sector (manufacturing). Since aggregate growth is simply a weighted average of sectoral growth, the higher the stagnant sector's share in value added or in employment, the lower the aggregate growth rate. In advanced economies, notwithstanding the increasing tertiarization, manufacturing sector's share in total output has lowered much less than its share in total employment, what reflects differences in the evolution of labour productivity (Rodrik, 2016).

countries specialized in the type of goods typically exported by rich countries have grown faster than middle-income countries specialised in other goods.

Such results are, however, not surprising. Goods differ enormously in terms of sophistication and connectivity to other products[32]. To a large extent, rich countries are rich because they produce and export rich-country type of product (Felipe, Kumar & Abdon, 2014). The types of activities a country engages in determine its development prospects. As stated by Hausmann, Hwang & Rodrik (2007), "countries become what they produce". Their chances to diversify to more sophisticated products depend on the capabilities they already possess. Hausmann *et al.* (2011) consider that productive specialisation, proxied by export pattern, reveals the capabilities a country possesses, which in turn will determine its chances to diversify to more sophisticated products. If this country successfully exports a product that requires a certain set of capabilities, it will likely to be able to export products that require the same sort of capabilities (Hausmann *et al.*, 2011). These elements are combined in the concept of economic complexity, which express itself in the composition of a country's production, which in turn reflects the type of knowledge embedded in its individuals and organizations. The Economic Complexity Index, proposed by Hausmann *et al.* (2011), is used as proxy for economic structures in the subsequent sections of this chapter.

Turning back to the main theme, the question this chapter aims to answer is: *does the economic specialization of countries influence the relationship between human capital and aggregate growth?* If the structuralist approach – which highlights the differences between industries in several aspects – is right, the answer for this question is *yes, it does.* The most likely channel is through demand of skilled labour. Education is believed to make individuals more productive. However, the extent of the productivity improvement is likely to depend on the skill intensity of the economy. The (usually high) private return from an additional year of schooling, as estimated by Mincerian equation, may be very different from the growth return from an equivalent addition to the country's average stock of human capital, since the later clearly shift the labour supply curve. If there is no accompanying increase in demand for skilled labour, the potential productivity gains from higher schooling will hardly materialise. In other words, the productivity gains

[32] Felipe, Kumar & Abdon (2014) follow Hausmann, Hwang & Rodrik (2007) and define product sophistication as the weighted average of per capita GDP of the countries that export the product with revealed comparative advantage (RCA). Product connectivity is measured by the sum of pairwise product proximities, which in turn is measured by the probability that a country exports product *x* with RCA given that it exports product *y* with RCA. According to this classification, the most connected product groups are machinery, chemicals and metal products, while primary products are the less connected.

arising from studying engineering will be very different if a person is employed as an engineer or as a taxi driver. The demand for skilled labour varies across countries due to differences in economic specialization. For this reason, an equivalent marginal increase in human capital may produce very different effects in two different countries. If the skill intensity of an economy does not accompany its human capital improvements, a problem of overeducation may arise. This is characterised by the widespread occupation of jobs that offer very low returns to education by people with relatively high educational levels. Mehta *et al.* (2009; 2011) identify this problem in the Philippines, as rising levels of education were not accompanied by a significant expansion in education-intensive jobs. In early 2000s, low-skilled services were absorbing more than half of the new secondary and college graduates (Mehta *et al.*, 2009). According to Mehta *et al.* (2011, p.1345), their finding is in opposition to the view that "education supply yields its own demand". They conclude that "the returns to education, and the value of education for growth, will be specific to the types of work available" (Mehta *et al.*, 2009, p.27).

The complementarities between human capital and economic structure – or economic specialisation – has been widely disregarded in the literature on economic growth. The only study found which resembles this chapter's proposal is Teixeira & Queiros (2016). Using two different samples – one with traditional OECD members (in the period 1960-2011), the other adding some Mediterranean and former socialist economies, but for a shorter period (1990-2011) – they find that a higher share of employment in technology/knowledge intensive activities and a higher number of years of schooling were associated with higher economic growth. For the OECD sample, they also find a positive relationship between the interaction of those variables and growth, meaning that the impact of human capital was higher the larger the specialization of the economy in high tech sectors. However, for the larger sample, they find a negative association between the interaction term and growth. The authors interpret the unexpected negative interaction term as if "in the sample with a shorter time horizon and transition economies, the *matching* between an adult population with high educational attainment and structural change towards a specialization in knowledge/technology-intensive activities does not contribute to higher economic growth" (Teixeira & Queiros, 2016, p. 1643). However, a more meaningful interpretation would be that human capital and high-tech specialization are substitutes in their effect on economic growth. In other words, growth would be less dependent on high levels of human capital the higher the specialization in high tech sectors – or, alternatively, growth would be less dependent on specialization in high tech sectors the higher the stock of human capital.

Some empirical results about the complementarities between human capital and economic structure are also provided by Szirmai & Verspagen (2015), although through different lens. Indeed, they are interested in testing the "manufacturing as the engine of growth" hypothesis (Kaldor's first law) on a sample of 88 countries over the period 1950-2005. Some specifications include an interaction term between the manufacturing share in GDP and human capital. The coefficient of the interaction term is positive, what is interpreted as an indication that the effect of manufacturing on growth depends on the level of absorptive capacity of the country. However, the interaction term can also be read in a different way, that is, the extent to which the effect of human capital on growth depends on the size of the manufacturing sector. The direct effect of human capital on growth is negative in the base model without interaction and becomes even more negative in the model with interaction. As the interaction term is positive, the results suggest that the effect of human capital on growth is "more positive" – in fact less negative – when the country has a larger manufacturing sector[33].

3. Econometric model and data

As shown in previous section, empirical studies about the role of human capital in economic growth differ among themselves in several aspects: i) the underlying growth theory, which determines whether stocks or changes in stocks of human capital enter in the model; ii) the functional form relating educational variables to human capital stocks; ii) the nature of the human capital proxy used – flows, stocks or changes in stocks measures; iv) the assumption (or not) of linear/homogeneous effects across observations; v) the covariates included in the econometric model; vi) the structure of the data – cross-sectional or panel-data; vii) the estimation methods – OLS, fixed-effects panel data, nonparametric regression, among others; viii) the periods and countries covered by the sample; ix) the choice of data frequency.

Empirical models of cross-country growth are usually based on some variation of the Cobb-Douglas aggregate production function. This is true not only for studies inspired by the neoclassical model, but also for studies adopting other theoretical perspectives[34].

[33] According to the authors, the marginal effect of human capital on growth is significantly negative for observations (27% of the total observations) with manufacturing share in GDP below 12% (Szirmai & Verspagen, 2015, p. 53).

[34] Bernanke & Gurkaynak (2001) show that Mankiw, Romer and Weil's (1992) empirical specification of the augmented Solow model is broadly consistent with any growth model that admits a balanced growth path.

Output growth is generally represented as a linear-log function of the right-hand side variables, which may include the usual factors of production (labour, physical capital and human capital), as well as other potential growth determinants. Additionally, most empirical specifications include initial per capita income among the regressors.

This chapter adopts the perspectives of the endogenous growth models and of the technological gap model. Therefore, it is assumed that a country's growth rate is impacted mostly by its initial stock of human capital. Nonetheless, a relevant practical problem cannot be disregarded: most of those models assume that existing human capital stock affects growth in the subsequent period, but the length of this period is not defined. Therefore, it is up to the researcher to decide what time interval to use, but this involves a trade-off. On the one hand, due to the high volatility of growth rates in the short run, the use of high-frequency data such as annual data in cross-country growth studies is not recommended (Durlauf, Johnson & Temple, 2005). Furthermore, the effects of measurement error on estimated parameters tend to be stronger the higher the frequency of data (Krueger & Lindahl, 2001, Johnson *et al.*, 2013). On the other hand, as the time period widens, the assumption, implicit in the aforementioned theories, that additions to the human capital stock during the period does not affect growth rates gets increasingly implausible[35] (Breton, 2011). Therefore, carefully deciding the time interval is critical to an accurate empirical specification of the underlying growth theory.

To avoid the problems brought about by very short and very large time intervals, the sample used in this chapter, which covers the period 1970-2010, is divided in eight 5-year periods[36]. In order to maximize the number of countries covered, the panel is unbalanced. Given the dubious usefulness of using fixed-effects in a study focused on cross-country comparison, data is simply pooled for the estimations[37].

The sample of country/periods used in most estimations throughout this chapter was selected in three steps. Initially, it included all the observations for which data for all

[35] Therefore, it is not surprising that Hanushek & Kimko (2000) fail to find a robust association between the level of schooling in 1960 and average growth rates over the subsequent 40 years.

[36] In the terminology adopted in the chapter, base year refers to the year when variables on initial conditions are observed. For example, for the 5-year period 1971-1975, the base year is 1970.

[37] Including country dummies (fixed-effects) would change the interpretation of the results completely. The between variation would be swept away. In this case, the coefficient of interest would not indicate whether, at any point in time (given the time fixed-effects), countries with higher human capital stocks grow faster. Instead, it would be an average of country-specific coefficients estimated from within variations. The question answered, in this case, would be: for an average country, does departing from a higher human capital level lead to a higher growth rate? These are completely different questions. The chapter is interested in answering the former, not the latter question.

the variables (of model 1) were available in the respective sources[38]. Then, all the observations for countries with less than one million inhabitants in 2010 were excluded, as a means of avoiding distortions caused by a large number of tax havens. Next, all the observations in which average annual growth rate of per worker GDP exceeded 10 percent or was lower than -7 percent were excluded from the sample, under the justification that such extreme episodes can hardly be explained by the usual factors emphasised in growth theories[39]. Finally, the basic econometric model was run to identify additional outliers[40]. All the observations that severely affected the coefficient of at least one continuous variable of Model 3 – shifting the coefficient for more than one estimated standard error of the coefficient – were excluded from all subsequent estimations[41].

The data used in this chapter come mainly from the Penn World Table 9.0 – PWT9.0 (Feenstra, Inklaar & Timmer, 2015). The other source is the Atlas of Economic Complexity database (Hausmann *et al.*, 2011), which provides the Index of Economic Complexity. All the estimated models include time dummies in order to capture world growth trends. In addition, some models include region dummies[42], as previous studies have indicated that substantial regional differences in growth rates remain even after the inclusion of a large number of covariates (Durlauf, Kourtellos & Tan, 2008; Henderson, Papageorgiou & Parmeter, 2011). A full description of the data is presented in table 1. Descriptive statistics are shown in Table A1, in the Appendix A.

---

[38] Some African countries are covered only from the 1980s. Most former communist countries are covered only from the 1990s.

[39] Those 14 observations, although representing less than 2% of the total, seems to affect considerably the results. While the effect of human capital on growth is positively impacted by the inclusion of observations in both growth rate extremes, the coefficient of economic complexity is strongly overestimated when the few observations with growth rates below -7% are included.

[40] Temple (1999a, p.132) shows that a few outliers can seriously affect the coefficient of education variables in growth regressions. For this reason, he advises that "one should focus on characterising the most coherent part of the dataset rather than the full sample". Easterly's (2005) study on influence of macroeconomic policies on cross-country growth is another example of the sensitivity of estimations to the presence of outliers. Once extreme observations are excluded from the sample, particularly countries with extremely bad policies, variables formerly correlated with growth, such as inflation, trade openness and government consumption, lose statistical significance. Therefore, cumulated experience shows that it may be necessary to discard a few observations to be able to effectively discern patterns from the data.

[41] The following observations were excluded according to this criterion (base year in parentheses): Angola (1990), Cambodia (1975), Egypt (1975), Gabon (2000, 2005), Kuwait (1975, 1990), Liberia (2005), Madagascar (2005), Mozambique (1995), Nigeria (1970, 1985), Romania (1985), Saudi Arabia (1970), Sudan (1985, 1990), Syria (1985), United Arab Emirates (1970, 1980) and Zimbabwe (2005).

[42] The regional classification takes geographical and historical factors into consideration and follows closely the ones used in the 2000s by the United Nations system. The regions are: Advanced Nations, East Asia, Eastern Europe and Central Asia, Latin America and the Caribbean, North Africa and Middle East, South Asia, SubSaharan Africa.

Table 1 - Variables used in the econometric estimations

Variable	Description	Measure	Source	
GROWTH	Growth rate of per worker GDP (at constant national prices)	5-year average, in percentage points	PWT 9.0	(a)
GDP	Per worker GDP (at chained PPPs)	base year, 2011 US$	PWT 9.0	
POP	Population growth rate plus 5	5-year average, in	PWT 9.0	(b)
INV	Gross capital formation / GDP ratio	5-year average, in	PWT 9.0	
HC	Human capital stock per worker less 1	base year, index	PWT 9.0	(c)
K	Physical capital stock per worker (at constant national prices)	base year, 2011 US$	PWT 9.0	
COMPLEX	Economic complexity index	base year, index	Hausmann *et al.* (2011)	
PRECIPITATION	Precipitation rate	litre per year, 2011	WB's Climate Change Data	
TEMPERATURE	Average daily maximum temperature	degree Celsius, 2011	WB's Climate Change Data	
LANDLOCKED	Landlocked country	dummy	CIA World Factbook	
LINGUISTIC	Linguistic fractionalisation index	index, 2001	Alesina *et al.* (2003)	
RELIGIOUS	Religious fractionalisation index	index, 2001	Alesina *et al.* (2003)	

Notes: a) Nuxoll (1994) argues that growth rates based on national prices are preferable to those based on PPPs because they better reflect the trade-offs faced by economic agents; b) Since Mankiw, Romer & Weil (1992), numerous studies have added 0.05 to population growth in order to capture thecombined effect of the depreciation rate and the rate of technological change on growth; c) In PWT 9.0, human capital is treated as a multiplicative factor that enhances the productivity of labour, so that an index equal to 1 refers to labour with no human capital.

Most of the estimated models revolves around the following basic specification:

$$GROWTH_{it} = \alpha + \beta_1\, ln(\,GDP_{it}) + \beta_2\, ln(\,INV_{it}) + \beta_3\, ln(\,POP_{it}) + \beta_4\, ln(\,HC_{it})$$

$$+\beta_5\, ln(\,COMPLEX_{it}) + u_{it} \qquad (3)$$

The first three elements in the right-hand side are the traditional Solow variables. What differs this chapter from most previous studies are the inclusion of COMPLEX among the explanatory variables and the specification of the human capital variable.

Since the launch of Barro & Lee’s dataset, most cross-country growth studies has used average years of schooling as proxy for human capital stock, usually in logs. This means that an increase of average years of schooling from 0.5 to 1 would be expected to affect growth in the same way as an increase from 5 to 10, what seems quite implausible. For this reason, this chapter adopts a different approach, following Hall & Jones (1999), Bils & Klenow (2000), Temple (2001), Caselli (2005), Cohen & Soto (2007) and Lee & Lee (2016). In equation 4, human capital stock per worker is an exponential function of average years of schooling, where the function *Φ*(s) reflects the efficiency of a unit of labour with s years of schooling relative to one with no schooling, and its derivative is the return to schooling estimated in a Mincerian regression (Hall & Jones, 1999).

$$HC_{it} = e^{\phi(s_{it})} \qquad (4)$$

The PWT9.0 provides estimates of Φ(s). Its sources of schooling data are Barro & Lee (2013) and Cohen & Leker (2014)[43]. For the rate of return of an additional year of schooling, the PWT9.0 follows Caselli (2005) and assumes that it varies according to the number of years of schooling (s), from 0.134, if $s \leq 4$; to 0.101, if $4 < s \leq 8$; and 0.068 if $s > 8$[44].

The Economic Complexity Index (ECI) is an ingenious synthetic measure proposed by Hausmann *et al.* (2011). Simply put, it reflects the level of diversity of a country's productive structure. However, it weights diversity by the ubiquity of the products a country exports, which, roughly speaking, is the number of countries that export each of those products with comparative advantage. The rationale is that complex products are less ubiquitous because only a few countries have the requisites to their production. To differentiate cases in which low ubiquity is due to rarity from cases in which it is due to complexity, the number of products that exporting countries of that specific product are able to export is taken into account. If it is high, low ubiquity is likely to be related to complexity. Thus, diversity is used to correct information carried by ubiquity and vice-versa. In sum, the complexity of an economy is defined by the average complexity of the products it exports, while the complexity of a product is defined by the average complexity of the countries exporting it[45].

The ECI has the great advantage of enabling quantitative comparisons of the productive structures of different economies. A country with a high ECI tends to have a diversified productive structure and the products it produces tend to be produced only in a few countries with similar ECI levels. In turn, the productive structure of a country with low ECI tends to be concentrated in a few industries and the goods it exports with revealed comparative advantage tends to be exported by many other countries, most of which have similarly low ECI levels. As shown in Figure 1, the ECI correlates positively with per

[43] According to a companion paper of the PWT 9.0, despite several improvements from previous versions, Barro & Lee's (BL) dataset is still unreliable for a number of countries, for which Cohen & Leker's (CL) present smoother expansion in educational attainment over the years. The correlation between growth rates of human capital based on the two datasets is not very high, 0.37, indicating that estimates would be sensitive to the source of data. For this reason, PWT 9.0 uses different sources for different countries. For 56 countries, only BL provide data, while other 5 countries are covered only by CL. For countries covered by both sources, PWT 9.0 chooses the series that are closer to De la Fuente & Domenech's (2006) dataset and/or UNESCO data. The preferred source is BL, but when CL seems more consistent, this source is used. In the end, PWT 9.0 provides human capital data for 150 countries, of which 95 are based primarily on BL and 55 on CL. As CL is available only once every 10 years, data are interpolated linearly between observations.

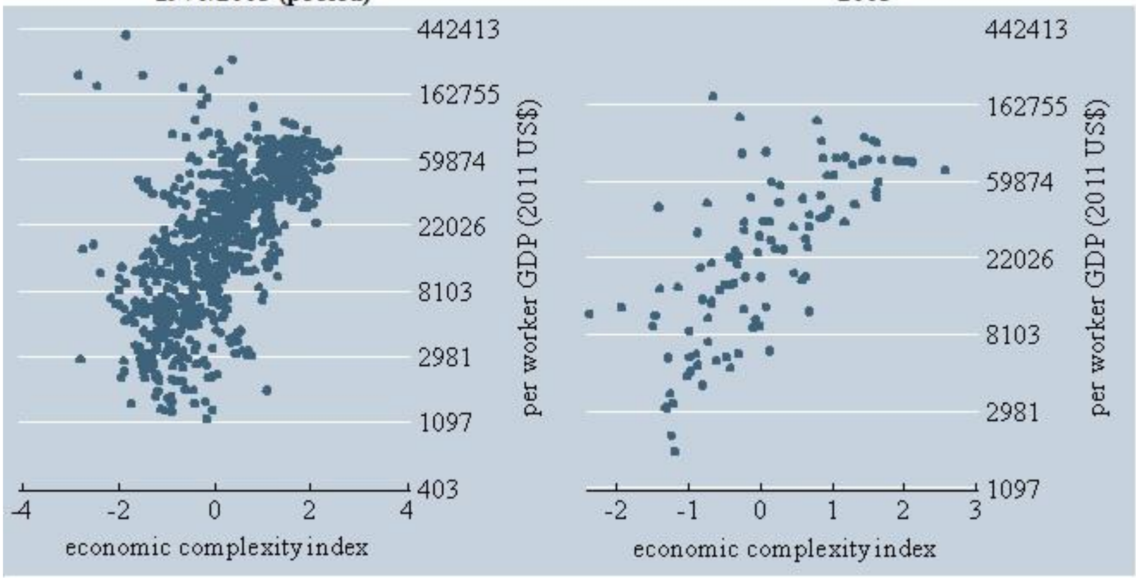
[44] According to Psacharopoulos (1994), the source used by Caselli (2005) to define those rates, the world average rate of return of an additional year of schooling was 10.1 percent, but in Subsaharan Africa it was 13.4 percent, while in OECD countries it was 6.8 percent.

[45] A more detailed description of the ECI, as well as some statistics, is presented in the Appendix B.

worker GDP but the two variables are not redundant because the ECI varies within a strict range.

Figure 1 - Relationship between the Economic Complexity Index and per worker GDP

1970/2005 (pooled) **2005**



In respect to potential endogeneity problems, it is largely acknowledged that many of the supposed determinants of economic growth are likewise contemporaneously affected by economic growth, and the longer the timespan under analysis, the more severe this endogeneity problem tends to get. Variables expressing within-period averages or within-period changes, such as the investment rate and the population growth rate included in equation 3, are particularly sensitive to the economic cycle. This potentially cause the overestimation of parameters, but there is no simple way to tackle the endogeneity problem. Valid instruments that are correlated with the explanatory variables but are not with growth are essentially non-existent. Compared to flows or changes variables, stock variables are less sensitive to exogenous shocks that may affect growth in the short run. Hence a human capital measure based on average years of schooling of the adult population is unlikely to raise relevant endogeneity questions, especially when entering in initial levels (Krueger & Lindahl, 2001).

4. Results

4.1. Some preliminary parametric results

A first set of estimations of equation 3, obtained by pooled OLS[46], is presented in Table 1. Its basic aim is to identify, and exclude, outliers, in order to have a working sample that better reflects the patterns of a large share of the total observations. Model 1 contains all the observations for which all the variables are available[47], except countries with less than one million inhabitants in the last period (2006-2010). In this model, all the continuous variables are significant, with the expected signs. The model is able to explain nearly a quarter of cross-country variation of growth rates, what is consistent with other studies[48]. Model 2 excludes some potential outliers: all the observations in which GROWTH is higher than 10 percent or lower than -7 percent. These 14 observations clearly exert a strong influence on previous results, particularly on COMPLEX coefficient, which declines from 0.547 to 0.108, and loses statistical significance. For this reason, these observations are excluded from the sample. When region dummies are added in Model 3, all the coefficients are reduced, but remain significant, except COMPLEX, that gets close to zero, and HC, which becomes barely non-significant. Model 3 also serves to identify additional outliers. All the observations that severely affect the coefficient of at least one continuous variable of Model 3 – shifting the coefficient for more than one estimated standard error of the coefficient – are excluded from all subsequent estimations. Model 4 presents the results without those outliers. The effect of INV increases substantially, while the HC coefficient falls to 0.261, losing further significance. From these estimations, it can be said that any general effect of HC on GROWTH is probably due to the presence of outliers, especially episodes of growth disaster in countries with very low levels of human capital. Similarly, any direct effect of COMPLEX on growth, that is, not through its effect on capital accumulation, is probably due to the inclusion of outliers. One could point out that the lack of significance of COMPLEX could be caused by its collinearity with GDP. However, COMPLEX remains insignificant even when GDP is excluded from Model 4. The same occur when oil exporting countries[49] are excluded.

---

[46] All the parametric estimations presented in this chapter were performed through pooled OLS with robust standard errors.

[47] It is worth to reiterate that the panel is unbalanced from the outset. In many cases, the country simply did not exist in a given period, while in other cases data is missing in the sources employed in the study.

[48] Delgado, Henderson & Parmeter (2014), for example, get R^2's around 0.28 in their parametric estimations of a similar model.

[49] Countries in which hydrocarbons account for more than 70 percent of total exports and natural resource rents are higher than 10 percent of gross domestic product in most 5-year periods covered by the sample.

Table 2 - GDP per worker annual rate of growth (in %) - 1970/2010

	Model 1		Model 2		Model 3		Model 4	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
ln POP	-2.050	-1.90	-3.121	-5.26	-2.793	-4.01	-3.283	-5.30
ln GDP	-1.436	-6.06	-1.030	-8.01	-0.827	-5.54	-0.804	-6.20
COMPLEX	0.547	2.49	0.108	0.75	0.023	0.16	-0.013	-0.09
ln INV	1.74	5.91	1.536	6.55	1.294	5.19	1.477	7.78
ln HC	0.569	2.03	0.474	2.09	0.367	1.61	0.261	1.24
Constant	14.30	6.23	13.37	8.86	11.46	6.09	11.61	8.17
Time dummy	Yes		Yes		Yes		Yes	
Region dummy	No		No		Yes		Yes	
R-squared	0.24		0.26		0.31		0.35	
N	803		789		789		769	

In the empirical cross-country growth literature, the conventional approach is to estimate "average" effects for all the countries in the growth regression. However, this may be a misleading way to conduct research. In the presence of parameter heterogeneity, what is very likely since countries are hardly in the same aggregate production function, the average effect may hide the true effect, which can be large for some countries, but irrelevant for others. For this reason, the assumption of homogeneous effects is abandoned in the next section.

4.2. Results from nonparametric regression

When specifying an empirical model, researchers often ignore the underlying data generating process. It is up to them to decide whether they trust in the linearity of the relationships, or to include some polynomials and/or interactive terms to account for possible nonlinearities. Alternatively, they can employ estimation methods that do not impose linearity, such as the nonparametric kernel regression[50].

There are pros and cons in using nonparametric regression to study cross-country growth. On the one hand, it is well-known that a true relationship between two variables could be masked by a poor choice of the functional form in a parametric regression. Thus, avoiding the difficult decision of an a priori functional form is precisely the main advantage of using nonparametric estimation. Additionally, it facilitates the detection of interactions among explanatory variables that are not always obvious in underlying theory. This may be particularly useful when an explanatory variable does not have a

[50] If the true data generating process is linear, the estimation by nonparametric kernel regression will not differ from an estimation by parametric linear regression.

direct effect, but influence the effects exerted by third variables on the dependent variable. On the other hand, their main disadvantage is the need to use parsimonious models due to the curse of dimensionality (Henderson & Parmeter, 2015). Taking all this into consideration, nonparametric regression is employed to re-estimate Model 4, in search of possible nonlinearities and interactions between variables.

Nonparametric regression estimators differ from their parametric counterparts primarily because they use local samples of nearby points to estimate point-specific parametric models, and then link these local fits to construct the global function estimator, instead of using the full sample to estimate the global function. For this reason, the choice of the bandwidth is critical in nonparametric estimation. If it is too small, there may not be enough points for smoothing of the relationship. On the other hand, if the bandwidth is too big, the estimates may be oversmoothed, and potential non-linearities will not show up (Henderson & Parmeter, 2015).

Table 3 - GDP per worker annual rate of growth (in %) - 1970/2010

	Parametric (OLS)		Nonparametric (LLLS)	
	coefficient	p-value	coefficient	p-value
ln POP	-3.283	0.00	-3.214	0.00
ln GDP	-0.804	0.00	-0.957	0.00
COMPLEX	-0.013	0.93	0.013	0.09
ln INV	1.477	0.00	1.716	0.00
ln HC	0.261	0.22	0.382	0.10
Time dummy	Yes		Yes	
Region dummy	Yes		Yes	
R-squared	0.35		0.74	
N	769		769	

Notes: For the nonparametric model, values displayed are averages of observation-specific gradients. Standard errors obtained through bootstrapping (400 replications).

Model 4 is re-estimated using the local-linear least-squares (LLLS) estimator, which is basically a locally weighted linear regression that uses a kernel function to assign different weights to observations – the closer to that point, the bigger the weight. For each regressor, LLLS renders observation-specific gradient estimates, instead of single coefficients. This allow for the observation of heterogeneous effects, including for the categorical variables. Following the pattern of resorting to automatic selection procedures, optimal bandwidths are set using least-squares cross-validation (LSCV). The kernel used is Gaussian. Bootstrapping is employed to generate standard errors of the gradients.

The results from parametric and nonparametric estimations of Model 4 are presented in table 2. The nonparametric estimates presented are averages of the gradients. Bootstrapped standard errors are used to calculate p-values. In general, the average effects of the variables are larger than the respective coefficients in OLS regression, and the R^2 jumps from 0.35 to 0.74. The average effect of HC increases from 0.261 to 0.382, with an average p-value equal to 0.1. The average effect of COMPLEX turns positive but remains statistically insignificant.

One of the advantages of using nonparametric regression is that it facilitates the identification of interactive effects between variables. This is key for the present study as its main hypothesis is that the effect of human capital on growth depends on the demand for skilled workers, which, in turn, depends on the "range of productive activities to which educated workers may apply their skills" (Mehta & Felipe, 2014, p.6).

Figure 2 - Three-dimensional conditional mean plot of GROWTH versus ln HC and COMPLEX - 1970/2010

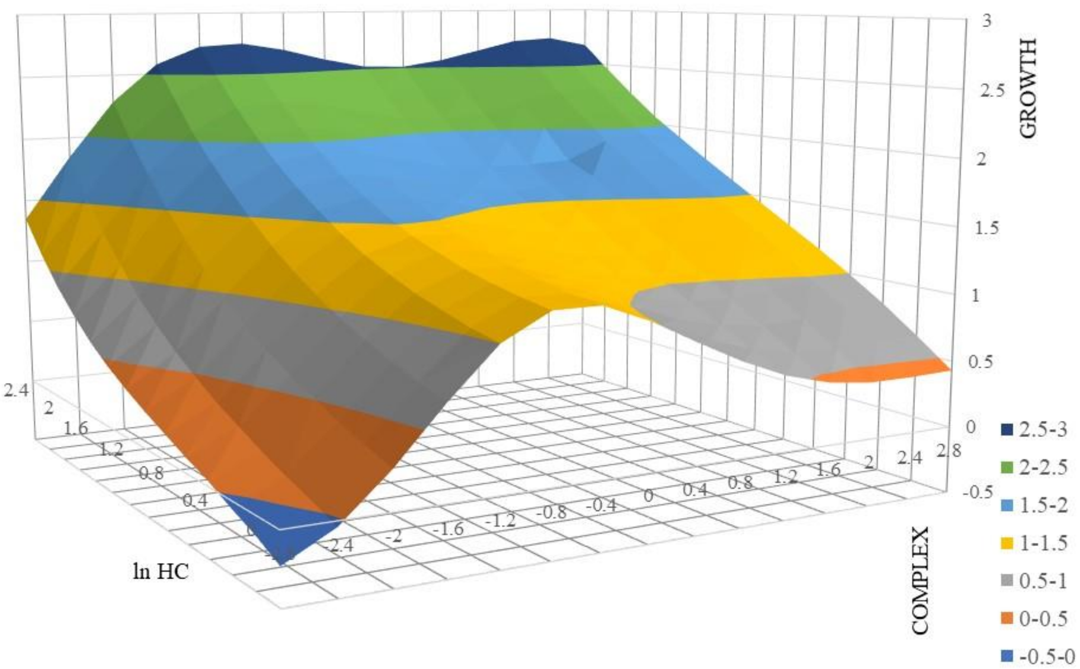


Figure 2 presents the conditional mean of GROWTH according to different levels of ln HC and COMPLEX. It should be stressed that this exercise must not be taken at face value because, to be able to present the results in a three-dimensional chart, the other variables had to be held constant at their average levels. Despite this limitation, the figure presents some thoughtful insights. Human capital is a more important determinant of growth than COMPLEX. Indeed, growth increases with HC at any COMPLEX level, but the reverse is not true. Looking closely at the picture, it is possible to identify two turning points: the first where COMPLEX is around -0.5; the second where COMPLEX is around +1.0.

Figure 2 suggests that, in fact, HC may have distinct importance for GROWTH depending on the economic specialization of the country. To further investigate this hypothesis, observations are divided into 3 groups, according to their corresponding levels of economic complexity. In the low complexity group (LOWCOMPLEX) are included all country/periods in which the ECI is equal or below -0.5. In the mid complexity group (MIDCOMPLEX) are included the observations in which the ECI is higher than -0.5 but does not exceed +1.0. Finally, the high complexity group (HIGHCOMPLEX) is compounded by observations with ECI higher than +1.0.

Figure 3 - Kernel density estimates of the distribution of observation-specific HC gradients

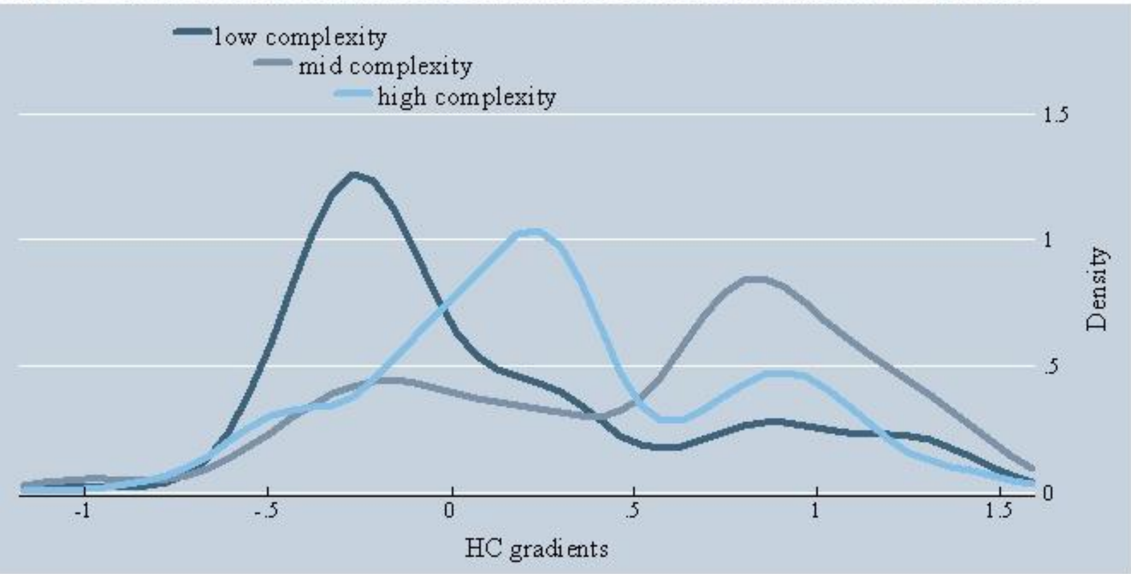
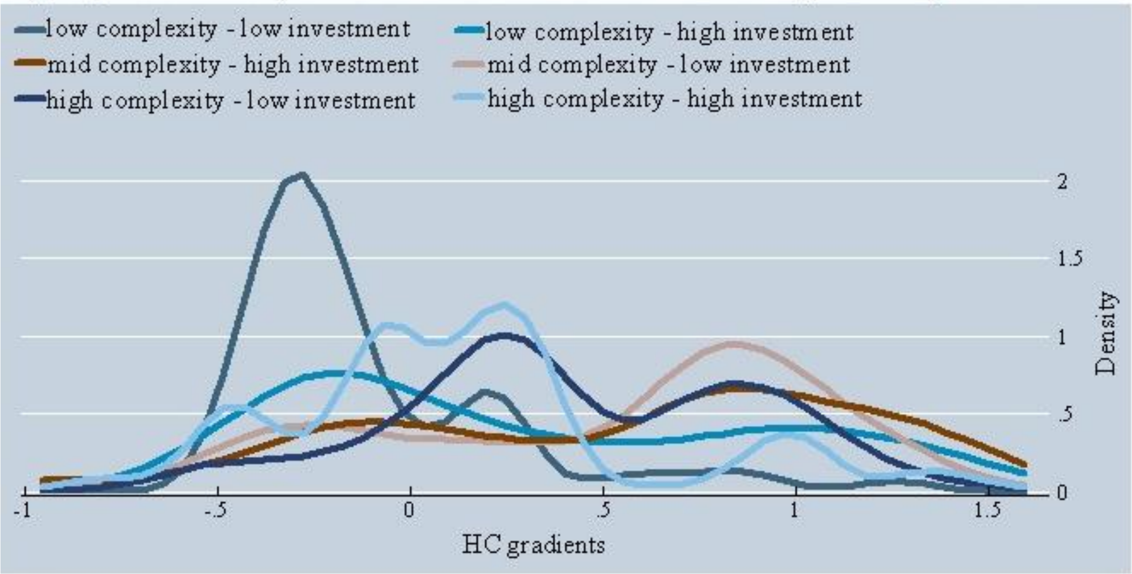


Figure 3 presents kernel density estimates of the distribution of the observation-specific HC gradients (obtained in Model 4) for the 3 complexity groups. Two aspects stand out. First, coefficients are clearly larger for the mid complexity group and smaller for the low complexity group. Second, all the distributions are bimodal. To further investigate what could be causing these patterns, every complexity group is divided into two, according to the median investment rate of each group[51]. Figure 4 presents the distribution of HC gradients according to these six groups. Within de low complexity group, bimodality is clearly associated with investment rate. Negative HC gradients prevail when the investment rate is below the groups' median but are less frequent when investment rate is above that level. Investment rates also seem to help explain bimodality

[51] The median investment rates are 0.151, 0.186 and 0.258 for the low, mid and high complexity groups, respectively.

within the high complexity group. However, in this case, larger HC gradients are more frequent when the investment rate is below the groups' median. Finally, within the mid complexity group, it is harder to perceive an association of HC gradients and investment rates. Indeed, Kolmogorov-Smirnov test does not reject the hypothesis of equality of the two distributions at the 10% significance level, while in the other complexity groups this hypothesis is rejected at the 1% level.

Figure 4 - Kernel density estimates of the distribution of observation-specific HC gradients



As previously underlined, there are two clear advantages in using nonparametric regression, instead of parametric regression, in cross-country growth studies. First, real effects are less likely to go unnoticed as their detection does not depend on the right specification of a linear functional form. Second, nonparametric regression allows the identification of interactions between explanatory variables in a much richer way than in parametric regression.

The nonparametric estimation confirms the previous finding that COMPLEX is not a relevant direct determinant of growth. Nonetheless, it suggests that the effect of HC on growth may be substantially different depending on the type of economic specialisation of the economy. When COMPLEX is low – what to a large extent indicates specialisation in natural resource intensive goods – marginal increases in human capital hardly affects growth. Above a certain COMPLEX threshold, positive effects of HC on growth become more likely, especially if the country's COMPLEX is not very high. The results also suggest that within the low and the high complexity groups, the direction and the magnitude of the HC effect seems to be associated to the economy's rate of investment. These findings are incorporated in additional parametric models in the next section.

4.3. Parametric models incorporating the findings of nonparametric estimation

The empirical literature on cross-country growth has typically expanded by adding new causal proxies to a basic Solow regression, using parametric estimation methods. One of the problems of this approach, already mentioned, relates to the implicit assumption that all countries have the same production function. Another problem comes from the assumption that the additional factor affects growth on its own, instead of affecting growth through its effect on the production function.

The findings of the nonparametric regression are now taken into consideration to construct parametric models that better fit the data. As neither parametric nor nonparametric regression indicate a direct effect of COMPLEX on GROWTH, this variable is withdrawn from equation 3. Nonetheless, its interactions with HC and INV, revealed by nonparametric regression, are not ignored: the effects of HC and INV on GROWTH are allowed to be heterogeneous across different complexity groups.

In Model 5, COMPLEX and region dummies are replaced by dummies that identify the observations according to the complexity group they belong to. HC coefficient is slightly higher than in Model 4 but remains insignificant. A very different picture emerges from Model 6, which introduces interactions between HC and the complexity dummies. Now HC appear to be relevant only in the mid complexity group, in which the coefficient is large and significant. A one standard-deviation increase of HC within this group (0.563) would be associated to incremental growth of 0.285 percentage points. Given that the average growth rate in this group is 1.43 percent, it can be considered a large effect. In the other two complexity groups, the estimated parameters of HC are quite close to zero. In model 7, interactions between the complexity dummies and INV are included, but the HC coefficients remain almost unaffected.

Triple interactions involving the complexity dummies, HC and INV are introduced in Model 8. For the low complexity group, point estimates confirm the findings of the nonparametric estimation, as the effect of HC tends to be negative when INV is below the group’s median and positive when INV is above the group’s median. The former subgroup is comprised almost exclusively by Subsaharan African countries whereas the latter is comprised mostly by oil exporting countries. Nonetheless, the HC coefficients of the low complexity group are jointly insignificant (p-value=0.35). For the mid complexity group, there is an indication that HC and INV are substitutes in terms of growth. The higher the INV, the lower growth seems to depend on initial HC. The HC effect is positive through the whole relevant range and is significant at 10% up to an investment rate of 22.9 percent. The effect of HC is higher than the "average" effect estimated in Model 7 up to an investment rate of about 20 percent. A similar pattern can be observed within the high complexity group, in which HC and INV seems to be substitute sources of growth. The HC coefficient is positive up to an investment rate of 24.8 percent and is statistically significant up to an investment rate of 20 percent.

Table 4 - GDP per worker annual rate of growth (in %) - 1970/2010

	Model 5		Model 6		Model 7		Model 8	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
ln POP	-3.506	-6.27	-3.437	-6.14	-3.450	-6.14	-3.126	-5.57
ln GDP	-1.075	-8.86	-1.074	-8.85	-1.078	-8.73	-1.143	-9.22
ln INV	1.759	9.08	1.734	8.92				
LOW COMPLEX	-0.753	-1.89	-1.115	-1.51	-0.171	-0.10	13.05	3.11
MID COMPLEX	-0.255	-1.04	-0.972	-1.73	-0.342	-0.21	9.886	2.46
ln HC	0.290	1.36						
ln HC x LOW COMPLEX			-0.039	-0.05	0.019	0.02	-6.091	-1.41
ln HC x MID COMPLEX			0.507	1.94	0.501	1.88	2.225	2.17
ln HC x HIGH COMPLEX			0.013	0.05	-0.004	-0.01	8.221	3.44
ln INV x LOW COMPLEX					1.618	4.55	0.963	1.79
ln INV x MID COMPLEX					1.750	7.00	2.235	6.73
ln INV x HIGH COMPLEX					1.951	4.37	5.644	4.65
ln HC x ln INV x LOW COMPLEX							2.304	1.45
ln HC x ln INV x MID COMPLEX							-0.574	-1.69
ln HC x ln INV x HIGH COMPLEX							-2.564	-3.54
Constant	14.19	10.65	14.61	10.72	14.00	7.41	2.371	0.58
Time dummy	Yes		Yes		Yes		Yes	
R-squared	0.28		0.29		0.29		0.30	
N	769		769		769		769	

Models 5 to 8 do not include region dummies. Such exclusion is justified by the substantial overlapping between some complexity categories and regions, especially the low complexity group and SubSaharan Africa and the high complexity group and the advanced economies. Nonetheless, growth rates are likely to be influenced by geographical and historical factors, which the region dummies are supposed to be proxing for. Thus, results may be misinterpreted if these factors are not taken into consideration. Including country-fixed effects is a usual way of "controlling" for time invariant variables. However, the interpretation of the results would change completely, as the variance between countries would be ignored. To avoid this change, a more appropriate way of dealing with such omitted variable problem is to include a few meaningful geographical and historical variables directly in the model.

Table 5 - GDP per worker annual rate of growth (in %) - 1970/2010

	Model 5		Model 9		Model 6		Model 10	
	coefficient	t-stat			coefficient	t-stat	coefficient	t-stat
ln POP	-3.506	-6.27	-3.206	-5.25	-3.437	-6.14	-3.099	-5.08
ln GDP	-1.075	-8.86	-1.131	-8.43	-1.074	-8.85	-1.108	-8.24
ln INV	1.759	9.08	1.765	9.05	1.734	8.92	1.719	8.81
LOW COMPLEX	-0.753	-1.89	-0.735	-1.83	-1.115	-1.51	-1.432	-1.89
MID COMPLEX	-0.255	-1.04	-0.162	-0.63	-0.972	-1.73	-1.118	-1.94
ln HC	0.290	1.36	0.247	0.94				
ln HC x LOW COMPLEX					-0.039	-0.05	0.140	0.18
ln HC x MID COMPLEX					0.507	1.94	0.472	1.61
ln HC x HIGH COMPLEX					0.013	0.05	-0.189	-0.55
PRECIPITATION			-0.019	-0.16			-0.003	-0.03
TEMPERATURE			-0.026	-1.59			-0.032	-1.85
LANDLOCKED			-0.552	-2.27			-0.532	-2.18
LINGUISTIC			0.453	1.24			0.580	1.55
RELIGIOUS			-0.045	-0.11			-0.076	-0.18
Constant	14.19	10.65	14.66	10.48	14.61	10.72	15.19	10.74
Time dummy	Yes			Yes	Yes		Yes	
R-squared	0.28			0.29	0.29		0.30	
N	769			769	769		769	

Table 5 shows the results of the re-estimation of Models 5 and 6 with the inclusion of five additional variables: i) a dummy differentiating landlocked countries; ii) the precipitation rate; iii) the average daily maximum temperature; iv) an index of linguistic fractionalisation and; v) an index of religious fractionalisation. The two climate variables come from the World Bank's Climate Change Data. Alesina *et al.* (2003) is the source of the fractionalisation indexes. The results confirm some previous studies. Landlocked countries have a worse growth performance, as found by MacKellar, Worgotter & Worz (2002). Higher temperatures are associated with slower growth, as in Bloom, Canning & Sevilla (2003). The coefficient of rainfall is inexpressive, but this may be due to possible non-linear effects of this variable on economic growth. Higher linguistic fractionalisation is possibly associated with higher economic growth, while religious fractionalisation has no association, after controlling for the former variable. The variable of interest, HC, is not much impacted by the inclusion of the geographical and historical variables. In Model 9, which resembles Model 5, the coefficient of HC drops to 0.247 (from 0.290) and remains statistically insignificant. In Model 10, which resembles Model 6, the human capital coefficient for the mid complexity group remains almost unchanged, though its significance decreases somewhat. In the other two complexity groups, the human capital coefficients vary a bit, but remain largely insignificant.

As an additional robustness check, Model 6 is re-estimated with the inclusion of the outliers. The results are presented in Table 6. Model 11 reintroduces the 20 observations that were excluded due to their severe impact on at least one continuous variable of Model 3. It can be noted that the impact on the HC coefficients is not substantial – in fact, the largest impact is on the mid complexity group. Model 12 reintroduces the remaining 14 observations that were excluded because they are extreme growth episodes (5-year averages higher than 10% or lower than -7%). Once more, it is clear the distortion caused by the inclusion of these few observations in the sample. All the HC coefficients rise substantially. However, only in the mid complexity group HC is statistically significant. In the low complexity group, the estimated coefficient is even higher than in the mid complexity group, but the variance is very high. The sharp increase is caused mainly by the inclusion of observations with very low initial human capital stocks and extremely negative growth rates. Table 6 suggests, therefore, that the main results of this chapter are hardly driven by the criteria used to identify outliers. Nonetheless, their exclusion from the main estimations is justified since the aim is to analyse what is going on in most of the sample.

Table 6 - GDP per worker annual rate of growth (in %) - 1970/2010

	Model 6		Model 11		Model 12	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
ln POP	-3.437	-6.14	-2.914	-4.93	-1.982	-1.88
ln GDP	-1.074	-8.85	-1.050	-8.31	-1.432	-6.18
ln INV	1.734	8.92	1.484	6.31	1.681	5.69
LOW COMPLEX	-1.115	-1.51	-1.287	-1.67	-2.826	-2.96
MID COMPLEX	-0.972	-1.73	-1.123	-1.92	-1.621	-2.34
ln HC x LOW COMPLEX	-0.039	-0.05	0.035	0.04	0.837	0.89
ln HC x MID COMPLEX	0.507	1.94	0.598	2.15	0.784	2.41
ln HC x HIGH COMPLEX	0.013	0.05	0.056	0.20	0.201	0.54
Constant	14.61	10.72	14.28	9.48	15.75	6.95
Time dummy	Yes		Yes		Yes	
R-squared	0.29		0.26		0.26	
N	769		789		803	

Summing up, both parametric and nonparametric models indicate the existence of important heterogeneity in HC effects on growth associated to the patterns of economic specialisation of the economies. For this reason, it is not surprising that many previous studies that relied upon the estimation of an average effect failed to find a significant association between those variables. The results suggest that differences in HC cannot explain differences in growth performances across low complexity countries. However, it has an explanatory power among mid complexity countries. Within the group of high complexity countries, HC seems to be more associated with growth when the investment rate is relatively low.

4.4. Economic complexity as a determinant of investments in human and physical capital

The results presented in previous sections suggest that the importance of human capital to economic growth depends on the actual level of economic complexity as well as the rate of investment of the economies. Complexity *per se* does not seem to be a direct determinant of growth, but it may exert an indirect influence, through its effect on both investments in human capital and physical capital. To check these hypotheses, equations on the determinants of the rates of change of the stocks of human capital and physical capital are estimated.

According to the results presented in Table 7, initial COMPLEX is positively related to changes in human capital stocks per worker, but the coefficient is statistically significant only when the model includes region dummies (Model 14). Changes in COMPLEX also appear positively associated to changes in human capital, after controlling for initial COMPLEX, but the coefficient is never statistically significant. Therefore, the results presented in Table 7 suggest that initial COMPLEX may be a relevant predictor of subsequent increase in human capital stock.

Table 7 - 5-year change in human capital stock per worker - 1970/2010

	Model 13		Model 14		Model 15		Model 16	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	oefficient 1	t-stat
ln K	0.01016	4.39	0.01103	4.31	0.01154	4.82	0.01253	4.69
ln HC	-0.01671	-2.75	-0.01002	-1.49	-0.01907	-3.11	-0.01164	-1.73
COMPLEX	0.00419	1.23	0.00640	1.79	0.00482	1.34	0.00755	2.00
change COMPLEX					0.00948	1.41	0.00770	1.20
change ln K					0.02629	3.03	0.02060	2.47
Constant	-0.00392	-0.18	-0.04838	-1.77	-0.02242	-0.96	-0.04902	-1.78
Time dummy	Yes		Yes		Yes		Yes	
Region dummy	No		Yes		No		Yes	
R-squared	0.06		0.16		0.07		0.17	
N	769		769		769		769	

The results are somewhat different in the case of investment in physical capital. Model 17 suggests that initial COMPLEX is positively and significantly related to changes in physical capital stock per worker in subsequent 5 years, after controlling for initial physical and human capital stocks. However, when region dummies are included, in Model 18, the coefficient of COMPLEX drops substantially and becomes statistically insignificant. To further investigate this phenomenon, Model 18 was re-estimated with the inclusion of interactions between the region dummies and COMPLEX (results not shown). North Africa and Middle East is clearly a discrepant region. For this reason, two additional models are estimated, excluding the oil exporting countries. Initial COMPLEX resumes significance in Model 19, and changes in complexity also appears as significant in Model 20.

In sum, these results suggest that countries' patterns of economic specialisation help to predict their subsequent investments in both human and physical capital. Although these cannot be viewed as proofs of causality, they reinforce the findings of previous sections, which suggested a subsidiary role for economic complexity in explaining cross-country growth patterns.

Table 8 - 5-year change in physical capital stock per worker - 1970/2010

	Model 17		Model 18		Model 19		Model 20	
	coefficient	t-stat	coefficient	t-stat	oefficient 1	t-stat	oefficient 1	t-stat
ln K	-0.06743	-6.98	-0.08727	-7.83	-0.08035	-5.99	-0.08370	-6.20
ln HC	0.03763	1.48	0.03273	1.12	0.02484	0.89	0.02129	0.76
COMPLEX	0.03810	2.69	0.01601	1.03	0.03565	2.21	0.04566	2.70
change COMPLEX							0.05542	1.95
Constant	0.85354	9.22	1.08200	7.77	1.03206	7.43	1.05898	7.60
Time dummy	Yes		Yes		Yes		Yes	
Region dummy	No		Yes		Yes		Yes	
R-squared	0.17		0.19		0.23		0.23	
N	769		769		653		653	

Note: Models 17 and 18 do not include countries of Middle East and North Africa.

5. Conclusion

This chapter had two main objectives. It first reviewed the extant literature on human capital and economic growth. After a brief presentation of the main theoretical approaches, the cross-country empirical literature was thoroughly discussed. The central point to be emphasised is that the empirical findings usually fall short of the great expectations. Although some studies find a positive association between human capital and growth, many others find no effect or even a negative effect. Apart from the possibility that human capital may be, indeed, irrelevant for growth, several causes may be behind the disappointing results. From a technical point-of-view, the inadequacy of educational proxies, the mismeasurement of educational variables and the misspecification of econometric models may bias the results. From a theoretical point-of-view, the implicit assumption of a human capital Say's law (Mehta *et al.*, 2011) may simply be inconsistent with the real world. Building on the structuralist tradition, this chapter advocates that the effect of human capital on growth is irremediably contingent on the possibilities of using the accumulated human capital for productive ends which ultimately depend on the economy's type of specialisation. Human capital will produce better results in terms of aggregate growth if the economy is engaged in activities that benefits more from learning, technical progress and knowledge spillovers. Furthermore, an economy runs the risk of ending up in a situation of overeducation if its structure does not evolve alongside human capital improvements.

Incorporating the role of economic specialisation – or economic structure – in a cross-country growth regression was the second objective of this chapter. For such, the Economic Complexity Index (Hausmann *et al.*, 2011) was used as a proxy for economic specialisation of the countries. Considering that departing from purely linear specifications is a more promising way to conduct cross-country growth studies – as evidenced by Durlauf & Johnson (1995), Liu & Stengos (1999), Durlauf, Kourtellos & Minkin (2001), Kalaitzidakis *et al.* (2001), Henderson, Papageorgiou & Parmeter (2011) and Delgado, Henderson & Parmeter (2014) – the chapter employed nonparametric regression as a means to identify not only heterogenous effects of the explanatory variables but the complex interactions between them. The results indeed indicate that not accounting for them may hide important relationships behind insignificant "average" effects. The findings of the nonparametric regression, which are relatively difficult to interpret, was latter used to specify more realistic parametric regression models.

The results seem to confirm that the technological gap model is a good description of the growth process for most part of the economies. Human capital seems to positively affect growth only after a minimal critical mass is reached, what is also in accord with endogenous growth models with threshold externalities (Azariadis & Drazen, 1990). As expected, differences in human capital cannot explain different growth patterns across countries specialised in natural-resource based products. However, human capital is a relevant predictor of growth performance among countries with intermediate complexity economic structures, which are typical of middle-income countries. Among high complexity economies, the relevance of human capital to growth seems to be contingent on their levels of physical capital investments. When these are relatively low, human capital is positively associated with growth. This may be an indication that in economies more reliant on services – which tend to be less capital-intensive than manufacturing – growth is more dependent on human capital. On the other hand, in economies with high levels of physical capital investment, the results suggest that human capital could even have a negative association with growth. However, such results should be interpreted with caution because it is likely that part of the strong and increasing effects of physical capital investment on growth, among the high complexity countries, may in fact be just reflecting a positive association between initial human capital stocks and subsequent investments in physical capital, as was earlier noticed by Benhabib & Spiegel (1994).

This chapter also highlights the need of taking the channels through which *growth determinants* affect growth more seriously. Most studies simply add new *causal factors* along with traditional variables in the right-hand side of the growth equation. As this chapter shows, in this type of specification, economic structure plays no role in explaining growth differentials. However, it does not mean that it is unimportant. Indeed, this chapter demonstrates that the relationship between human capital and growth is contingent on the economic structure of the country. The results also suggest that the economic specialisation of a country is a relevant predictor of its investments in both human and physical capital.

The main policy implication of this study is that investments in human capital are meritorious *per se*, as they help to enhance people's quality of life, but their effects on economic growth depend on the country's economic specialisation. Complimentary policies may be needed to move the economic structure in the direction of activities in which the economic returns of the improved human capital are higher. Over the last three centuries, this has been largely associated with industrialisation but more recently the emergence of a range of sophisticated services has made this development path less unavoidable.

It must be underlined that the ECI has the great advantage of being a "synthetic measure" but it also has important limitations as a proxy for economic specialisation or economic structure. Calculated using merchandise trade data, it does not reflect neither the weight nor the degree of sophistication of the services and other non-tradable industries[52]. The ECI tends to underestimate the "true" level of sophistication of high-income countries whose merchandise export structure is concentrated in mineral and agricultural products. Nonetheless, this problem is limited to a few countries, such as Australia and New Zealand, whose exclusion of the econometric analysis does not alter substantially the results. To reduce the influence of measurement errors, this work could be extended in the future using an index based on output, value added or employment data, instead of the ECI. However, this will require the construction of more disaggregated internationally comparable databases than the ones currently available.

References

Abramovitz, M. (1986) Catching up, forging ahead, and falling behind. *Journal of Economic History*, 46(2), 385-406.

Abramovitz, M.; David, P. (1996) Convergence and deferred catch-up: Productivity leadership and the waning of American exceptionalism. In: Landau, R.; Taylor, T.; Wright, G. (Eds.) *The mosaic of economic growth*. Stanford: Stanford University Press.

Aditya, A.; Acharyya, R. (2013) Export diversification, composition, and economic growth: Evidence of cross-country analysis. *Journal of International Trade & Economic Development*, 22(7), 959-992.

Alesina, A.; Devleeschauwer, A.; Easterly, W.; Kurlat, S.; Wacziarg, R. (2003) Fractionalization. *Journal of Economic Growth*, 8, 155-194.

Azariadis, C; Drazen, A. (1990) Threshold externalities in economic development. *Quarterly Journal of Economics*, 105(2), 501-526.

Barro, R. (1991) Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106(2), 407-443.

Barro, R.; Lee, J. (1993) International comparisons of educational attainment. *Journal of Monetary Economics*, 32, 363-394.

Barro, R.; Lee, J. (2013) A new data set of educational attainment in the world, 1950-2010. *Journal of Development Economics*, 104, 184-198.

Barro, R.; Sala-i-Martin, X. (1997) Technological diffusion, convergence, and growth. *Journal of Economic Growth*, 2(1), 1-26.

Baumol, W. (1967) Macroeconomics of unbalanced growth: The anatomy of urban crisis. *American Economic Review*, 57(3), 415-426.

Becker, G. (1962) Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5), 9-49.

[52] Some services are highly tradable but are not captured in detail by internationally comparable trade databases.

Becker, G.; Murphy, K.; Tamura, R. (1990) Human capital, fertility, and economic growth. *Journal of Political Economy*, 98, S12-S37.

Benhabib, J.; Spiegel, M. (1994) The role of human capital in economic development: Evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34, 143-174.

Benos, N.; Zotou, S. (2014) Education and economic growth: A meta-regression analysis. *World Development*, 64, 669-689.

Bernanke, B.; Gurkaynak, R. (2001) Is growth exogenous? Taking Mankiw, Romer, and Weil seriously. *NBER Macroeconomics Annual*, 16(1), 11-57.

Bloom, D.; Canning, D.; Sevilla, J. (2003) Geography and poverty traps. *Journal of Economic Growth*, 8, 355-378.

Breton, T. (2011) The quality vs. the quantity of schooling: What drives economic growth? *Economics of Education Review*, 30, 765-773.

Breton, T. (2015) Higher test scores or more schooling? Another look at the causes of economic growth. *Journal of Human Capital*, 9(2), 239-263.

Caselli, F.; Esquivel, G.; Lefort, F. (1996) Reopening the convergence debate: A new look at the cross-country growth empirics. *Journal of Economic Growth*, 1(3), 363-390.

Caselli, F. (2005) Accounting for cross-country income differences. In: Aghion, P.; Durlauf, S. (eds). *Handbook of Economic Growth, vol. 1A*. Amsterdam: North Holland.

Cass, D. (1965) Optimum growth in an aggregate model of capital accumulation. *Review of Economic Studies*, 32, 233-240.

Cohen, D.; Leker, L. (2014) Health and education: Another look with proper data. Paris: Paris School of Economics. manuscript.

Cohen, D.; Soto, M. (2007) Growth and human capital: good data, good results. *Journal of Economic Growth*, 12, 51-76.

De la Fuente, A.; Domenech, R. (2006) Human capital in growth regressions: how much difference does data quality make? *Journal of the European Economic Association*, 4, 1-36.

Delgado, M.; Henderson, D.; Parmeter, C. (2014) Does education matter for economic growth? *Oxford Bulletin of Economics and Statistics*, 76(3), 334-359.

Dietrich, A. (2012) Does growth cause structural change, or is it the other way around? A dynamic panel data analysis for seven OECD countries. *Empirical Economics*, 43(3), 915-944.

Durlauf, S.; Johnson, P. (1995) Multiple regimes and cross-country growth behaviour. *Journal of Applied Econometrics*, 10(4), 365-384.

Durlauf, S.; Johnson, P.; Temple, J. (2005) Growth econometrics. In: Aghion, P; Durlauf, S. (Eds.) *Handbook of economic growth, Vol. 1A*. Amsterdam: North Holland.

Durlauf, S.; Kourtellos, A.; Minkin, A. (2001) The local Solow growth model. *European Economic Review*, 45, 928-960.

Durlauf, S.; Kourtellos, A.; Tan, C. (2008) Are any growth theories robust? *Economic Journal*, 118(527), 329-346.

Easterly, W. (2005) National policies and economic growth: A reappraisal. In: Aghion, P.; Durlauf, S. (Eds.) *Handbook of economic growth, Vol. 1A*. Amsterdam: North Holland.

Echevarria, C. (1997) Changes in sectoral composition associated with economic growth. *International Economic Review*, 38, 431-452.

Fagerberg, J. (1994) Technology and international differences in growth rates. *Journal of Economic Literature*, 32(3), 1147-1175.

Feenstra, R.; Inklaar, R.; Timmer, M. (2015) The next generation of the Penn World Table. *American Economic Review*, 105(10), 3150-3182.

Felipe, J.; Kumar, U.; Abdon, A. (2014) How rich countries became rich and why poor countries remain poor: It's the economic structure…duh! *Japan and the World Economy*, 29, 46-58.

Gerschenkron, A. (1962) *Economic Backwardness in Historical Perspective*. Cambridge: Harvard University Press.

Hall, R.; Jones, C. (1999) Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics*, 114(1), 83-116.

Hanushek, E.; Kimko, D. (2000) Schooling, labor-force quality, and the growth of nations. *American Economic Review*, 90(5), 1184-1208.

Hanushek, E.; Woessmann, L. (2008) The role of cognitive skills in economic development. *Journal of Economic Literature*, 46(3), 607-668.

Hartwig, J. (2012) Testing the growth effect of structural change. *Structural Change and Economic Dynamics*, 23(1), 11-24.

Hausmann, R.; Huang, J.; Rodrik, D. (2006) What you export matters. *Journal of Economic Growth*, 12, 1-25.

Hausmann, R.; Hidalgo, C.; Bustos, S.; Coscia, M.; Simoes, A.; Yildirim, M. (2011) *The atlas of economic complexity: Mapping paths to prosperity*. Cambridge, MA: Center for International Development/Harvard University and Media Lab/MIT.

Henderson, D. (2009) A non-parametric examination of capital-skill complementarity. *Oxford Bulletin of Economics and Statistics*, 71(4), 519-538.

Henderson, D.; Papageorgiou, C.; Parmeter, C. (2011) Growth empirics without parameters. *Economic Journal*, 122(559), 125-154.

Henderson, D.; Parmeter, C. (2015) *Applied nonparametric econometrics*. New York: Cambridge University Press.

Islam, N. (1995) Growth empirics: A panel data approach. *Quarterly Journal of Economics*, 110(4), 1127-1170.

Johnson, S.; Larson, W.; Papageorgiou, C.; Subramanian, A. (2013) Is newer better? Penn World Table revisions and their impact on growth estimates. *Journal of Monetary Economics*, 60(2), 255-274.

Kalaitzidakis, P.; Mamuneas, T.; Savvides, A.; Stengos, T. (2001) Measures of human capital and nonlinearities in economic growth. *Journal of Economic Growth*, 6, 229-254.

Kiker, B. (1966) The historical roots of the concept of human capital. *Journal of Political Economy*, 74(5), 481-499.

Krueger, A.; Lindahl, M. (2001) Education for growth? Why and for whom? *Journal of Economic Literature*, 39(4), 1101-1136.

Lee, J.; Lee, H. (2016) Human capital in the long run. *Journal of Development Economics*, 122, 147-169.

Levine, R.; Renelt, D. (1992) A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82(4), 942-963.

Liu, Z.; Stengos, T. (1999) Non-linearities in cross-country growth regressions: A semiparametric approach. *Journal of Applied Econometrics*, 14, 527-538.

Lucas Jr., R. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22, 3-42.

MacKellar, L.; Worgotter, A.; Worz, J. (2002) Economic growth of landlocked countries. In: Chaloupek, G.; Guger, A.; Nowotny, E.; Schwodiauer, G. (Eds.) *Okonomie in Theorie und Praxis.* Berlin: Springer.

Mamuneas, T.; Savvides, A.; Stengos, T. (2006) Economic development and the returns to human capital: A smooth coefficient semiparametric approach. *Journal of Applied Econometrics*, 21, 111-132.

Mankiw, N.; Romer, D.; Weil, D. (1992) A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407-437.

Masanjala, W.; Papageorgiou, C. (2004) The Solow growth model with CES technology: Nonlinearities and parameter heterogeneity. *Journal of Applied Econometrics*, 19(2), 171-201.

Mehta, A.; Felipe, J. (2014) Education and the journey to the core: Path dependence or leapfrogging? Manila: Asian Development Bank. (Working Paper no. 395).

Mehta, A.; Felipe, J.; Quising, P.; Camingue, S. (2009) Where have all the educated workers gone? Education and structural transformation in three Asian economies. Santa Barbara, CA: University of California-Santa Barbara, Center for Global and International Studies. (Working Paper).

Mehta, A.; Felipe, J.; Quising, P.; Camingue, S. (2011) Overeducation in developing countries: How can we test for it, and what does it mean? *Economics of Education Review*, 30(6), 1334-1347.

Mincer, J. (1970) The distribution of labor incomes: A survey with special reference to the human capital approach. *Journal of Economic Literature*, 8(1), 1-26.

Murphy, K.; Shleifer, A.; Vishny, R. (1991) The allocation of talent: Implications for growth. *Quarterly Journal of Economics*, 106(2), 503-530.

Nelson, R.; Phelps, E. (1966) Investment in humans, technological diffusion and economic growth. *American Economic Review*, 56, 69-75.

Nuxoll, D. (1994) Differences in relative prices and international differences in growth rates. *American Economic Review*, 84(5), 1423-1436.

Pasinetti, L. (1981) *Structural change and economic growth: A theoretical essay of the dynamics of the wealth of nations.* Cambridge: Cambridge University Press.

Pasinetti, L. (1993) *Structural economic dynamics: A theory of the economic consequences of human learning.* Cambridge: Cambridge University Press.

Peneder, M. (2003) Industrial structure and aggregate growth. *Structural Change and Economic Dynamics*, 13, 387-414.

Psacharopoulos, G. (1994) Returns to investment in education: A global update. *World Development*, 22(9), 1325-1343.

Psacharopoulos, G.; Patrinos, H. (2004) Returns to investment in education: A further Update. *Education Economics*, 12(2), 111-134.

Pritchett, L. (2001) Where has all the education gone? *World Bank Economic Review*, 15, 367-391.

Pritchett, L. (2006) Does learning to add up add up? The returns to schooling in aggregate data. In: Hanushek, E.; Welch, F. (Eds.) *Handbook of the Economics of Education, Vol. 1*. Amsterdam: North-Holland.

Rodrik, D. (2016) Premature deindustrialization. *Journal of Economic Growth*, 21, 1-33.

Romer, P. (1986) Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.

Romer, P. (1990) Endogenous technological change. *Journal of Political Economy*, 98(5-2), S71-S102.

Schultz, T. (1961) Investment in human capital. *American Economic Review*, 51(1), 1-17.

Silva, E.; Teixeira, A. (2011) Does structure influence growth? A panel data econometric assessment of "relatively less developed" countries, 1979-2003. *Industrial and Corporate Change*, 20(2), 457-510.

Solow, R. (1956) A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.

Szirmai, A.; Verspagen, B. (2015) Manufacturing and economic growth in developing countries, 1950-2005. *Structural Change and Economic Dynamics*, 34, 46-59.

Teixeira, A.; Queiros, A. (2016) Economic growth, human capital and structural change: A dynamic panel data analysis. *Research Policy*, 45(8), 1636-1648.

Temple, J. (1998) Robustness tests of the augmented Solow model. *Journal of Applied Econometrics*, 13(4), 361-375.

Temple, J. (1999a) A positive effect of human capital on growth. *Economics Letters*, 65, 131-134.

Temple, J. (1999b) The new growth evidence. *Journal of Economic Literature*, 37, 112-156.

Temple, J. (2001) Generalizations that aren't? Evidence on education and growth. *European Economic Review*, 45, 905-918.

Verspagen, B. (1991) A new empirical approach to catching-up or falling behind. *Structural Change and Economic Dynamics*, 2(2), 359-380.

Wacziarg, R. (2002) Review of Easterly's The elusive quest for growth. *Journal of Economic Literature*, 40, 907-918.

Appendix A

Table A1 - Main descriptive statistics of the variables

Variable	mean	std. dev.	min	max
GROWTH	1.540	2.611	-6.734	9.987
ln POP	1.889	0.200	1.293	3.049
ln GDP	9.728	1.084	7.043	12.892
ln INV	2.931	0.520	0.404	4.094
ln HC	1.151	0.691	0.016	2.628
low complex	0.476	0.281	0.016	1.163
mid complex	0.978	0.563	0.023	2.539
high complex	1.743	0.545	0.226	2.628
COMPLEX	0.093	1.064	-2.829	2.582
PRECIPITATION	1.139	0.741	0.051	2.926
TEMPERATURE	23.190	8.617	-0.600	35.600
LANDLOCKED	0.150	0.357	0.000	1.000
LINGUISTIC	0.366	0.295	0.000	0.923
RELIGIOUS	0.413	0.242	0.002	0.860
ln K	10.443	1.440	6.564	13.992

Appendix B

Over the decades, structuralist scholars have devoted their efforts to study the causes and consequences of economic structures and structural change. Even though the sophistication of productive structures has been a central idea in this tradition, measuring sophistication and making comparisons proved to be a very difficult task, what helps to explain why most studies tended to follow a prose style or to be largely descriptive, even when sound disaggregate statistics were available. For this reason, the Economic Complexity Index (ECI), put forth by a team led by economist Ricardo Hausmann and physicist Cesar Hidalgo in the *Atlas of Economic Complexity* (Hausmann et al., 2011) can be considered a breakthrough contribution to structuralism because it offers what this tradition lacked for a long time: a relatively simple way to quantitatively compare different productive structures.

The ECI assumes that a country's output reveals the degree of sophistication – or complexity – of its productive structure. According to Hausmann *et al.* (2011, p. 18), "increased economic complexity is necessary for a society to be able to hold and use a larger amount of productive knowledge".

The ECI should be ideally estimated using output data. However, the *Atlas of Economic Complexity* relies on international trade data because it is the only dataset that allows cross-country comparison at a very disaggregated level since it is produced under a standardised classification. This is a great advantage for the purposes of this chapter, as the ECI tends to be a meaningful indicator of a country's pattern of specialisation. However, the indicator has some limitations. The most important is that the ECI does not reflect production for the domestic market – for example, Brazil has a non-negligible production of wine, but since the country is not a big wine exporter, this is not reflected in the database. Other problem derives from the fact that these data are collected by customs offices, what implies that trade in services is not covered.

The ECI is estimated in steps. First, international trade data is used to calculate diversification and ubiquity. Diversification ($K_{c,0}$) is the number of products a country *c* exports with revealed comparative advantage (RCA). Ubiquity ($K_{p,0}$) is the number of countries that has RCA in a product *p*:

$$Diversification = K_{c,0} = \sum_{p} d\ RCA_{cp}$$

$$Ubiquity = K_{p,0} = \sum_{c} d\ RCA_{cp}$$

A country´s specialization pattern is revealed by the diversity and ubiquity of the products it makes. Complex or sophisticated products are less ubiquitous because only a few countries possess the requisites to produce them. In some cases, a product is ubiquitous due to its scarcity – rare mineral resources, for example. To differentiate these from the cases in which ubiquity is due to complexity, the index takes into consideration the other products the countries that produce that good are able to produce. If those countries produce only a few products, then ubiquity is probably due to rarity instead of complexity. Therefore, diversity (the number of goods a country produces) is used to correct the information carried by ubiquity, while ubiquity qualifies the information brought by diversity. This is done through an iterative process, that is described in the formulas below. After a few iterations, the process converges to two groups of measures: the product complexity index (PCI) and the country economic complexity index (ECI).

$$K_{c,n} = \frac{1}{K_{c,0}} \sum_{p} dRCA_{cp} \times K_{p,n-1}$$

$$K_{p,n} = \frac{1}{K_{p,0}} \sum_{c} dRCA_{cp} \times K_{c,n-1}$$

Machinery is produced in a few countries and the countries that produce them tend to be very diversified. Hence, machinery's PCI is high. On the other hand, crude oil and wood are produced by many countries and many of these countries are little diversified. Hence, their PCIs are low. Diamonds are produced by a few countries but since they are not very diversified the ubiquity of diamonds does not reflect complexity but rarity. Hence, diamonds' PCI is lower than machinery's, but it is higher than crude oil's[53].

Table B1 shows the most extreme values of the ECI found in the main sample used in the chapter. As expected, all the observations with the highest ECI belongs to advanced economies. In turn, the observations with the lowest ECI include some poor countries but also some high-income economies that are large oil producers.

[53] In 2010, the products with the highest and the lowest PCIs were *analogous instruments for physical analysis* (2.016) and *tin* (-3.113), respectively.

Table B1 - 20 observations with the highest and the lowest ECI in the sample

Country	Year	Complexity	Country	Year	Complexity
Japan	2005	2.582	Qatar	1970	-2.829
Japan	1995	2.409	Laos	1985	-2.783
Japan	1990	2.407	Nigeria	1980	-2.741
Japan	2000	2.352	Saudi Arabia	1980	-2.527
Sweden	1990	2.319	Nigeria	1975	-2.517
Germany	1995	2.274	Nigeria	1985	-2.464
Switzerland	1990	2.265	Saudi Arabia	1975	-2.435
Germany	2000	2.255	Nigeria	2005	-2.370
Switzerland	1995	2.249	Congo	1980	-2.147
Sweden	1995	2.200	Nigeria	1970	-2.126
Sweden	1970	2.146	Liberia	1985	-2.082
Japan	1985	2.143	Cameroon	1990	-2.053
United Kingdom	1990	2.138	Cameroon	1985	-1.989
Germany	2005	2.132	Côte d'Ivoire	1980	-1.984
United Kingdom	1970	2.132	Angola	1980	-1.979
Switzerland	2005	2.128	Uganda	1985	-1.935
Japan	1970	2.124	Angola	2005	-1.928
Switzerland	2000	2.123	Uganda	1975	-1.891
Austria	1990	2.101	Malawi	2000	-1.884
Switzerland	1970	2.081	Cameroon	1980	-1.864

CHAPTER THREE:

FDI, MULTINATIONALS AND STRUCTURAL CHANGE IN DEVELOPING COUNTRIES[54]

1. Introduction

The structuralist tradition defines economic development as a process in which output growth is accompanied by qualitative changes in the structures of production and employment (Kuznets, 1966). The direction of change is expected to follow Lewis' (1954) dual economy model, in which factors of production – particularly labour – move from the traditional, low-productivity sector, to the modern, higher-productivity sector of the economy[55]. As the traditional sector is viewed as stagnant, this move depends fundamentally on the 'pulling forces' accruing from the modern sector, whose growth is intrinsically associated with the accumulation of factors of production, particularly physical and human capital, and increases in their productivity, which in turn is determined by efficiency improvements and technological progress (Szirmai, 2005; Narula, 2018).

The hypothesis that countries could remain indefinitely trapped in a "vicious circle of poverty" was suggested by Ragnar Nurkse in 1953, based on the observation that low income leads to low savings, which leads to low investment, that leads to low productivity, that leads to low income, and so on and so forth (Nurkse, 1953). Foreign direct investment (FDI) might help countries to break out this vicious circle not only by complementing domestic savings and easing balance-of-payments constraints but, most importantly, by bringing better technologies and management practices that could improve productivity (Narula, 2014). Furthermore, FDI may leverage an "unbalanced growth" strategy (Hirschman, 1958) when a few key investments can stimulate further investments along the value chain. Increased demand for inputs can enable productivity gains due to higher specialisation and increasing returns to scale, thereby benefiting domestic firms in downstream sectors (Rivera-Batiz, 1990; Rodriguez-Clare, 1996; Markusen & Venables, 1999). In addition, the multinational enterprises (MNEs) may

---

[54] This chapter is a longer version of Pineli, Narula & Belderbos (2020), co-authored by Rajneesh Narula and Rene Belderbos. The PhD candidate made most of the work (>80%). The other authors contributed mainly as reviewers and commenters.

[55] Perhaps more appealing is Hirschman's (1958, p. 5) claim that development "depends not so much on finding optimal combinations for given resources and factors of production as on calling forth and enlisting for development purposes resources and abilities that are hidden, scattered, or badly utilized".

generate knowledge spillovers to domestic firms (Caves, 1974) and improve the allocation of resources in host economy by causing the exit of the less efficient producers (Melitz, 2003; Alfaro & Chen, 2018), thus contributing to enhanced aggregate productivity. All these elements would impact not only the rate of output growth, but also the structure of the economy.

This paper provides an overview of the extant knowledge about the relationship between MNE activity and economic development in developing countries. Following an introduction to the core theoretical and conceptual issues in the next section, the key findings of the empirical literature on the developmental effects of FDI are discussed in Section 3. The main contribution of the paper is presented in section 4, where the paucity of quantitative evidence on the relationship between FDI and structural change is addressed. Specifically, the aim is to investigate whether the development impact of FDI depends on its sectoral concentration and whether this relationship varies according to the stage of development of the country – two major suggestions emanating from the literature review. This is examined in a two-step approach. In the first step, long-run country-specific coefficients are estimated relating FDI to employment structure as an indicator of structural change. Next, a set of country characteristics and the sectoral concentration of FDI are employed to explain the heterogeneity observed in the FDI-structural change nexus across countries. This approach reflects both theoretical arguments and previous empirical findings suggesting that the relationship between FDI and development is highly country-specific. The results confirm such heterogeneity as well as the roles of the sectoral concentration of FDI and the development stage in partially determining it. Conclusions are presented in section 5.

2. MNEs, FDI and economic development in theory

2.1. FDI, domestic investment and economic growth

Since most empirical studies are underpinned by mainstream models of economic growth, it is worth briefly presenting how they view the differential effect of investments made by MNEs *vis-à-vis* investments made by domestic firms. In the neoclassical model (Solow, 1956), economic growth is a product of factor accumulation. As every dollar of investment has the same effect on growth whatever the source, there is no specific role to

MNEs – not even as a source of technology since technological improvement is exogenous to the model.

Conversely, in endogenous growth models there is scope for distinguishing different sources of investment according to their technological levels. Romer (1993, p. 543) states that "nations are poor because their citizens do not have access to the ideas that are used in industrial nations to generate economic value". MNEs are firms that have the potential to create and transfer knowledge across borders, both intentionally and unintentionally. If foreign MNEs bring more efficient technologies to host countries, their impact on growth would be higher than a quantitatively equivalent investment made by a domestic firm. Furthermore, endogenous growth models emphasise the roles played by specialisation (Rivera-Batiz, 1990), economies of scale (Romer, 1986) and human capital externalities (Lucas, 1988; Azariadis & Drazen, 1990) in the process of economic growth, all of them often related with the presence of foreign MNEs in the host economy.

2.2. FDI, comparative advantages and economic development

Another relevant issue is whether the development impact of FDI is contingent on its "nature". FDI projects can be broadly classified into two categories: FDI driven by factor-cost considerations – resource-seeking or vertical FDI – and FDI driven mainly by improved access to markets, often as a means of bypassing trade restrictions – market-seeking or horizontal FDI[56].

According to the proponents of the "dynamic comparative advantage theory of FDI"[57] (Akamatsu, 1961; 1962; Kojima, 1973; 1982; Kojima & Ozawa, 1984; Lee, 1990) – also known as the "international flying geese model" – FDI contributes to increased productivity, while also promoting positive structural change in both home and host

[56] Albeit being the two most relevant motivations for FDI in developing countries they are not the sole ones. For a contemporary discussion of FDI motives, see Cuervo-Cazurra, Narula & Un (2015).

[57] Besides this macroeconomic approach, the theoretical literature on why MNEs exist revolves around two microeconomic perspectives. A governance explanation is provided by the "internalisation school" (Buckley & Casson, 1976; Rugman, 1980; Hennart, 1982), which predicts that an MNE will emerge when a domestic firm internalises the cross-border market of an intermediate product, after weighting production costs against transaction, contracting, coordination and monitoring costs of different governance modalities, ranging from full internalisation to pure arm's length transaction. However, some influential scholars (Hymer, 1960; Dunning, 1977) argued that simply performing a value-adding activity overseas is not sufficient to transform a domestic firm in an MNE. The firm's internationalisation must be underpinned by some type of ownership-specific advantage because when competing in foreign markets, foreign firms face costs that local competitors do not incur. Thus, the "market power" theory of the MNE emphasises the role played by the control or access to proprietary assets (technology, brands, channels of distribution etc.) in conferring MNEs advantages over its competitors in host countries.

countries, when a firm whose home country has a comparative disadvantage in an industry invests in a host country with a comparative advantage in the same industry (Kojima, 1973; 1982; Kojima & Ozawa, 1984). For Kojima (1973; 1982; 2000), this type of FDI improves the allocation of resources and enhances trade. The "wrong" type of FDI overlooks countries' comparative advantages, driven by trade barriers under oligopolistic structures.

This comparative advantage-based reasoning has recently been revived by Lin & Chang's (2009) debate on whether development effects are greater by conforming to comparative advantage, or by defying it[58]. Lin (2010) argues that an economy's optimal industrial structure is endogenous to its comparative advantage, so that upgrading industrial structure follows a change in its endowment structure. Lin & Monga (2011) propose that following comparative advantage is the optimal strategy to optimise capital accumulation[59]. In the same way as in the flying-geese model, FDI may assist development if it is oriented to industries in which the country has comparative advantage, otherwise it can promote inefficiency[60]. The structuralist tradition, on the other hand, views prevailing economic structures acting as obstacles to economic development (Prebisch, 1949)[61]. FDI can reinforce the patterns of comparative advantage, locking-in countries to low productivity activities[62].

---

[58] For a comprehensive discussion of the role played by factor endowments in economic development, see Dosi & Tranchero (2020).

[59] Lin & Monga (2011) suggest that the state should act to identify new industries in which the country may have latent comparative advantage, remove the constraints that impede the emergence of those industries and create the conditions to allow them to become the country's actual comparative advantages, with the countries that have preceded them being a useful reference as to which industries might offer latent comparative advantages. If domestic firms are absent in industries in which the country has latent comparative advantages, the government could adopt specific measures to attract foreign investors that may have incentives to relocate their production to lower-cost locations. Nonetheless, Chang & Andreoni (2016) consider Lin & Monga's (2011) approach inconsistent because it recommends adhering to comparative advantage while recognising the need to deviate from it.

[60] Lin & Monga's (2014) evaluation that Latin American countries' import-substitution strategies failed in achieving structural transformation because they gave priority to the development of the capital-intensive heavy industry, when those economies were capital-poor, is quite similar to Kojima's (2000).

[61] The so-called Latin American structuralism (Prebisch, 1949) divided the world into two groups of countries – the centre and the periphery – which differ from each other in terms of technological capabilities. In the periphery, there is a reinforcing mechanism linking technological capabilities and patterns of specialisation. Upgrading is obstructed because learning is highly dependent on what the economic agents produce (Porcile, 2020). The low income-elasticity of the products usually exported by developing countries would impose a deterioration of their terms of trade *vis-à-vis* the advanced nations and bind their rate of economic growth consistent with long-run equilibrium in the balance-of-payments. The remedy for this situation would be a development strategy less dependent on international trade, which would focus on the building up of a manufacturing sector that would replace imports by goods produced domestically.

[62] Lee (2013) distinguishes low-income from middle-income countries in respect to the best development strategy. Specialisation according to comparative advantage may be advantageous to low-income countries but is less suitable for middle-income countries that have already passed initial stages of growth by technology emulation. In his view, sustained catch-up requires not only an engagement with mature

2.3. The coevolution of FDI and economic structure

MNE activity can influence the economic structures of host economies but it is also affected by structural transformation. The investment development path (IDP) framework (Dunning, 1981; Dunning & Narula, 1996; Narula, 1996; Narula & Dunning, 2010), states that the quantity and the quality of FDI a country receives (and sends abroad) changes as its domestic firms accumulate assets that enhance their capacity to explore economic opportunities and to compete with firms from other countries, the country's location advantages change relatively to other countries' location advantages and the market failures that make hierarchies (internalisation) to be preferable to market transactions change. According to the IDP, the relationship between FDI and economic structure follows five stages that are likely to be observed in every country but whose transition points, in terms of the country's level of development, cannot be determined *a priori*, since they depend on several aspects, such as geography, natural resource wealth or institutional development, that are unique to each country.

A stages-of-development approach to the relationship between FDI and economic structure is also present in Ozawa (1992), where three sequential stages of economic development are identified: factor-driven, investment-driven and innovation-driven. Following the logic of the flying-geese model, he advocates a stages-compatible order of sequential structural upgrading, instead of a development strategy that defies comparative advantage. MNEs contribute to development if they help to align the economic structures of countries with their comparative advantages determined by factor endowments.

3. An assessment of empirical studies on the development effects of FDI[63]

Given the lack of quantitative studies relating FDI and structural change, this section focuses on the main findings of two related streams of literature. The first aims to analyse

industries, but also an effort to leapfrog into emerging industries that are new to both advanced and developing countries.

[63] FDI and MNE activity are largely regarded as synonyms in the empirical literature. This is because most statistics collected and published by national governments and multilateral institutions are still based on the balance-of-payments definition of FDI – which is confined to equity investments, reinvested earnings and intra-firm loans. However, that equivalence is false since MNEs can engage in cross-border value-adding activities through arrangements that does not necessarily involve FDI such as those related to the control of global value chains (GVCs). Since data on other modes of MNE activity is still scarce and, even when it exists, is hardly comparable across countries, this paper follows the extant literature and considers FDI and MNE activity as synonymous.

how the presence of foreign MNEs affect the domestic actors in an economy, through linkages, externalities and spillovers, using in most cases firm-level data in a single-country context. The second deals with the relationship between FDI and economic growth, in a cross-country setting. It is important to underline that these micro and macro approaches complement each other – while the latter allows the assessment of the effects of local conditions on the way that FDI foster economic development, the former is needed to investigate the mechanisms through which FDI affect host economies.

3.1 FDI linkages, externalities and spillovers

Considering that MNE affiliates tend to be more productive than their domestic counterparts, which can be largely explained by their differences in terms of size, assets and capabilities[64], aggregate productivity tends to rise when MNEs gain market share in host countries (Melitz, 2003). However, such direct effects of MNE presence have attracted much less academic interest than the indirect effects.

The presence of a foreign MNE in a host country produces external effects on other economic agents, including affiliates of other foreign MNEs and domestic firms, through four (main) channels: i) competition[65]; ii) demonstration/imitation[66]; iii) labour turnover[67]; iv) and backward and forward linkages[68]. FDI externalities can be of the

[64] For a comprehensive review of the empirical literature on the differences between domestic and foreign-owned firms, see Bellak (2004).

[65] The competition effect produces mostly pecuniary externalities, which may affect competitors (horizontal) as well as suppliers and buyers (vertical), in both product and factor markets. By reducing the monopoly power of domestic firms in some sectors, the entry of MNEs may contribute to enhance allocative efficiency (Caves, 1974). Although it may encourage domestic firms to be more efficient, more competition means fewer opportunities to exploit scale economies, with possible (negative) effects on sectoral productivity (Aitken & Harrison, 1999). The composite effect on competing domestic firms tends to be negative. They may be crowded-out by foreign competitors. However, if higher competition translates into lower prices or increased quality, existing domestic firms in downstream sectors will benefit, and new ones may enter the market (crowding-in effect).

[66] Production techniques and managerial practices used by the MNE may be more efficient than those used by domestic firms – indeed, the ownership of distinctively superior assets is a necessary condition for the occurrence of FDI according to the market power theory of the MNE (Hymer, 1960; Dunning, 1977). Their use by the MNE "demonstrates" their superior attributes, and local competitors are able to observe and imitate them.

[67] MNEs train their local employees, who accumulate managerial and technical know-how. This acquired knowledge leaks from the MNE when workers move to a collocated competitor or start their own firm. However, MNEs seek to minimise such spillovers often by paying above-market salaries to retain such employees (Fosfuri, Motta & Ronde, 2001), as has been confirmed over the years in countries such as Mexico and Venezuela (Aitken, Harrison & Lipsey, 1996), Indonesia (Lipsey & Sjoholm, 2004) and China (Chen, Ge & Lai, 2011).

[68] The presence of the MNE may affect local firms that can supply inputs or buy their intermediate products. The MNE's production itself increases supply for downstream sectors, possibly bringing prices down. Furthermore, the increased demand created by the MNE may enable domestic suppliers to benefit from scale and specialisation economies, ultimately benefiting any firm that use the same inputs, including the

pecuniary type – that is, are transmitted through prices in the market – or can constitute (non-pecuniary) knowledge externalities, with these two types difficult to disentangle (Castellani, 2012; Belderbos & Mohnen, 2013).

Besides these indirect (and mostly unintentional) effects, domestic firms may be affected by intentional measures undertaken by foreign MNEs to establish linkages with them. Through these linkages[69], MNEs can provide technical, managerial and financial assistance to their suppliers, for example. As the MNE expects a benefit from this type of relationship, it has incentives to create and deepen backward linkages. However, the absorption of knowledge through linkages with foreign MNEs, as well as the internalisation of true FDI knowledge spillovers, requires costly efforts by host country's domestic firms (Narula & Driffield, 2012; Zanfei, 2012).

The hypothesis that MNEs produce significant external effects on domestic firms has been under intense scrutiny over the last three decades. Empirical findings are quite diverse and, on some issues, inconclusive. What a meta-analysis of productivity spillovers studies (Havranek & Irsova, 2011) shows with some clarity is that the presence of foreign MNEs tends to be associated with substantial improvements in the productivity of their local suppliers. There is also evidence that the survival odds of domestic firms in Czechia and Vietnam (Ayyagari & Kosova, 2010; Kokko & Thang, 2014) is enhanced by the presence of MNEs in downstream industries. Much less clear, however, is the effect of foreign MNEs on the productivity of their domestic buyers. On average, forward vertical spillovers appear economically irrelevant, but there is large variation across countries (Havranek & Irsova, 2011)[70].

Another relevant issue is whether foreign MNEs crowd-out domestic firms (in the same industry) or, on the contrary, their presence produces a crowding-in effect. The available evidence is also quite inconclusive. Studies point to crowding-out in Vietnam (Kokko & Thang, 2014), crowding-in in Czechia (Ayyagari & Kosova, 2010), and no effect at all in Turkey (Taymaz and Ozler, 2007; Ferragina, 2014). The impact seems to vary over time. In Czechia, crowding-out prevails in the short-run, due to increased

MNE's own competitors. Therefore, backward linkages entail positive horizontal productivity externalities, besides the more obvious vertical ones (Rodriguez-Clare, 1996; Markusen & Venables, 1999).

[69] Lall (1980) defines linkages as the "direct relationships established by firms in complementary activities which are external to 'pure' market transactions" (Lall, 1980, p. 204). This definition is narrower than Hirschman's (1958) classic definition of linkages as it precludes any non-intentional effect such as pecuniary externalities.

[70] It must be underlined that empirical studies on FDI spillovers are (generally) incapable of distinguishing between pecuniary externalities, knowledge spillovers and (intentional) knowledge transfers.

competition, but as time allows knowledge spillovers to take place, crowding-in becomes the norm (Kosova, 2010). However, we do not yet know what circumstances cause crowding-in to prevail over crowding-out. Some indication on this matter is provided by Munemo (2017). Using country-level data he finds that FDI seems to stimulate domestic entrepreneurship in developing countries only when financial development surpasses a certain threshold[71].

The effects of MNEs' presence on the productivity of their domestic competitors tend to be negligible (Irsova & Havranek, 2013). This is not surprising given that negative and positive spillovers transmitted through different channels are likely to cancel each other out. In addition, the available evidence does not suggest any moderating role of country-specific regulations on business, investment, financial or labour issues (Farole & Winkler, 2014). In contrast, the occurrence of export spillovers has been identified for countries as diverse as Chile (Duran & Ryan, 2014), Venezuela (Aitken & Harrison, 1999), China (Chen, Cheng & Findlay, 2013), Poland (Cieslik & Hagemejer, 2014) and Vietnam (Anwar and Nguyen, 2011)[72].

An important recent contribution to this line of research, and the first that effectively touches upon the issue of structural change using firm-level data, is Javorcik, Lo Turco & Maggioni (2017). Using Hausmann *et al.*'s (2011) concept of product complexity to make the quality of different products quantitatively comparable, they investigate how the presence of MNEs affects Turkish domestic firms' product portfolios. Their results indicate that foreign affiliates in downstream sectors do not affect the likelihood of new products being introduced by domestic firms, but their presence affects the complexity (or degree of sophistication) of the new products. Similar effects are not found when FDI takes place in the same or in upstream sectors. They conclude that the interactions between MNEs and their local suppliers boost the latter's ability to upgrade their production structures. Positive effects are associated with FDI from high income countries, rather than FDI in general. The smaller and the less sophisticated domestic firms are the most benefited by interactions with MNEs.

---

[71] It must be underlined, however, that the proxy used does not enable identifying the industries the new domestic firms belongs to.

[72] In the case of China, the presence of foreign MNEs increases the probability of domestic firms' initiation on a new export market (Mayneris & Poncet, 2015) and the survival odds of an export market (Swenson and Chen, 2014). Furthermore, the positive influence seems to be more relevant for penetrating in "difficult" markets, defined as countries with poorer institutional quality and/or tougher import procedures (Mayneris & Poncet, 2011).

Regarding structural change, the establishment of linkages with domestic actors is probably the most important indirect effect of the presence of foreign MNEs in host economies[73]. A key issue is whether foreign MNEs behave differently from domestic firms in terms of backward linkages with the domestic economy. Alfaro and Rodriguez-Clare (2004) find that MNE affiliates operating in Brazil, Chile, Mexico and Venezuela source a lower share of their inputs domestically compared to local firms. However, the value of their domestic purchases of inputs per worker employed is higher than the same ratio observed among domestic firms, except in the case of Mexico. Jordaan (2011) finds that MNE affiliates are more supportive of their suppliers than domestic Mexican firms, particularly in respect to the improvement of suppliers' production processes.

The motivation for FDI is one of the key determinants of linkages and spillovers. In general, domestic-oriented affiliates tend to create more linkages than export-oriented affiliates because they are less dependent on low cost inputs to be competitive (UNCTAD, 2001). However, if FDI is focused on the domestic market but mainly motivated by tariff-jumping, and trade restrictions are limited to final products, a likely side-effect will be an increase of imports of intermediate goods from parent company or other suppliers in home country (Belderbos, 1997; Belderbos & Sleuwaegen, 1998), thus diminishing the potential for linkage creation. Indeed, Belderbos, Capannelli & Fukao (2001) provide evidence that Japanese MNEs' affiliates established to circumvent trade barriers create fewer vertical linkages in the local economy.

The quality of linkages is certainly at least as important as their quantity. The nature of the relationship between foreign affiliates and domestic agents, that is the extent to which resources and knowledge are transferred between them, is key to the enhance the potential for learning, improvement and upgrading (Giroud & Scott-Kennel, 2009). High levels of local sourcing do not necessarily result in technological learning by local suppliers (Ivarsson & Alvstam, 2005). For this reason, Merlevede & Schoors' (2009) finding that backward vertical spillovers are generally positive in Romania but

[73] Most studies on FDI linkages are still based on qualitative case studies. If, on the one hand, this research technique permits a deeper understanding of the mechanisms of linkage formation and its dynamic evolution, on the other hand it hinders a generalisation of the findings since the specificities of each industry or region are hardly found elsewhere. In turn, the quantitative literature on FDI linkages is relatively underdeveloped, probably reflecting the difficulty of collecting reliable data in developing countries. Nonetheless, there are clear limits to quantitative approaches to the study of linkages because it is difficult to measure the transfer of tacit knowledge. For this reason, this section reviews both quantitative and qualitative studies.

significantly larger among export-oriented industries does not cause surprise, even considering that MNEs in these industries tend to source less inputs locally (UNCTAD, 2001).

Other important issue is the differential linkage impact of different “types” of MNE affiliates. In the context of four European transition economies, Jindra, Giroud & Scott-Kennel (2009) find that the share of inputs sourced locally is positively associated with the affiliates’ levels of autonomy, initiative and technological capability. Similarly, Giroud & Mirza (2006) find that MNE affiliates that play a strategic role (R&D or marketing) tend to source more locally than affiliates that solely run a production plant in four Southeast Asian countries. In a study of Taiwanese MNEs investing in the US, China and Southeast Asia, Chen, Chen & Ku (2004) find that investors in a producer-driven network are more likely to build local linkages than their counterparts in buyer-driven networks because the former have more power to promote innovations in the network. According to Driffield & Noor (1999), MNEs in the Malaysian electronics sector that employ significant numbers of local managers and engineers source more locally, what they attribute to the fact that their superior knowledge of local economy reduces transaction costs of trading with local firms in comparison to MNEs that employ large numbers of expatriates. The willingness of MNE affiliates to develop local linkages is also affected by technology sophistication, economies of scale, country experience, geographic proximity to parent firm/other affiliates, and market power (Altenburg, 2000). The business culture of the home country also affects the extent and depth of linkages. Japanese MNEs seem to find it more difficult to establish linkages with domestic firms, but once they do so these tend to be more intense compared to American MNEs (UNCTAD, 2001).

The breadth and depth of the linkages forged by MNEs in developing countries – as well as the extent to which potential spillovers materialise – are also contingent on the characteristics of the domestic sector. Chief among these seems to be the absorptive capacity of domestic firms, or their ability to internalise knowledge created by others (Narula & Marin, 2003). Spillovers need to be internalised and this is not a costless process (Narula & Driffield, 2012). As highlighted by Ivarsson & Alvstam (2005), even embodied elements of technology can only be used at best practice levels if they are complemented by tacit elements that need to be developed locally, what means that investment in physical capital is not sufficient to upgrading. Available evidence (Görg & Strobl, 2001; Narula & Marin, 2003; Blalock & Simon, 2009; Castillo, Salem & Moreno,

2014) indicates that firms with higher absorptive capacity indeed benefit more from foreign presence. The inadequacy of considering domestic firms as a homogeneous group is underlined by Pavlinek & Zizalova's (2016) study on the Czech automotive industry: although the presence of foreign car assemblers benefits most domestic firms in backward industries through demonstration effects, low absorptive capacity prevents most domestic firms from benefiting from direct knowledge transfer from MNEs.

Host countries' characteristics influence the type of activities conducted by MNE affiliates, and thus limit or enhance the potential for linkages development (Lall & Narula, 2004). In a study of Japanese electronic MNEs, Belderbos, Capannelli & Fukao (2001) find that host country's quality of infrastructure and the size of local components industry positively affect the extent of backward linkages. Local content requirements positively affect the level of local procurement, as expected, but do not affect the procurement from domestically owned suppliers[74]. The presence of supporting institutions that provide, for example, training and quasi-public goods, is a key determinant of the strength of the linkages between MNEs and suppliers, as they affect the building of absorptive capacity of local firms (Rasiah, 2003). When such institutions are absent, MNEs may prefer to integrate vertically or source inputs from abroad.

From a developmental point of view, changes in business culture and practices fostered by MNEs in developing countries are particularly important. As shown by Okada (2004), the introduction by MNEs of performance-based contracts with stringent requirements promoted changes in the patterns of skill development of indigenous suppliers in the Indian automotive industry (Okada, 2004). Duanmu & Fai (2007) emphasise that as technical and managerial techniques are transferred by MNEs to their local suppliers, the business ideology of the suppliers evolves because MNEs need to explain and convince them why those techniques are important.

Case studies help to clarify the evolutionary nature of linkages between MNEs and domestic firms. From their study of the electronics industry in China, Duanmu & Fai (2007) identify three stages of the relationship development: initiation, development and intensification. Transition between them depends fundamentally on the upgrading of domestic suppliers' capabilities and the increase of mutual trust. Moving from the second to the third stage also involves changes in the motivation of FDI – increasingly strategic

[74] Interestingly, high local content requirements exert a deterrent effect on foreign investment by Japanese MNEs. However, Japanese MNEs are more likely than American MNEs to bring their home country suppliers with them when investing in a production plant abroad (Hackett & Srinivasan, 1998).

asset-augmenting instead of solely low-cost labour-seeking – as the local suppliers convert themselves into partners in technology development. A similar evolutionary pattern appears in Giroud (2007), who finds that, as local suppliers' capabilities improve owing to knowledge transfer from MNEs, domestic firms in Malaysia engage in new joint tasks with MNEs, such as joint design of inputs.

Summing up, it can be said that the presence of foreign MNEs potentially affects both the macro and micro structures of host economies, although the materialisation of such potential depends on several factors, most of which very context-specific. MNEs' operations generate demand for inputs, skills and capabilities, thus opening up opportunities to the emergence of new backward industries. Similarly, their production can be utilised by domestic actors as inputs in new forward industries. The provision of direct assistance, as well as the occurrence of (unintentional) knowledge spillovers, may generate productivity gains for domestic firms, thus enhancing their competitiveness and survival odds. The presence of foreign MNEs also induces intra-industry firm selection and market share reallocation (Alfaro & Chen, 2018), giving rise to productivity differentials across industries. The combined effects on the micro (industry-level) structures ultimately affects the macro structure.

3.2 FDI and economic growth

There is a substantial empirical literature on the relationship between inward FDI and GDP growth. Most studies find a positive correlation between these variables, particularly among developing countries. Nonetheless, such an association might not be taken for granted, as it is likely to depend on key characteristics of host countries.

Particularly relevant is Balasubramanyam, Salisu & Sapsford's (1996) finding that, in the period 1970-1985, FDI contributed to growth only in developing countries that followed an export promotion strategy, while developing countries that persisted with import-substitution strategy did not reap the benefits of FDI in terms of enhanced growth. In outward-oriented economies, economic policy was largely trade-neutral, FDI was driven mainly by factor prices and, thus, fostered economic efficiency. In inward-oriented countries FDI, was motivated by trade barriers. Excessive protection led to x-inefficiencies and misallocation of resources.

Another influential study is Borensztein, De Gregorio & Lee (1998). Their results show a positive correlation between FDI and GDP growth within a sample of developing countries, but the size of the effect is dependent on the availability of human capital in the host economy. This suggests that a country needs adequate absorptive capacity to be able to benefit from the inflow of superior technologies brought along by foreign investors.

Another factor that seems to moderate the effect of FDI on GDP growth is the level of financial development of the host country. Alfaro *et al*. (2004) and Durham (2004) find that a positive association between FDI and economic growth only takes place among countries that have reached a minimum level of financial development. This suggests that potential FDI externalities rarely materialise when local entrepreneurial development is restricted by limited access to credit markets (Alfaro, Kalemli-Ozcan & Sayek, 2009)[75].

Some studies analyse whether the institutional environment influences the relationship between FDI and economic growth. Alguacil, Cuadros & Orts (2011) find that the FDI-growth nexus is stronger among a group of low and lower-middle income countries when the Economic Freedom index is lower. They justify their finding on the basis that in these economies the shortage of capital means that FDI is the only option to increase the rate of accumulation. In these countries FDI would be less likely to crowd-out domestic investment. Jude & Levieuge (2017) employ several measures of institutional quality and find a positive association between FDI and GDP growth only for countries above certain thresholds of institutional quality. However, the effect of FDI on growth seems to be independent of the levels of political stability and control of corruption. Harms & Meon (2012) distinguish FDI flows in the form of greenfield projects from mergers and acquisitions (M&As). While greenfield FDI has a positive impact on GDP growth among developing countries, M&As has no effect. They fail to find any moderating role to control of corruption and political rights.

Despite the relevance of the cited studies, a few econometric issues cast doubt on their findings. Blonigen & Wang (2005) question the adequacy of pooling data from advanced and developing economies in the same sample, as done by Alfaro *et al.* (2004) and Durham (2004), among others[76]. Studies have also indicated that the causality between FDI and growth can be mutual (Basu, Chakraborty & Reagle, 2003; Li & Liu,

[75] According to Javorcik & Spatareanu's (2009) study, credit-constrained domestic firms are hindered from becoming MNE suppliers in Czechia.
[76] When replicating Borensztein, De Gregorio and Lee's (1998) study with a sample that includes advanced countries, Blonigen & Wang (2005) fail to find the positive effects of FDI on growth found in the original study that included only developing countries.

2005; Hansen & Rand, 2006) or even reverse, as found by Basu, Chakraborty & Reagle (2003) for a group of relatively closed developing economies. Another problem that is often overlooked, but was pointed out by Choe (2003), is the overwhelming influence of outliers on the results of cross-country growth regressions. Finally, the restrictive structure imposed in most econometric specifications may exert a big influence on the results. Indeed, FDI is found to exert no effect (Carkovic & Levine, 2005) or even to be harmful to growth (Herzer, 2012) when country-specific heterogeneous effects are accounted for. Possibly the most important lesson to be extracted from the extant literature is that the relationship between FDI and growth cannot be captured by a single regression coefficient because it seems to be quite heterogeneous across countries. This is precisely the conclusion of Kottaridi & Stengos (2010, p. 866-7), who after estimating a semi-parametric model, affirm that "it appears that the way FDI affects growth differs across and within countries. The relationship seems to be complex and the impact varies according to a country's level of FDI. (…) parameter heterogeneity may exist in the sense that the effect of a change in a particular variable is not the same. (…) In other words, there exists a different FDI-growth nexus in different countries".

4. A new look on the relationship between FDI and structural change

The empirical literature reviewed in previous section is intended to enhance the understanding of the development effects of FDI, although the issue of structural change is seldom addressed directly. The apparent disinterest on the topic has certainly been influenced by the lack of adequate FDI data at the industry level – or even the sector level – for a relatively lengthy period and for a reasonable number of developing countries. In such a scenario, resorting to aggregate FDI data may be considered an acceptable alternative. The main objective of the empirical exercise presented in this paper is to investigate whether MNE activity can be associated to structural change in developing countries hosting the activities and under what circumstances. More specifically, it examines the potential influence of FDI on the move of the labour force from the traditional sector to the modern sector of the economy.

The literature reviewed in section 2 proposes, on the one hand, that FDI can promote structural change when it conforms to comparative advantages. On the other hand, the older structuralist tradition (*a la* Prebisch) argues that prevailing economic structures are impediments to overcoming underdevelopment. Empirically examining either view is difficult given the data limitations. It would require an FDI database that classifies investments at the individual establishment level according to the main factors of production employed. A specific manufacturing plant can require quite different factors of production depending on the activities that are performed in the country. Upstream activities such as R&D are intensive in skilled labour, while other manufacturing processes are intensive in physical capital, or semi-skilled labour. However, no available databases provide this level of detail, as investments are only distinguished by broad industry classifications. Given the available data, the best that can be done is a sectoral classification distinguishing FDI into the traditional sector, the manufacturing sector and the non-manufacturing modern sector. Thus, the main hypotheses to be tested in the following analysis are whether the development impact of FDI depends on its sectoral concentration and whether this relationship varies according to the stage of development of the country, as suggested by the stages-of-development approaches to FDI, such as Ozawa's (1992) framework and the IDP. In addition, the paper builds on the empirical literature reviewed in section 3.2 to identify other factors that may help to explain the differences in the FDI-structural change nexus across countries.

4.1. The empirical model

The analysis is undertaken in two steps. In the first step, a panel time-series method is employed to estimate country-specific long-run coefficients relating FDI to employment in the modern sector. In the second step, a set of variables is employed to explain the cross-country differences verified in the first step. This procedure seems preferable to a standard panel data estimation with interaction terms because it is much more in the spirit of the IDP framework, which highlights the idiosyncratic nature of the relationship between the level of MNE activity associated with a country and its level of economic development (Narula, 1996; Narula & Dunning, 2010). Furthermore, empirical studies (Kottaridi & Stengos, 2010; Herzer, 2012) that allow for heterogeneity beyond simple interaction terms have shown that the FDI-growth nexus varies substantially across countries.

Since there is no formal theoretical model explicitly relating the share of employment in the modern sector to MNE activity in a country, an empirical model is specified based on the usual aggregate production function. With the employment share of the modern sector replacing output in the left-hand side, this leads to equation 1:

$$\frac{MODEMP_{it}}{WAP_{it}} = \alpha_i + \delta_i t + \beta_1 \ln\left(\frac{FDI_{it}}{WAP_{it}}\right) + \beta_2 \ln\left(\frac{DK_{it}}{WAP_{it}}\right) + \beta_3 \ln(HC_{it}) + u_{it} \qquad (1)$$

The rationale of the model is the following: in dual economies, economic growth comes from two sources: i) increases in capital/labour ratios and technological progress in the modern sector; ii) labour force movements from the stagnant traditional sector to the modern sector. Even considering that additions to the physical capital and human capital stocks as well as technological upgrading tend to be labour-saving, it is assumed that the widening of the productivity gap tends to drain factors of production from the traditional to the modern sector, as pointed out by Lewis (1954)[77]. Thus, as pulling factors dominate pushing factors in driving labour out of the traditional sector, it can be assumed that the same factors that determine the aggregate output level are likely to determine the level of employment in the modern sector. However, this association is not automatic. Rapid economic growth can take place with negligible labour movements – this is usually what happens when a developing country discovers large oil reserves[78]. Thus, the way that FDI and other growth determinants affect the employment structure depends on how they affect the demand for labour of the leading industries in the modern sector.

The working age population is used as denominator in calculating the modern sector share in employment (instead of the number of persons employed) because official employment statistics rarely capture the large contingent of subsistence workers in developing countries. The same variable is used to bring the FDI stocks and domestic capital stocks to a "per worker" basis. In respect to human capital, the paper follows the approach proposed by Hall & Jones (1999), in which human capital stock per working age person is an exponential function of average years of schooling, where the function ϕ(s) reflects the efficiency of a unit of labour with *s* years of schooling relative to one with no schooling, and its derivative is the return to schooling estimated in a Mincerian regression.

$$HC_{it} = e^{\phi(s_{it})} \qquad (2)$$

The empirical model also includes country-specific constants and time trends (*t*) to reflect country-specific factors not captured by the explanatory variables. Ideally, equation 1 should include some measure of technology because structural change is likely

[77] The historical experience of today's developed countries indeed indicates that, at least in initial development stages, technological advancement in the manufacturing sector drives labour movement out of (traditional) agriculture (Alvarez-Cuadrado & Poschke, 2011).

[78] Employment is used instead of output because it better captures the dual economy nature of developing countries.

to be affected by technological upgrading. Nonetheless, there is no simple way to measure the technological level of a country, particularly for developing countries where technological upgrading is based much more on imitation rather than on innovation. In microeconomic studies, total factor productivity (TFP) is often used as a measure of technological gap. However, its use in cross-country analysis is even more controversial than in the firm-level context because the residuals of the aggregate production function reflects not only technological level, but allocative and productive efficiency as well as the economic structure of the countries.

4.2 Data

The dataset used in the analysis is comprised by 28 developing countries over the period 1980-2010. Definitions of the variables as well as their respective sources are presented in table 1.

Table 1 - Description of variables and sources

Variables	Description	Source of data
MODEMP	Employment in the modern sector *Number of persons engaged*	Groningen Growth and Development Centre
WAP	Working age population *Number of persons aged 15 to 64*	World Development Indicators
FDI	FDI stock *Data on FDI/GDP is used to estimate FDI stock at PPP*	United Nations Conference on Trade and Development
DK	Domestic physical capital stock *Data on total physical capital stock and on FDI is used to estimate DK at PPP*	Penn World Table 9.0 (total physical capital stock)
HC	Human capital per working age person *Index based on average years of schooling of the WAP and returns to education* *A unit is subtracted from the Penn World Table HC index so that HC=0 when average years of schooling=0*	Penn World Table 9.0
credit/GDP	Financial development *Credit to the private sector/GDP*	World Development Indicators
trade/GDP	Openness to trade *(Exports+imports)/GDP*	World Development Indicators
control of corruption	Control of Corruption *Indicator that ranges from -2.5 to +2.5* *Higher values mean lower perceived corruption*	Worldwide Governance Indicators
FDI manufacturing	Manufacturing ratio in FDI	FDI Markets
FDI non-manufacturing modern sector	Non-manufacturing modern sector ratio in FDI	FDI Markets
FDI traditional sector	Traditional sector ratio in FDI	FDI Markets
	Data on capital expenditure of projects registered in FDI Markets database is used *The database covers the period 2003-2010* *For a considerable part of the projects, capital expenditure is estimated by FDI Markets team*	

Given the inadequacy of the data for some key concepts used in the empirical exercise, a few adaptations are needed. First, what constitutes the traditional sector and the modern sector of an economy has to be redefined because the classical structuralist definition (Lewis, 1954) is not reflected in the available statistics, which disaggregate economic activity according to conventional industry-level classification. According to the definition adopted in this paper – which follows closely Lavopa & Szirmai (2018; 2020), who distinguish industries based on a few key characteristics such as their potential for scale economies and technological upgrading – the modern sector comprises all the economic activity undertaken in mining, manufacturing, utilities, construction, transport, storage and communication, finance, insurance, real estate and business services. In turn, the traditional sector comprises all the economic activity undertaken in agriculture, trade, restaurants and hotels, government services, and community, social and personal services.

This redefinition clearly bears some degree of arbitrariness since, for example, highly mechanised export-oriented agriculture exists in developing countries and cannot be labelled traditional in the structuralist sense. However, as the focus of the empirical exercise is on employment, the distortions are less relevant than they would be in the case of output.

For the estimation of equation 1, countries' total physical capital stocks are divided into domestically-owned physical capital and foreign-owned physical capital. Since there is no data on the latter, FDI stocks are used as proxy, while domestic-owned capital stocks are obtained by subtracting FDI stocks from the total physical capital stocks. Using this criterion in a conventional growth regression in which the investment rate belongs to the set of explanatory variables could be problematic because FDI flows do not necessarily translate into capital formation (Farla, Crombrugghe & Verspagen, 2016). The concept of FDI relates to international financial flows and the respective statistics are drawn from the balance of payments, not from national accounts. Part of these financial flows is used to acquire existing assets instead of creating new ones. However, as the explanatory variables of this empirical exercise refer to capital stocks instead of flows, the potential measurement errors are attenuated because even acquired productive assets add to the stock of foreign-owned physical capital.

4.3 Results

The coefficient of interest in equation 1 is β_1. A positive β_1 means that a higher level of FDI/WAP is associated with a higher level of MODEMP/WAP. Thus, if a higher share of the modern sector in employment is assumed as a welcome structural change (Lavopa & Szirmai, 2018; 2020), a positive β_1 can be interpreted as a signal that FDI contributes to economic development.

As statistical tests suggest that all the variables in equation 1 have a unit root and are cointegrated[79], using conventional panel data estimators is not recommended as they may produce spurious results. Instead, the panel dynamic ordinary least squares (PDOLS) estimator proposed by Pedroni (2001)[80] is used to estimate the long-run (cointegration)

---

[79] Panel unit root tests and panel cointegration tests are presented in the Appendix A.

[80] A remarkable advantage of the PDOLS is that it grants more flexibility to account for heterogeneous cointegrating vectors across countries than other estimation techniques that usually impose a unique cointegration vector for every country. In addition, by including lead and lag differences of the regressors, the PDOLS account for serial correlation and endogeneity of the regressors. This feature is important in the present context because, as underlined by the IDP framework, FDI affects economic structure but is also

relationship of the variables. Table 2 shows the results of the PDOLS estimation of equation 1. The mean-group estimator, which simply averages the individual countries' coefficients, indicates a positive association between FDI and employment structural change across the sample of developing nations. Doubling the FDI/WAP ratio would imply, on average, an increase of half a percentage point in the MODEMP/WAP ratio.

Table 2 - PDOLS estimation of equation 1 - Group mean

variable	coefficient	t-stat
ln (FDI/WAP)	0.00548	8.35
ln (DK/WAP)	0.02574	8.50
ln (HC)	0.05129	1.31

Notes: Data is time-demeaned. DOLS regression includes one lead and one lag differences of the explanatory variables.

Table 3 displays the country-specific β_1's[81]. They indicate the existence of marked differences in the long-run relationship between FDI and employment structure across countries. In some countries, like Colombia, Malaysia and Thailand, the semi-elasticity is quite high – an increase of 17% in FDI/WAP would suffice to increase the long-run MODEMP/WAP ratio in these countries by one percentage point. On the other hand, for half of the sampled countries, the estimated β_1 is negative.

Table 3 - PDOLS estimation of equation 1 - Country-specific β1's

Country	Initial MODEMP/WAP	β_1	t-stat	Country	Initial MODEMP/WAP	β_1	t-stat
Argentina	0.242	-0.02550	-1.32	Malawi	0.061	0.04290	4.27
Bolivia	0.159	0.04513	0.84	Malaysia	0.193	0.06837	9.68
Botswana	0.079	-0.00364	-0.24	Mauritius	0.204	0.04419	16.43
Brazil	0.244	0.03694	3.37	Mexico	0.204	-0.00159	-0.42
Chile	0.182	-0.03775	-1.32	Morocco	0.116	-0.02168	-1.69
China	0.154	-0.00526	-2.15	Nigeria	0.102	0.01661	1.25
Colombia	0.173	0.05969	2.91	Peru	0.136	0.01688	7.49
Costa Rica	0.168	-0.03862	-1.81	Phillipines	0.145	0.01322	1.83
Egypt	0.120	-0.03582	-10.12	Senegal	0.054	-0.02590	-10.42
Ethiopia	0.021	0.00660	1.10	South Africa	0.204	-0.00480	-2.52
Ghana	0.166	-0.03524	-4.40	South Korea	0.210	-0.02021	1.90
India	0.090	0.02389	8.31	Tanzania	0.034	0.01081	1.71
Indonesia	0.105	0.01760	1.89	Thailand	0.110	0.06262	26.60
Kenya	0.057	-0.03214	-3.09	Venezuela	0.207	-0.02379	-2.11
				Group mean		0.00548	8.35

To investigate the causes of such heterogeneity, OLS regressions are estimated, in which country features enter as explanatory variables for the (PDOLS regression)

determined by it. However, a disadvantage of the PDOLS estimator is the fact that it assumes cross-sectional independence – what means no correlation between the residuals of different individuals – except for common time effects (time dummies).

[81] Full results are presented in Table B1 in the Appendix B.

country-specific β_1's (hereafter called BETAs). The choice of variables follows mainly the empirical literature on the FDI-growth nexus and includes financial development (credit to the private sector/GDP), openness to trade ((exports + imports)/GDP), human capital and control of corruption[82]. Considering that the space for marginal increases in the MODEMP/WAP ratio is larger the lower the initial level is, the values observed in 1980 are also included in the OLS regression. To test the hypothesis that the development effects of FDI depends on its sectoral concentration, the shares of manufacturing and non-manufacturing modern sector in total FDI are included.

Whenever possible, the variables are averaged for the whole 1980-2010 period, to better reflect the average conditions faced in the countries. However, in a few cases, assumptions about the variable's behaviour over the entire period are needed due to data limitations. In the case of the variable control of corruption, the indicator for 1996 – the first year available for all countries in the sample – is used. For the sectoral concentration of FDI, the procedure adopted is more complex and, certainly, more controversial – for this reason, the results need to be interpreted cautiously. Since several countries of the sample do not have FDI statistics disaggregated by sector covering the period under analysis, the only possible source of this kind of data is *FDI Markets*, a database of global greenfield FDI projects maintained by the Financial Times group. However, this database started only in 2003, what means that it does not cover three quarters of the period analysed. In the following estimation, it is assumed that the sectoral distribution of FDI among the manufacturing sector, the non-manufacturing modern sector and the traditional sector in the period 1980-2010 was similar to the distribution of greenfield FDI projects among the same sectors in the period 2003-2010. It is also assumed that data on individual projects' capital expenditure is reliable, even though for many projects this indicator is not based on reported information but estimated econometrically by *FDI Markets* based on information about similar projects[83].

Given that there are only 28 observations, a parsimonious model is desirable in order to preserve degrees of freedom. So, initially, a series of estimations is run with each explanatory variable entering individually in the regression. Then, a couple of models is

---

[82] The other individual components of the Worldwide Governance Indicators were also tested, with qualitatively similar results, although not always statistically significant. As they are strongly correlated, only the results for the variable control of corruption are presented here.

[83] Using the number of projects instead could seem a better alternative since this variable would be less prone to measurement error. However, as the fixed capital per project tends to vary considerably across sectors, this procedure would tend to underestimate the real share of the extractive sector, while overestimating the share of the tertiary sector.

estimated with all the variables entering together, differing from each other only by the FDI variable included. Finally, since the "right" model is unknown, all the possible combinations of explanatory variables are examined and the best-fitted model is selected according to Akaike information criterion (AIC). The results are presented in table 4.

Table 4 - Determinants of the long-run relationship between FDI and employment structure (β1's)

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8	model 9	model 10
constant	0.005	0.013	-0.005	-0.011	0.003	0.005	0.000	-0.031	-0.009	-0.033
	(0.34)	(0.45)	(-0.47)	(-0.87)	(0.47)	(0.31)	(0.00)	(-0.84)	(-0.19)	(-2.15)
initial MODEMP/WAP	0.001							0.103	0.087	
	(0.01)							(0.66)	(0.56)	
HC		-0.004						-0.017	-0.014	
		(-0.27)						(-0.72)	(-0.58)	
credit/GDP			0.027					0.031	0.032	0.036
			(1.26)					(1.18)	(1.22)	(1.55)
trade/GDP				0.034				0.049	0.046	0.039
				(1.45)				(1.74)	(1.64)	(1.58)
control of corruption					-0.010			-0.027	-0.026	-0.024
					(-1.02)			(-2.07)	(-1.92)	(-2.22)
FDI manufacturing						0.001		0.036		
						(0.03)		(0.86)		
FDI non-manufacturing modern sector							0.011		-0.023	
							(0.31)		(-0.53)	
R-squared	0.00	0.00	0.06	0.07	0.04	0.00	0.00	0.28	0.27	0.25
AIC	-108.4	-108.5	-110.1	-110.6	-109.5	-108.4	-108.5	-107.7	-107.1	-112.5

Note: t-statistics in parentheses.

The explanatory power of the simple regressions (1-7) is very low. When other factors are controlled for, openness to trade and financial development seems to strengthen the FDI-structural change nexus, but only the former variable is statistically significant. In turn, the sectoral composition of FDI seems to have little relevance to that relationship[84]. Likewise, the ability of FDI to promote structural change does not seem to be affected by a country's level of human capital. This result, however, should be taken cautiously because the PDOLS regression already included human capital among the regressors and this may have captured most of its effect on structural change. The variable control of corruption appears as significant, with a negative sign. Finally, the initial MODEMP/WAP level does not seem to affect BETAs significantly. According to AIC, the best fitted model contains three explanatory variables: financial development, openness to trade and control of corruption.

[84] When the shares of manufacturing and non-manufacturing modern sector in FDI are aggregated in a single variable, it remains statistically insignificant.

All the models presented in table 4 implicitly assume that the FDI-structural change nexus does not differ substantially at different stages of development. However, the importance of the factors included in the second step of the analysis may change as countries climb the development ladder. Stages-of-development approaches to FDI indeed suggest that the type of investment a country attracts as well as its development effect tend to vary as a country becomes richer. To test this hypothesis, models 3 to 7 are re-estimated, with countries divided into two groups, according to their initial MODEMP/WAP levels (below/above median). The results are presented in table 5.

Table 5 - Determinants of the long-run relationship between FDI and employment structure (β1's) - Testing the homogeneity of coefficients across subsamples

	model 3A	model 4A	model 5A	model 6A	model 7A
Sample	credit/ GDP	trade/ GDP	control of corruption	FDI manufacturing	FDI non-manufacturing modern
initial MODEMP/WAP below median	0.048	0.030	-0.002	0.102	-0.083
	(1.08)	(0.66)	(-0.08)	(2.08)	(-1.65)
initial MODEMP/WAP above median	0.028	0.037	-0.017	-0.078	0.082
	(0.97)	(1.25)	(-1.21)	(-1.77)	(1.86)
F-statistic (equality of coefficients)	0.15	0.02	0.46	7.46	6.06
all countries (Table 4)	*0.027*	*0.034*	*-0.010*	*0.001*	*0.011*
	(1.26)	*(1.45)*	*(-1.02)*	*(0.03)*	*(0.31)*

Notes: t-statistics in parentheses. Coefficients of the group dummies not shown.

In the cases of financial development, openness and control of corruption, the F-statistics cannot reject the hypothesis that both groups of countries have the same coefficient. Nonetheless, for the FDI variables, the differences between the two groups are clear, as demonstrated by the F-statistics. Among countries at initial stages of development, the FDI-structural change nexus is stronger when FDI is more concentrated in the manufacturing sector. In contrast, within the group of countries at more advanced stages of development, a higher concentration of FDI in the non-manufacturing modern sector is conducive to a stronger FDI-structural change nexus.

In view of these findings, new models, that allow for different effects of the FDI concentration variable depending on the development stage of the countries, are estimated. Table 6 presents the best fitted models according to AIC. Both models 11 and 12 improves the AIC statistic obtained in model 10. The signs of the FDI concentration coefficients do not change and their size and significance are not much impacted by the inclusion of other variables (when compared to models 6 and 7 in table 5). Once again F-statistics reject the equality of the FDI concentration coefficients of the two groups of countries, for both models. A higher concentration of FDI in manufacturing seems to strengthen the FDI-structural change nexus at initial stages of development, but not at more advanced development stages. The opposite seems to occur when the FDI is more concentrated in non-manufacturing modern sector. Controlling for the share of FDI in the traditional sector, in model 13, does not fundamentally change the results. In comparison to model 10, the inclusion of the FDI concentration variables increases the size and the statistical significance of the financial development coefficient but has the opposite effect on the openness coefficient.

The fact that the cross-country growth literature is plagued by outlier-driven results is well-known[85]. Since the empirical model used here is inspired by the aggregate production function, there is a considerable risk that the results obtained are driven by outliers. To check this possibility, a sensitivity analysis is performed on models 11 and 12. One-by-one, each country observation is excluded and the models re-estimated with the remaining countries. It should be underlined, however, that this sensitivity analysis is merely illustrative because the exclusion of any alleged outlier from the OLS regression would imply its exclusion from the PDOLS regression as well, a procedure that would affect the BETAs used as dependent variables in the OLS regression. The results are presented in tables 7 and 8.

[85] For example, the estimated effect of a bunch of macroeconomic variables such as inflation, openness and government consumption on growth is demonstrated by Easterly (2005) to be driven by outliers, usually a few countries with extremely bad policies and negative growth.

Table 6 - Determinants of the long-run relationship between FDI and employment structure (β1's)

	model 11	model 12	model 13
constant	-0.006	-0.075	0.003
	(-0.25)	(-2.73)	(0.09)
dummy initial MODEMP/WAP below median	-0.078	0.095	-0.073
	(-3.15)	(2.81)	(-2.27)
credit/GDP	0.050	0.048	0.051
	(2.34)	(2.14)	(2.33)
trade/GDP	0.033	0.035	0.032
	(1.53)	(1.54)	(1.42)
control of corruption	-0.025	-0.021	-0.022
	(-2.43)	(-1.79)	(-1.79)
FDI manufacturing			
initial MODEMP/WAP below median	0.126		0.116
	(2.97)		(2.55)
initial MODEMP/WAP above median	-0.072		-0.080
	(-1.73)		(-1.75)
FDI non-manufacturing modern sector			
initial MODEMP/WAP below median		-0.102	
		(-2.24)	
initial MODEMP/WAP above median		0.079	
		(1.69)	
FDI traditional sector			
initial MODEMP/WAP below median			-0.085
			(-0.72)
initial MODEMP/WAP above median			-0.057
			(-0.40)
F-statistic (equality of FDI coefficients)	12.26	9.11	2.91
p-value	0.00	0.01	0.03
R-squared	0.54	0.48	0.55
AIC	-119.8	-116.7	-116.8

Notes: t-statistics in parentheses. When FDI in the traditional sector is included (as in model 13), models 11 and 12 are econometrically equivalent.

For the FDI concentration variables, it must be underlined, first, that the equality of coefficients between the two groups of countries is always rejected. Among the countries at initial stages of development, Nigeria is the only country that seems to affect the coefficients of FDI concentration substantially. Its inclusion in the sample weakens the effect. Therefore, the positive association between FDI in manufacturing and BETAs within this group does not seem to be driven by outliers. In the other group, Colombia is very influential. When this country is excluded from the sample, the FDI concentration variable becomes insignificant for the countries at higher development stage in both models. However, the influence of Colombia is counterbalanced by Brazil and Malaysia, in model 11, and Brazil and Mexico, in model 12.

It seems clear that the effect of openness on BETA is strongly affected by the inclusion of Malaysia in the sample. When this country is excluded, the coefficient drops to almost zero. Although Brazil and Colombia affect the coefficient in the opposite direction, even their combined effect is insufficient to counterbalance the effect of

Malaysia. Thus, the actual effect of openness on BETA is likely to be smaller than the one estimated with the full sample.

In the case of financial development, there seems to be two outliers affecting the results, pushing into opposite directions. The inclusion of China lowers the coefficient while the inclusion of Ghana increases it. However, the coefficient of financial development is always positive and remains significantly different from zero in almost all the cases reported in tables 7 and 8.

The control of corruption coefficient seems to be less affected by individual countries, except for Venezuela. When this country is excluded from the sample, the coefficient becomes more negative.

Table 7 - Sensitivity analysis of model 11 to the presence of outliers

Country excluded	Variable										Test of the equality of FDI coefficients		R-squared
	Credit/GDP		Trade/GDP		Control of Corruption		FDI manufacturing: initial MODEMP/WAP below median		FDI manufacturing: initial MODEMP/WAP above median		F-statistic	p-value	
Argentina	0.048	(2.21)	0.031	(1.37)	-0.025	(-2.32)	0.126	(2.91)	-0.074	(-1.75)	12.00	0.00	0.53
Bolivia	0.049	(2.28)	0.034	(1.54)	-0.023	(-2.18)	0.124	(2.89)	-0.067	(-1.58)	10.91	0.00	0.52
Botswana	0.050	(2.13)	0.033	(1.41)	-0.025	(-2.14)	0.126	(2.89)	-0.072	(-1.69)	11.57	0.00	0.53
Brazil	0.053	(2.89)	**0.046**	(2.41)	-0.025	(-2.87)	0.125	(3.46)	**-0.096**	(-2.65)	20.57	0.00	0.67
Chile	0.050	(2.29)	0.034	(1.49)	-0.026	(-2.12)	0.127	(2.88)	-0.073	(-1.70)	11.40	0.00	0.50
China	**0.060**	(2.61)	0.029	(1.32)	-0.028	(-2.64)	0.129	(3.05)	-0.066	(-1.60)	12.03	0.00	0.56
Colombia	0.045	(2.23)	**0.043**	(2.01)	-0.026	(-2.66)	0.127	(3.14)	**-0.033**	(-0.72)	7.62	0.01	0.55
Costa Rica	0.044	(1.96)	0.035	(1.60)	-0.023	(-2.08)	0.123	(2.87)	-0.072	(-1.73)	11.77	0.00	0.52
Egypt	0.052	(2.38)	0.031	(1.38)	-0.024	(-2.29)	0.114	(2.45)	-0.074	(-1.77)	10.19	0.00	0.52
Ethiopia	0.050	(2.29)	0.034	(1.53)	-0.025	(-2.34)	0.127	(2.92)	-0.072	(-1.71)	11.84	0.00	0.54
Ghana	**0.039**	(1.77)	0.039	(1.82)	-0.027	(-2.62)	0.128	(3.08)	-0.066	(-1.62)	12.27	0.00	0.55
India	0.049	(2.30)	0.036	(1.55)	-0.025	(-2.40)	0.122	(2.74)	-0.071	(-1.67)	10.66	0.00	0.53
Indonesia	0.050	(2.29)	0.033	(1.50)	-0.026	(-2.38)	0.127	(2.91)	-0.071	(-1.68)	11.76	0.00	0.54
Kenya	0.050	(2.45)	0.035	(1.67)	-0.029	(-2.83)	0.117	(2.84)	-0.066	(-1.66)	11.12	0.00	0.57
Malawi	0.052	(2.36)	0.032	(1.43)	-0.025	(-2.35)	0.113	(2.28)	-0.074	(-1.75)	9.37	0.01	0.52
Malaysia	0.044	(2.10)	**0.003**	(0.09)	-0.020	(-1.89)	0.122	(2.97)	**-0.090**	(-2.15)	14.57	0.00	0.52
Mauritius	0.050	(2.27)	0.033	(1.45)	-0.025	(-2.35)	0.126	(2.90)	-0.069	(-1.29)	8.94	0.01	0.51
Mexico	0.055	(2.39)	0.031	(1.40)	-0.023	(-2.11)	0.124	(2.86)	-0.086	(-1.81)	12.14	0.00	0.54
Morocco	0.050	(2.28)	0.034	(1.50)	-0.026	(-2.33)	0.128	(2.75)	-0.071	(-1.67)	11.37	0.00	0.52
Nigeria	0.056	(2.70)	**0.022**	(1.04)	-0.021	(-2.08)	**0.169**	(3.59)	-0.082	(-2.05)	16.65	0.00	0.60
Peru	0.050	(2.28)	0.033	(1.46)	-0.025	(-2.38)	0.129	(2.79)	-0.072	(-1.69)	11.26	0.00	0.53
Phillipines	0.050	(2.28)	0.034	(1.53)	-0.025	(-2.39)	0.128	(2.92)	-0.072	(-1.69)	11.84	0.00	0.54
Senegal	0.049	(2.27)	0.033	(1.48)	-0.024	(-2.27)	0.122	(2.76)	-0.073	(-1.72)	11.26	0.00	0.52
South Africa	0.055	(2.27)	0.029	(1.24)	-0.024	(-2.18)	0.124	(2.87)	-0.075	(-1.76)	11.98	0.00	0.54
South Korea	0.051	(2.33)	0.034	(1.52)	-0.025	(-2.41)	0.126	(2.92)	-0.064	(-1.45)	10.41	0.00	0.53
Tanzania	0.051	(2.34)	0.034	(1.53)	-0.025	(-2.37)	0.126	(2.91)	-0.073	(-1.73)	11.95	0.00	0.54
Thailand	0.048	(1.91)	0.033	(1.48)	-0.025	(-2.31)	0.125	(2.79)	-0.071	(1.67)	10.70	0.00	0.48
Venezuela	0.047	(2.37)	0.036	(1.79)	**-0.031**	(-3.07)	0.132	(3.34)	-0.074	(-1.91)	15.24	0.00	0.60
None	0.050	(2.34)	0.033	(1.53)	-0.025	(-2.43)	0.126	(2.97)	-0.072	(-1.73)	12.26	0.00	0.54

Notes: t-statistics in parentheses. Changes in coefficient higher than 20 percent are highlighed in bold.

Table 8 - Sensitivity analysis of model 12 to the presence of outliers

Country excluded	Variable										Test of the equality of FDI coefficients		R-squared
	Credit/GDP		Trade/GDP		Control of Corruption		FDI non-manufacturing modern sector: initial MODEMP/WAP below median		FDI non-manufacturing modern sector: initial MODEMP/WAP above median		F-statistic	p-value	
Argentina	0.047	(2.02)	0.033	(1.39)	-0.020	(-1.69)	-0.102	(-2.19)	0.081	(1.69)	8.89	0.01	0.47
Bolivia	0.047	(2.05)	0.036	(1.54)	-0.020	(-1.67)	-0.101	(-2.18)	0.071	(1.45)	7.53	0.01	0.46
Botswana	0.049	(2.01)	0.034	(1.39)	-0.022	(-1.59)	-0.103	(-2.19)	0.078	(1.60)	8.55	0.01	0.48
Brazil	0.051	(2.58)	**0.048**	(2.34)	-0.020	(-1.98)	-0.101	(-2.54)	**0.103**	(2.48)	14.79	0.00	0.61
Chile	0.048	(2.09)	0.035	(1.45)	-0.021	(-1.52)	-0.102	(-2.16)	0.079	(1.65)	8.41	0.01	0.44
China	0.057	(2.35)	0.031	(1.34)	-0.024	(-1.96)	-0.105	(-2.29)	0.073	(1.54)	8.64	0.01	0.50
Colombia	0.043	(1.96)	**0.045**	(1.96)	-0.024	(-2.12)	-0.107	(-2.42)	**0.031**	(0.58)	4.64	0.04	0.49
Costa Rica	0.043	(1.78)	0.037	(1.59)	-0.019	(-1.57)	-0.101	(-2.17)	0.076	(1.61)	8.34	0.01	0.45
Egypt	0.051	(2.20)	0.032	(1.35)	-0.019	(-1.61)	-0.085	(-1.64)	0.083	(1.75)	7.07	0.02	0.46
Ethiopia	0.048	(2.12)	0.037	(1.59)	-0.020	(-1.71)	-0.107	(-2.29)	0.081	(1.70)	9.27	0.01	0.49
Ghana	**0.037**	(1.61)	0.041	(1.82)	-0.022	(-1.95)	-0.105	(-2.36)	0.076	(1.67)	9.54	0.01	0.50
India	0.047	(2.03)	0.039	(1.64)	-0.022	(-1.81)	-0.098	(-2.09)	0.077	(1.63)	8.08	0.01	0.49
Indonesia	0.048	(2.09)	0.035	(1.50)	-0.021	(-1.73)	-0.103	(-2.18)	0.079	(1.64)	8.69	0.01	0.48
Kenya	0.048	(2.24)	0.037	(1.70)	-0.026	(-2.24)	-0.098	(-2.25)	0.069	(1.53)	8.29	0.01	0.52
Malawi	0.053	(2.28)	0.033	(1.41)	-0.020	(-1.72)	-0.082	(1.63)	0.083	(1.77)	7.00	0.02	0.48
Malaysia	0.043	(1.88)	**0.011**	(0.35)	-0.017	(-1.37)	-0.098	(-2.17)	0.089	(1.90)	9.87	0.01	0.44
Mauritius	0.048	(2.10)	0.033	(1.36)	-0.022	(-1.79)	-0.103	(-2.21)	0.071	(1.37)	7.43	0.01	0.46
Mexico	0.054	(2.24)	0.033	(1.39)	-0.017	(-1.36)	-0.098	(-2.10)	**0.100**	(1.82)	9.38	0.01	0.49
Morocco	0.049	(2.14)	0.033	(1.42)	-0.019	(-1.60)	-0.098	(-2.09)	0.082	(1.73)	8.74	0.01	0.48
Nigeria	0.055	(2.58)	0.023	(1.01)	-0.016	(-1.42)	**-0.172**	(-3.14)	0.092	(2.09)	14.46	0.00	0.57
Peru	0.048	(2.09)	0.036	(1.51)	-0.021	(-1.74)	-0.100	(-2.06)	0.079	(1.65)	8.16	0.01	0.48
Phillipines	0.048	(2.09)	0.037	(1.57)	-0.022	(-1.80)	-0.110	(-2.27)	0.078	(1.64)	9.13	0.01	0.49
Senegal	0.047	(2.09)	0.035	(1.49)	-0.019	(-1.61)	-0.098	(-2.11)	0.082	(1.73)	8.76	0.01	0.48
South Africa	0.053	(2.06)	0.032	(1.27)	-0.020	(-1.58)	-0.100	(-2.14)	0.082	(1.70)	8.82	0.01	0.48
South Korea	0.049	(2.12)	0.036	(1.52)	-0.022	(-1.79)	-0.103	(-2.21)	0.071	(1.40)	7.53	0.01	0.47
Tanzania	0.049	(2.10)	0.035	(1.51)	-0.021	(-1.72)	-0.101	(-2.13)	0.080	(1.67)	8.61	0.01	0.48
Thailand	0.045	(1.69)	0.035	(1.47)	-0.021	(-1.69)	-0.100	(-2.09)	0.077	(1.61)	7.82	0.01	0.41
Venezuela	0.046	(2.22)	0.038	(1.78)	**-0.026**	(-2.33)	-0.108	(-2.56)	0.090	(2.06)	12.43	0.00	0.56
None	0.048	(2.14)	0.035	(1.54)	-0.021	(-1.79)	-0.102	(-2.24)	0.079	(1.69)	9.11	0.01	0.48

Notes: t-statistics in parentheses. Changes in coefficient higher than 20 percent are highlighed in bold.

4.4 Discussion

The findings confirm that the development effects of FDI are highly country-specific (as in Kottaridi & Stengos (2010) and Herzer (2012)), thus justifying the choice for the two-step approach. Such heterogeneity seems to be associated with the stage of development of the countries and the type of FDI they receive, as suggested by the stages-of-development approaches to FDI such as the IDP and Ozawa's (1992). At initial development stages, the effects of FDI on the employment structure are larger when FDI is more concentrated in the manufacturing sector. At later development stages, the effects are larger when FDI is more concentrated in the non-manufacturing modern sector. This occurs because the development effects of FDI projects are affected by the endowments and capabilities a country has, which in turn are associated with its development stage. Although the data only allows a very rough classification of FDI projects, it can be said that FDI is more likely to promote structural change when there is a certain alignment of the type of FDI to the stage of development of the country.

The extent to which openness favours a higher effect of FDI on structural change is quite uncertain. Although the main results suggest a positive effect, sensitivity analysis shows that they are considerably affected by one outlier. When Malaysia is excluded from the sample, the effect of openness disappears. However, this result is not surprising. Indeed, Balasubramanyam, Salisu & Sapsford's (1996) early finding that FDI promoted growth in outward-oriented countries but not in inward-oriented countries in the period 1970-1985 have not been confirmed by studies that used more recent data such as Carkovic & Levine (2005) and Herzer (2012), which find no moderating role for trade openness in the FDI-growth relationship.

The theoretical argument that the materialisation of the potential indirect effects of FDI depends on the level of development of the local financial market is corroborated by the empirical analysis. Indeed, the FDI-structural change nexus seems to be stronger the higher the financial development of the country. This result, which is shown to be robust to outliers, corroborates Alfaro *et al.* (2004) and Durham (2004).

Finally, the finding that the FDI-structural change nexus is stronger where the control of corruption is lower may seem quite odd at first sight as it could suggest that corruption is good for development. However, this conclusion needs to be refined. Studies using both firm-level (Javorcik & Wei, 2009) as well as country-level (Habib & Zurawicki, 2002; Hakkala, Norback & Svaleryd, 2008) data indicate that corruption has a detrimental effect on inward FDI. Thus, a possible interpretation for this unexpected finding is that higher levels of corruption may discourage FDI but, once it has taken place, the returns tend to be higher in less business-friendly environments because the risk of crowding out domestic investment is lower. Indeed, this resembles the justification put forth by Alguacil, Cuadros & Orts (2011)[86].

[86] It is also worth to cite a study done by D'Amelio, Garrone & Piscitello (2016), which finds that (aggregate) FDI promotes access to electricity in Sub-Saharan Africa and the effects seems to be stronger where the institutions are weaker.

5. Conclusions

In 1988, John Dunning (1988) wrote that

> One of the lacunae in the literature on international business is a dynamic approach to its role in economic development. What we believe is needed is a reinterpretation of W. W. Rostow's model of the economic growth process – first presented in the late 1950s (Rostow, 1959) – and an extension of Hollis Chenery's analysis of transitional growth and world industrialization (Chenery, 1977, 1979) explicitly to incorporate the various modalities of international economic involvement.

Since then, important contributions were made in several directions. In the theoretical/conceptual area, endogenous growth models made way for differentiating the development impact of foreign investment *vis-à-vis* domestic investment. Ozawa (1992) incorporated FDI into a stages approach to the process of development. The IDP framework, first proposed by Dunning in 1981, was refined in a series of contributions (Dunning & Narula, 1996; Narula, 1996; Narula & Dunning, 2010) which described the complex evolving relationship between MNE activity and economic structure.

Considerably less progress was observed within the literature concerned specifically with structural change in terms of incorporating MNEs and FDI in a meaningful way. Recent contributions such as Lin (2010) still devote a secondary role to MNEs in structural change. In such a scenario, it is not surprising that empirical studies on FDI and structural change are almost non-existent. For this reason, one of the objectives of this paper was to review the extant literature on related issues regarding FDI and development as to provide insights to a more direct treatment of the question.

The emergence of new comprehensive datasets in the last three decades enabled researchers to put many hypotheses about the development effects of FDI under scrutiny. Old ideas about MNE linkages and spillovers were tested using firm-level data. Comparable macroeconomic data enabled investigations of the FDI-growth nexus in a cross-country perspective. The main message of both streams of literature is that FDI has the potential to catalyse development, but actual outcomes are contingent on several factors, such as the absorptive capacity of domestic firms and the level of development of local financial markets.

This paper adds to the empirical literature by providing a more direct assessment of the relationship between FDI and structural change. The main hypotheses tested were whether the development impact of FDI depends on its sectoral concentration and whether this relationship varies according to the stage of development of the country. An unconventional two-stages econometric approach was adopted in order to better reflect both the theoretical proposition (IDP) and the empirical finding that the FDI-growth nexus is highly country-specific. In the first stage, long-run coefficients relating FDI to the employment structure were estimated for each country using a panel-times series method (PDOLS). In the second stage, a set of variables (some of which borrowed from the empirical literature on FDI and growth) were employed to explain the cross-country differences in the FDI-structural change nexus.

The results indicate that the FDI-structural change nexus is quite heterogeneous across countries. FDI is shown to be positively associated with increases in the modern sector's share in employment in some countries but negatively associated in others. The second stage indicates that the degree of matching between the stage of development of a country and the type of FDI it receives affects the capacity of FDI to promote structural change, a finding that is consistent with stages-of-development approaches to FDI. At initial stages of development, a higher concentration of FDI in manufacturing strengthens the FDI-structural change nexus. At later stages of development, a higher concentration of FDI in the non-manufacturing modern sector is more strongly associated with structural change. This finding suggests that there are crucial differences in the ability of countries to provide the capabilities required in these broadly defined sectors. In addition, cross-country differences in the FDI-structural change nexus are associated with the financial development and the (lack of) control of corruption of the countries, but no evidence is found for a relationship with trade openness[87].

Although FDI is generally welcomed by developing countries, governments should consider, when formulating their policies to attract MNE activity – which are often synonyms to subsidies – that the extent to which FDI promotes structural change will depend on the alignment between the type of investments a country receives and its stage of development. Some activities may require capabilities that are in short supply in developing countries, thus reducing the effects of the MNE presence. Initiatives that contribute to expand and deepen local financial markets may increase the potential development effects of FDI. Even though FDI is not a *sine-qua-non* for development, it seems to be particularly relevant for developing countries with poor business

[87] Taking some characteristics of investors' home countries, such as institutional distance, into account could improve this type of study. Given the small sample and the quality of FDI data, this could not be done in this chapter but constitutes an avenue open for future extensions.

environments. Higher concessions to foreign investors may be justified in this context given the lower risk of crowding out domestic investment.

The study has some important limitations. The estimations are not underpinned by a formal theoretical model – instead the empirical specification was borrowed from the economic growth literature. The full set of variables belonging to the theoretical and empirical models remains unknown. There are also data-related issues, in particular the lack of accuracy of the FDI concentration variables and the small sample that could be used in the analysis. Substantial efforts to improve FDI data, making it comparable across countries at more disaggregated levels, are essential to advance the research agenda on FDI and structural change in developing countries.

References

Aitken, B.; Harrison, A. (1999) Do domestic firms benefit from foreign direct investment? Evidence from Venezuela. *American Economic Review*, 89(3), 605-618.

Aitken, B.; Harrison, A.; Lipsey, R. (1996) Wages and foreign ownership: A comparative study of Mexico, Venezuela and the United States. *Journal of International Economics,* 40(3-4), 345-371.

Akamatsu, K. (1961) A theory of unbalanced growth in the world economy. *Weltwirtschaftliches Archiv*, 86, 196-217.

Akamatsu, K. (1962) Historical pattern of economic growth in developing countries. *Developing Economies*, 1, 3-25.

Alfaro, L.; Chanda, A.; Kalemli-Ozcan, S.; Sayek, S. (2004) FDI and economic growth: The role of local financial markets. *Journal of International Economics*, 64, 89-112.

Alfaro, L.; Chen, M. (2018) Selection and market reallocation: Productivity gains from multinational production. *American Economic Journal: Economic Policy*, 10(2), 1-38

Alfaro, L.; Kalemli-Ozcan, S.; Sayek, S. (2009) FDI, productivity and financial development. *World Economy*, 32, 111-135.

Alfaro, L.; Rodriguez-Clare, A. (2004) Multinationals and linkages: An empirical investigation. *Economia*, 4(2), 113-169.

Alguacil, M.; Cuadros, A.; Orts, V. (2011) Inward FDI and growth: The role of macroeconomic and institutional environment. *Journal of Policy Modeling*, 33(3), 481-496.

Altenburg, T. (2000) Linkages and spillovers between transnational corporations and small and medium-sized enterprises in developing countries: Opportunities and best policies. In: UNCTAD – United Nations Conference on Trade and Development (Ed). *TNC-SME linkages for development: Issues – experiences – best practices.* New York and Geneva: United Nations.

Alvarez-Cuadrado, F.; Poschke, M. (2011) Structural change out of agriculture: Labor push versus labor pull. *American Economic Journal: Macroeconomics*, 3, 127-158.

Anwar, S.; Nguyen, L. (2011) Foreign direct investment and export spillovers: Evidence from Vietnam. *International Business Review*, 20, 177-193.

Ayyagari, M.; Kosova, R. (2010) Does FDI facilitate domestic entry? Evidence from the Czech Republic. *Review of International Economics*, 18(1), 14-29.

Azariadis, C.; Drazen, A. (1990). Threshold externalities in economic development. *Quarterly Journal of Economics*, 105(2), 501-526.

Balasubramanyam, V.; Salisu, M.; Sapsford, D. (1996) Foreign direct investment and growth in EP and IS countries. *Economic Journal*, 106(1), 92-105.

Basu, P.; Chakraborty, C.; Reagle, D. (2003) Liberalization, FDI, and growth in developing countries: A panel cointegration approach. *Economic Inquiry*, 51, 510-516.

Belderbos, R. (1997) Antidumping and tariff jumping: Japanese firms' DFI in the European Union and the United States. *Weltwirtschaftliches Archiv*, 133(3), 419-457.

Belderbos, R.; Capannelli, G.; Fukao, K. (2001) Backward vertical linkages of foreign manufacturing affiliates: Evidence from Japanese multinationals. *World Development*, 29(1), 189-208.

Belderbos, R.; Mohnen, P. (2013) Intersectoral and international R&D spillovers. SIMPATIC Working Paper No. 2.

Belderbos, R.; Sleuwaegen, L. (1998) Tariff jumping DFI and export substitution: Japanese electronics firms in Europe. *International Journal of Industrial Organization*, 16, 601-638.

Bellak, C. (2004) How domestic and foreign affiliates differ and why does it matter? *Journal of Economic Surveys*, 18(2), 1-32.

Blalock, G.; Simon, D. (2009) Do all firms benefit equally from downstream FDI? The moderating effect of local suppliers' capabilities on productivity gains. *Journal of International Business Studies*, 40, 1095-1112.

Blonigen, B.; Wang, M. (2005) Inappropriate pooling of wealthy and poor countries in empirical FDI studies. In: Moran, T.; Graham, E.; Blomstrom, M. (Eds.) *Does foreign direct investment promote development?* Washington, DC: Institute for International Economics.

Borensztein, E.; De Gregorio, J.; Lee, J. (1998) How does foreign direct investment affect economic growth? *Journal of International Economics*, 45, 115-135.

Buckley, P.; Casson, M. (1976) *The future of the multinational enterprise*. London: Macmillan.

Carkovic, M.; Levine, R. (2005) Does foreign direct investment accelerate economic growth? In: Moran, T.; Graham, E.; Blomstrom, M. (Eds.) *Does foreign direct investment promote development?* Washington, DC: Institute for International Economics.

Castellani, D. (2012) In praise of pecuniary externalities. *European Journal of Development Research*, 24(1), 15-19.

Castillo, L.; Salem, D.; Moreno, J. (2014) Foreign direct investment and productivity spillovers: firm-level evidence from Chilean industrial sector. *Latin American Business Review*, 15(2), 93-122.

Caves, R. (1974) Multinational firms, competition, and productivity in host-country markets. *Economica*, 41(162), 176-93.

Chang, H.; Andreoni, A. (2016) Industrial policy in a changing world: Basic principles, neglected issues and new challenges. Paper presented at the Cambridge Journal of Economics 40 Years Conference.

Chen, T.; Chen, H.; Ku, Y. (2004) Foreign direct investment and local linkages. *Journal of International Business Studies*, 35, 320-333.

Chen, C.; Cheng, Y.; Findlay, C. (2013) Export spillovers of FDI on China's domestic firms. *Review of International Economics*, 21(5), 841-856.

Chen, Z.; Ge, Y.; Lai, H. (2011) Foreign direct investment and wage inequality: Evidence from China. *World Development*, 39(8), 1322-1332.

Chenery, H. (1977) Transitional growth and world industrialisation. In: Ohlin, B.; Hesselborn, P. Wijkman, P. (Eds.) *The international allocation of economic activity*. London: Palgrave Macmillan.

Chenery, H. (1979) *Structural change and development policy*. New York: Oxford University Press.

Choe, J. (2003) Do foreign direct investment and gross domestic investment promote economic growth? *Review of Development Economics*, 7(1), 44-57.

Cieslik, A.; Hagemejer, J. (2014) Multinational enterprises, absorptive capacity and export spillovers: evidence from Polish firm-level data. *Review of Development Economics*, 18(4), 709-726.

Cuervo-Cazurra, A.; Narula, R.; Un, C. (2015). Internationalization motives: Sell more, buy better, upgrade and escape. *Multinational Business Review*, 23(1), 25-35.

D'Amelio, M.; Garrone, P.; Piscitello, L. (2016) Can multinational enterprises light up developing countries? Evidences from the access to electricity in Sub-Saharan Africa. *World Development*, 88, 12-32.

Dosi, G.; Tranchero, M. (2020) The role of comparative advantage and endowments in structural transformation. In: Alcorta, L.; Szirmai, A.; Verspagen, B.; Foster-McGregor, N. (Eds.) *New perspectives on structural change: Causes and consequences of structural change in the global economy.* Oxford: Oxford University Press. (forthcoming)

Driffield, N.; Noor, A. (1999) Foreign direct investment and local input linkages in Malaysia. *Transnational Corporations*, 8(3), 1-24.

Duanmu, J.; Fai, F. (2007) A processual analysis of knowledge transfer: From foreign MNEs to Chinese suppliers. *International Business Review*, 16, 449-473.

Dunning, J. (1977) Trade, location of economic activity, and the multinational enterprise: A search for an eclectic approach. In: Hesselborn, P.; Ohlin, B.; Wijkman, P. (Eds.) *The international allocation of economic activity.* London: Macmillan.

Dunning, J. (1981) Explaining the international direct investment position of countries: Towards a dynamic or developmental approach. *Weltwirtschaftliches Archiv*, 177, 30-64.

Dunning, J. (1988) *Multinationals, technology and competitiveness.* Boston: Unwin Hyman.

Dunning, J.; Narula, R. (1996) The investment development path revisited: some emerging issues. In: Dunning, J.; Narula, R. (Eds.) *Foreign Direct Investment and Governments: Catalysts for Economic Restructuring.* Basingstoke: Edward Elgar.

Duran, I.; Ryan, M. (2014) Spillover effects from inward FDI and the exporting decisions of Chilean manufacturing plants. *Journal of Industry, Competition and Trade*, 14, 393-414.

Durham, J. (2004) Absorptive capacity and the effects of foreign direct investment and equity foreign portfolio investment on economic growth. *European Economic Review*, 48, 285-306.

Easterly, W. (2005) National policies and economic growth: A reappraisal. In: Aghion, P.; Durlauf, S. (Eds.) *Handbook of economic growth, Vol. 1A.* Amsterdam: North Holland.

Farla, K.; de Crombrugghe, D.; Verspagen, B. (2016) Institutions, foreign direct investment, and domestic investment: crowding out or crowding in? *World Development*, 88, 1-9.

Farole, T.; Winkler, D. (2014) The role of mediating factors for FDI spillovers in developing countries: Evidence from a global dataset. In: Farole, T.; Winkler, D. (Eds.) *Making foreign direct investment work for Sub-Saharan Africa: Local spillovers and competitiveness in global value chains.* Washington, DC: World Bank.

Ferragina, A. (2014) Foreign ownership, survival and growth dynamics in Turkish manufacturing. In: Ferragina, A.; Taymaz, E.; Yilmaz, K. (Eds.) *Innovation, Globalization and Firm Dynamics.* Abingdon: Routledge.

Fosfuri, A.; Motta, M.; Ronde, T. (2001) Foreign direct investment and spillovers through workers' mobility. *Journal of International Economics*, 53, 205-222.

Giroud, A. (2007) MNEs vertical linkages: The experience of Vietnam after Malaysia. *International Business Review*, 16, 159-176.

Giroud, A.; Mirza, H. (2006) Factors determining supply linkages between transnational corporations and local suppliers in ASEAN. *Transnational Corporations*, 15(3), 1-34.

Giroud, A.; Scott-Kennel, J. (2009) MNE linkages in international business: A framework for analysis. *International Business Review*, 18, 555-566.

Görg, H.; Strobl, E. (2001). Multinational companies and productivity spillovers: A meta-analysis. *Economic Journal*, 111(475), 723-739.

Habib, M.; Zurawicki, L. (2002) Corruption and foreign direct investment. *Journal of International Business Studies*, 33(2), 291-307.

Hackett, S.; Srinivasan, K. (1998) Do suppliers switching costs differ across Japanese and US multinational firms? *Japan and the World Economy*, 10, 13-32.

Hakkala, K; Norback, P.; Svaleryd, H. (2008) Asymmetric effects of corruption on FDI: Evidence from Swedish multinational firms. *Review of Economics and Statistics*, 90(4), 627-642.

Hall, R.; Jones, C. (1999) Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics*, 114(1), 83-116.

Hansen, H.; Rand, J. (2006) On the causal links between FDI and growth in developing countries. *World Economy*, 29(1), 21-41.

Harms, P.; Meon, P. (2012) Good and bad FDI: The growth effects of greenfield investment and mergers and acquisitions in developing countries. Paper presented at the European Trade Study Group Fourteenth Annual Conference, Leuven, 13-15 September 2012.

Hausmann, R.; Hidalgo, C.; Bustos, S.; Coscia, M.; Simoes, A.; Yildirim, M. (2011) *The atlas of economic complexity: Mapping paths to prosperity.* Cambridge, MA: Center for International Development/Harvard University and Media Lab/MIT.

Havranek, T.; Irsova, Z. (2011) Estimating vertical spillovers from FDI: Why results vary and what the true effect is. *Journal of International Economics*, 85(2), 234-244.

Hennart, J. (1982) *A theory of the multinational enterprise.* Ann Arbour, MI: University of Michigan Press.

Herzer, D. (2012) How does foreign direct investment really affect developing countries' growth? *Review of International Economics*, 20(2), 396-414.

Hirschman, A. (1958) *The strategy of economic development.* New Haven: Yale University Press.

Hymer, S. (1960) *The international operations of national firms: A study of direct foreign investment.* Cambridge, MA: MIT Press (published in 1976).

Im, K.; Pesaran, M.; Shin, Y. (2003) Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1), 53-74.

Irsova, Z.; Havranek, T. (2013) Determinants of horizontal spillovers from FDI: Evidence from a large meta-analysis. *World Development*, 42, 1-15.

Ivarsson, I.; Alvstam, C. (2005) Technology transfer from TNCs to local suppliers in developing countries: A study of AB Volvo's truck and bus plants in Brazil, China, India, and Mexico. *World Development*, 33(8), 1325-1344.

Javorcik, B.; Lo Turco, A.; Maggioni, D. (2017) New and improved: Does FDI boost production complexity in host countries? *Economic Journal*, 128(614): 2507-2537.

Javorcik, B.; Spatareanu, M. (2009) Liquidity constraints and firms' linkages with multinationals. *World Bank Economic Review*, 23(2), 323-346.

Javorcik, B.; Wei, S. (2009) Corruption and cross-border investment in emerging markets: Firm-level evidence. *Journal of International Money and Finance*, 28, 605-624.

Jindra, B.; Giroud, A.; Scott-Kennel, J. (2009) Subsidiary roles, vertical linkages and economic development: Lessons from transition economies. *Journal of World Business*, 44, 167-179.

Jordaan, J. (2011) FDI, local Sourcing, and supportive linkages with domestic suppliers: The case of Monterrey, Mexico. *World Development*, 39(4), 620-632.

Jude, C.; Levieuge, G. (2017) Growth effect of foreign direct investment in developing economies: The role of institutional quality. *World Economy*, 40(4), 715-742.

Kojima, K. (1973) A macroeconomic approach to foreign direct investment. *Hitotsubashi Journal of Economics*, 14(1), 1-21.

Kojima, K. (1982) Macroeconomic versus international business approach to foreign direct investment. *Hitotsubashi Journal of Economics*, 23, 630-640.

Kojima, K. (2000) The "flying-geese" model of Asian economic development: origin, theoretical extensions, and regional policy implications. *Journal of Asian Economics*, 11, 375-401.

Kojima, K.; Ozawa, T. (1984) Micro and macro economic models of foreign direct investment: Towards a synthesis. *Hitotsubashi Journal of Economics*, 25(2), 1-20.

Kokko, A.; Thang, T. (2014) Foreign direct investment and the survival of domestic private firms in Viet Nam. *Asian Development Review*, 31(1), 53-91.

Kosova, R. (2010) Do foreign firms crowd out domestic firms? Evidence from the Czech Republic. *Review of Economics and Statistics*, 92(4), 861-881.

Kottaridi, C.; Stengos, T. (2010) Foreign direct investment, human capital and non-linearities in economic growth. *Journal of Macroeconomics*, 32, 858-871.

Kuznets, S. (1966) *Modern economic growth: Rate, structure, and spread*. New Haven, CT: Yale University Press.

Lall, S. (1980) Vertical inter-firm linkages in LDCs: An empirical study. *Oxford Bulletin of Economics and Statistics*, 42(3), 203-226.

Lall, S.; Narula, R. (2004) Foreign direct investment and its role in economic development: do we need a new research agenda? *European Journal of Development Research*, 16(3), 447-464.

Lavopa, A.; Szirmai, A. (2018) Structural modernization and development traps: An empirical approach. *World Development*, 112, 59-73.

Lavopa, A.; Szirmai, A. (2020) Structural change as a modernization process. In: Alcorta, L.; Szirmai, A.; Verspagen, B.; Foster-McGregor, N. (Eds.) *New perspectives on structural change: Causes and consequences of structural change in the global economy.* Oxford: Oxford University Press. (forthcoming)

Lee, C. (1990) Direct foreign investment, structural adjustment, and international division of labor: A dynamic macroeconomic theory of direct foreign investment. *Hitotsubashi Journal of Economics*, 31(2), 61-72.

Lee, K. (2013) *Schumpeterian analysis of economic catch-up: Knowledge, path-creation, and the middle-income trap.* Cambridge: Cambridge University Press.

Lewis, A. (1954) Economic development with unlimited supplies of labour. *Manchester School*, 22, 139-191.

Li, X.; Liu, X. (2005) Foreign direct investment and economic growth: an increasingly endogenous relationship. *World Development*, 33(3), 393-407.

Lin, J. (2010) New structural economics: A framework for rethinking development. Washington, DC: World Bank. (Policy Research Working Paper no. 5197)

Lin, J.; Chang, H. (2009) DPR Debate: Should industrial policy in developing countries conform to comparative advantage or defy it? *Development Policy Review*, 27(5), 483-502.

Lin, J.; Monga, C. (2011) Growth identification and facilitation: The role of the State in the dynamics of structural change. *Development Policy Review*, 29(3), 259-310.

Lin, J. & Monga, C. (2014) The evolving paradigms of structural change. In: Currie-Alder, B.; Kanbur, R.; Malone, D.; Medhora, R. (Eds.) *International development: Ideas, experience, and prospects.* Oxford: Oxford University Press.

Lipsey, R.; Sjoholm, F. (2004) Foreign direct investment, education and wages in Indonesian manufacturing. *Journal of Development Economics*, 73, 415-422.

Lucas Jr., R. (1988) On the mechanics of economic development. *Journal of Monetary Economics*, 22, 3-42.

Markusen, J.; Venables, A. (1999) Foreign direct investment as a catalyst for industrial development. *European Economic Review*, 43, 335-356.

Mayneris, F.; Poncet, S. (2011) Entry on difficult export markets by Chinese domestic firms: The role of foreign export spillovers. CEPII Working Paper n. 2011-32.

Mayneris, F.; Poncet, S. (2015) Chinese firms' entry to export markets: The role of foreign export spillovers. *World Bank Economic Review*, 29(1), 150-179.

Melitz, M. (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6), 1695-1725.

Merlevede, B.; Schoors, K. (2009) Openness, competition, technology and FDI spillovers: Evidence from Romania. (Unpublished)

Munemo, J. (2017) Foreign direct investment and business start-up in developing countries: The role of financial market development. *Quarterly Review of Economics and Finance*, 65, 97-106.

Narula, R. (1996) *Multinational Investment and Economic Structure: Globalisation and Competitiveness.* London and New York: Routledge.

Narula, R. (2014) Foreign direct investment as a driver of industrial development: Why is there so little evidence? In: Van Tulder, R.; Verbeke, A.; Strange, R. (Eds.) *International Business and Sustainable Development (Progress in International Business Research, Volume 8).* Bingley: Emerald.

Narula, R. (2018) An extended dual economy model: Implications for emerging economies and their multinational firms. *International Journal of Emerging Markets*, 13(3), 586-602.

Narula, R.; Driffield, N. (2012) Does FDI cause development? The ambiguity of the evidence and why it matters. *European Journal of Development Research*, 24(1), 1-7.

Narula, R.; Dunning, J. (2010) Multinational enterprises, development and globalization: Some clarifications and a research agenda. *Oxford Development Studies*, 38(3), 263-287.

Narula, R.; Marin, A. (2003) Foreign direct investment spillovers, absorptive capacities and human capital development: Evidence from Argentina. Geneva: International Labour Office. (Working Paper no. 96)

Nurkse, R. (1953) *Problems of capital formation in underdeveloped countries*. Oxford: Oxford University Press.

Okada, A. (2004) Skills development and interfirm learning linkages under globalization: Lessons from the Indian automobile industry. *World Development*, 32(7), 1265-1288.

Ozawa, T. (1992) Foreign direct investment and economic development. *Transnational Corporations*, 1(1), 27-54.

Pavlinek, P.; Zizalova, P. (2016) Linkages and spillovers in global production networks: Firm-level analysis of the Czech automotive industry. *Journal of Economic Geography*, 16, 331-363.

Pedroni, P. (1999) Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, 61, 653-670.

Pedroni, P. (2001) Purchasing power parity tests in cointegrated panels. *Review of Economics and Statistics*, 83(4), 727-731.

Pedroni, P. (2004) Panel cointegration, asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory*, 20(3), 597-625.

Pineli, A.; Narula, R.; Belderbos, R. (2020) FDI, multinationals and structural change in developing countries. In: Alcorta, L.; Szirmai, A.; Verspagen, B.; Foster-McGregor, N. (Eds.) *New perspectives on structural change: Causes and consequences of structural change in the global economy.* Oxford: Oxford University Press. (forthcoming)

Porcile, G. (2020) Latin American structuralism. In: Alcorta, L.; Szirmai, A.; Verspagen, B.; Foster-McGregor, N. (Eds.) *New perspectives on structural change: Causes and consequences of structural change in the global economy.* Oxford: Oxford University Press. (forthcoming)

Prebisch, R. (1949) O desenvolvimento econômico da América Latina e seus principais problemas. *Revista Brasileira de Economia*, 3(3), 47-111.

Rasiah, R. (2003) Systemic coordination and the knowledge economy human capital development in Malaysia's MNC-driven electronics clusters. *Transnational Corporations*, 11(3), 89-130.

Rivera-Batiz, F. (1990) The effects of foreign direct investment in the presence of increasing returns due to specialization. *Journal of Development Economics*, 34, 287-307.

Rodriguez-Clare, A. (1996) Multinationals, linkages, and economic development. *American Economic Review*, 86(4), 852-873.

Romer, P. (1986) Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.

Romer, P. (1993) Idea gaps and object gaps in economic development. *Journal of Monetary Economics*, 32, 543-573.

Rostow, W. (1959) The stages of economic growth. *Economic History Review*, 12(1), 1-16.

Rugman, A. (1980) Internalization as a general theory of foreign direct investment: A re-appraisal of the literature. *Weltwirtschaftliches Archiv*, 116(2), 365-379.

Solow, R. (1956) A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.

Swenson, D.; Chen, H. (2014) Multinational exposure and the quality of new Chinese exports. *Oxford Bulletin of Economics and Statistics*, 76(1), 41-66.

Szirmai, A. (2005) *The dynamics of socio-economic development: An introduction*. Cambridge: Cambridge University Press.

Taymaz, E.; Ozler, S. (2007) Foreign ownership, competition, and survival dynamics. *Review of Industrial Organization*, 31, 23-42.

UNCTAD – United Nations Conference on Trade and Development (2001) *World Investment Report 2001: Promoting Linkages.* United Nations: New York and Geneva.

Wagner, M.; Hlouskova, J. (2009) The performance of panel cointegration methods: Results from a large scale simulation study. *Econometric Reviews*, 29(2), 182-223.

Zanfei, A. (2012) Effects, not externalities. *European Journal of Development Research*, 24(1), 8-14.

Appendix A

The Im, Pesaran & Shin (2003) unit root test for heterogeneous panels (IPS) was used to investigate whether the variables in equation 1 are integrated. In comparison to some other panel unit root tests, the IPS, which is based on the augmented Dickey-Fuller test (ADF), has the advantage of allowing for heterogenous autoregressive parameters. The null hypothesis of the IPS is that each panel contains a unit root, while the alternative hypothesis is that some panels are stationary. To control for autocorrelation, the tests were performed considering 4 lags. The results are presented in table A.1.

Table A.1 - IPS panel unit root tests

Variable	levels (c)		levels (c,t)		first differences (c)	
	test statistics	p-value	test statistics	p-value	test statistics	p-value
MODEMP/WAP	2.37	0.99	2.79	1.00	-3.79	0.00
ln (FDI/WAP)	4.64	1.00	0.00	0.50	-4.14	0.00
ln (DK/WAP)	1.60	0.95	2.58	1.00	-2.26	0.01
ln (HC)	2.69	1.00	0.87	0.81	-0.96	0.17
		Excl. Botswana and Mexico			-1.77	0.04

Note: c and t denote, respectively, country-specific intercepts and trends in the panel unit root test.

Table A.2 - Single-country KPSS tests of ln (HC)

Country	level-stationarity	trend-stationarity
	test statistics	test statistics
Botswana	0.72 **	1.96 **
Mexico	0.73 **	1.93 **

Notes: ** denotes statistical significant at the 5 percent level. The number of lags was selected according to the Newey-West procedure. The null hypothesis of the KPSS test is that the variable is stationary.

The test statistics suggested that all the variables of equation 1 have at least one unit root. The null that all the panels contains unit roots was not rejected for the variables in levels but was rejected for first differences of the variables, except in the case of ln(HC). Further investigation revealed that the panel unit root test of the first differences of ln(HC) was strongly influenced by the presence of two countries, Botswana and Mexico. The Kwiatkowski, Phillips, Schmidt, Shin (KPSS) test, applied individually to these countries, rejected the hypothesis that ln(HC) is stationary, as shown in table A.2. This was corroborated by the Augmented Dickey-Fuller (ADF) test, which could not reject the presence of a unit root in both levels and first differences of ln(HC), as shown in table A.3. However, the risk of an explosive behaviour on the part of ln(HC) is minimal since in both countries the variable ln(HC) trends upwards but its first difference trends downwards. When these two countries are excluded from the sample, the panel unit root test rejected the presence of a unit root in first differences of ln(HC) at the conventional significance levels.

Table A.3 - Single-country ADF tests of ln (HC)

Country	levels		levels with trend		first differences	
	test statistics	p-value	test statistics	p-value	test statistics	p-value
Botswana	-2.49	0.12	1.38	1.00	0.47	0.98
Mexico	-2.35	0.15	2.13	1.00	0.58	0.99

Notes: The test was performed with four lags. The null hypothesis of the ADF test is that the variable has a unit root.

Given the evidence that all variables present a unit-root, the next step was to test for cointegration using Pedroni's (1999) approach, which consists in testing for a unit root in the estimated residuals of the cointegrating regressions. Comprised by seven test statistics, it has the advantage of allowing for heterogeneous cointegrating vectors across countries. Pedroni refers to three statistics as group-mean panel cointegration statistics (or between dimension statistics) because they average the autoregressive (AR) coefficients that are estimated individually for each panel, what means that they can vary across panels. The remaining four statistics impose a same AR coefficient to every panel and are referred to as panel cointegration statistics (or within dimension statistics). No cointegration is the null hypothesis of the tests, while the alternative hypothesis is that all panels are cointegrated. The statistics of the cointegration tests are presented in table A.4. The null was rejected by four of the seven tests. However, contradictory results among the seven tests are not uncommon because their power is influenced by both the length of the time series and the number of panels. According to a simulation study conducted by Wagner & Hlouskova (2009), the two tests based on the ADF principle are the best performers amongst the seven Pedroni's (1999) tests. When the t dimension is as small as in the sample used in this empirical exercise, the statistical powers of the panel-v, the panel-rho and the group-rho statistics are very low, while the powers of the panel-t and the group-t are more acceptable (Pedroni, 2004)[88]. Considering that low power means a high probability of accepting the null when it is false, the evidence presented by the two ADF-based tests as well as the panel-t and the group-t tests favouring the alternative hypothesis of cointegration seems more reliable than the evidence in the opposite direction provided by the other tests.

[88] Considering the example provided in figure 6 of Pedroni (2004, p. 614), the statistical power of the group-rho and the panel-v would be close to zero when t=30 (considering an AR coefficient for the regression residuals equal to 0.95), while the power of the panel-rho would be slightly higher than 0.2. In turn, the statistical power of the panel-t and the group-t would be close to 0.5.

Table A.4 - Pedroni's (1999) panel cointegration tests

Test	Statistic
Panel	
Variance ratio (panel-v)	0.51
Phillips-Perron rho (panel-rho)	0.5
Phillips-Perron t (panel-t)	-2.63 ***
ADF t (panel-ADF)	-3.87 ***
Group-mean	
Phillips-Perron rho (group-rho)	2.17
Phillips-Perron t (group-t)	-2.18 **
ADF t (group-ADF)	-4.15 ***

Notes: ** and *** denote rejection of the null hypothesis of no cointegration at the 5 and 1 percent significance levels, respectively. To (partially) control for cross-section dependency, the tests were applied to time-demeaned variables. The number of lags used in the ADF regression was determined by Akaike information criterion.

Appendix B

Table B1 - PDOLS estimation of equation 1 - Country-specific coefficients

Country	ln FDI/WAP		ln DK/WAP		ln HC	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Argentina	-0.0255	-1.32	-0.0438	-1.07	-0.0200	-0.34
Bolivia	0.0451	0.84	0.1594	0.57	0.6640	2.51
Brazil	0.0369	3.37	-0.0579	-2.68	0.2323	5.39
Botswana	-0.0036	-0.24	0.1480	4.65	0.1880	-2.29
Chile	-0.0378	-1.32	0.0089	0.46	0.0018	0.01
China	-0.0053	-2.15	0.0135	3.85	-0.4243	-11.21
Colombia	0.0597	2.91	0.0094	0.40	0.9044	4.41
Costa Rica	-0.0386	-1.81	-0.1755	-0.95	0.1245	0.38
Egypt	-0.0358	-10.12	-0.0246	-4.66	-0.0743	-4.24
Ethiopia	0.0066	1.10	-0.0110	-0.78	0.0416	0.87
Ghana	-0.0352	-4.40	0.0861	5.35	-0.1198	-2.20
Indonesia	0.0176	1.89	-0.0149	-0.45	0.3293	1.59
India	0.0239	8.31	-0.0979	-5.32	0.3005	3.52
Kenya	-0.0321	-3.09	0.0408	3.03	-1.1070	-1.82
South Korea	-0.0202	-1.90	0.0252	1.20	0.1058	0.93
Mexico	-0.0016	-0.42	0.0134	1.16	-0.7202	-12.76
Morocco	-0.0217	-1.69	-0.0354	-6.23	0.3561	6.29
Mauritius	0.0442	16.43	0.0392	6.53	0.8511	13.28
Malawi	0.0429	4.27	-0.0498	-3.43	0.1514	2.63
Malaysia	0.0684	9.68	0.2601	5.96	-0.2256	-3.38
Nigeria	0.0166	1.25	-0.0054	-0.90	0.2610	2.86
Peru	0.0169	7.49	0.2583	10.73	-0.1698	-6.84
Phillipines	0.0132	1.83	-0.0162	-3.65	0.2121	3.93
Senegal	-0.0259	-10.42	-0.0740	-5.54	0.3899	7.85
Thailand	0.0626	26.60	0.0686	13.40	0.4173	-24.65
Tanzania	0.0108	1.71	0.0369	4.48	-0.0707	-1.95
Venezuela	-0.0238	-2.11	0.0609	4.29	-0.0698	-1.45
South Africa	-0.0048	-2.52	0.0990	14.57	0.1172	9.72

Appendix C

This chapter uses, in its empirical part, Lavopa & Szirmai's (2018; 2020) categorisation of the modern sector, which foregrounds characteristics such as the potential for economies of scale and technological upgrading. In this classification, the mining industry belongs to the modern sector. However, such choice is debatable because in poor countries mining is known to be partially undertaken as a subsistence activity, notably in the cases of precious metals and stones. In addition, the fact that several developing economies are quite dependent on mining (including oil and gas extraction) calls this chapter's findings about the relevance of the non-manufacturing modern sector into question. Is the mining sector driving the results that have been assigned to the non-manufacturing modern sector? Are the conclusions dependent on the choice made?

In order to ensure that the results are not driven by what could be considered an arbitrary choice, both steps were re-estimated with mining classified in the traditional sector. In the first step, the average long-run country-specific coefficient of ln FDI/WAP remained almost the same (0.00578). The correlation between the original and the new BETAs is 0.98. Table C1 presents the results of the re-estimation of the second step, already distinguishing the effects of FDI concentration according to the development level of the country. Removing mining from the non-manufacturing modern sector does not seem to affect substantially this sector's coefficients. The conclusion that the concentration of FDI in the non-manufacturing modern sector produces negative development outcomes in countries at initial stages of development but has a positive impact in countries at a higher degree of development still holds. The most remarkable changes occur in the coefficients of FDI concentration in the traditional sector. Indeed, when mining is included in the traditional sector, the effects of FDI concentration in this sector become less negative, in the case of countries at initial stages of development, or more positive, in the case of countries at higher stages of development. The equality of the two coefficients is rejected by the F-statistic, thus suggesting that, conditional on FDI concentration in the non-manufacturing modern sector, a higher concentration of FDI in the traditional sector is more beneficial to development in countries at a higher stage of development as compared to countries at initial stages of development, in which the effect tends to be negative.

Table C1 - Determinants of the long run relationship between FDI and employment structure (β1's)

	Mining in modern sector	Mining in traditional sector
constant	-0.077	-0.067
	(-2.68)	(-2.73)
dummy initial MODEMP/WAP below median	0.123	0.108
	(3.20)	(3.32)
credit/GDP	0.051	0.049
	(2.33)	(2.57)
trade/GDP	0.032	0.020
	(1.42)	(0.96)
control of corruption	-0.022	-0.020
	(-1.79)	(-2.07)
FDI non-manufacturing modern sector		
initial MODEMP/WAP below median	-0.116	-0.132
	(-2.55)	(-2.64)
initial MODEMP/WAP above median	0.080	0.073
	(1.75)	(1.61)
FDI traditional sector		
initial MODEMP/WAP below median	-0.201	-0.086
	(-1.73)	(-2.11)
initial MODEMP/WAP above median	0.023	0.062
	(0.18)	(1.48)
F-statistic (equality of FDI coefficients - non manufacturing modern sector)	10.88	9.10
p-value	0.00	0.01
F-statistic (equality of FDI coefficients - traditional sector)	1.57	7.36
p-value	0.23	0.01
R-squared	0.55	0.55
AIC	-116.79	-125.42

Notes: The first step (equation 1) was reestimated to obtain the Betas used in model 15. t-statistics in parentheses.

CHAPTER FOUR:

FDI, PRODUCTIVITY GROWTH AND STRUCTURAL CHANGE IN EUROPEAN POST-COMMUNIST COUNTRIES: AN INDUSTRY-LEVEL ANALYSIS

1. Introduction

The empirical literature on the development effects of foreign direct investment (FDI) can be roughly divided into two major streams. There is a voluminous microeconomic literature, which has benefited from the increasing availability of longitudinal firm-level databases, that primarily focuses on how the presence of foreign multinational enterprises (MNEs) affect other economic agents, especially the firms owned by local nationals. Almost every sizeable country has already been covered by a study on FDI spillover effects on domestic firms' productivity, export propensity or innovation performance, to mention just the most studied issues. Besides this, there is a less numerous literature that focuses on the relationship between FDI and economic growth, aiming at identifying which factors make positive effects of FDI on growth more likely and stronger. In general, studies in this area either focuses on a single country or adopts a cross-country perspective. In both cases, the use of aggregate (country-level) data is the norm[89].

From a structuralist perspective, an intermediate (meso) treatment is clearly missing in the literature. More specifically, little is known about how the distribution of inward FDI between industries affect economic growth. Even less is known about how FDI influence the evolution of the economic structure. In order to fill this gap, this chapter builds on the structural change literature, more precisely on shift-share analysis, to firstly decompose labour productivity growth in former communist countries of Central and Eastern Europe into the within-industry productivity growth and the structural change components, and then investigate whether they can be associated with changes in FDI stocks at the industry level.

The choice of this group of countries can be justified on the following grounds. First, former communist economies represent a useful laboratory to test the effects of FDI on development because they departed from virtually no FDI stocks at the beginning of

---

[89] Narula & Pineli (2019) survey both streams of the literature on the development impacts of MNEs, highlighting the most robust empirical evidence and pointing out the remaining research gaps.

.

transition to market economy. Second, the particularities of these countries are still under-researched. Catching-up in an industrialised country after the fall of communism is likely to be very different from catching-up in a backward economy (Tondl & Vuksic, 2003). Indeed, the most industrialised communist countries and the advanced capitalist countries were much more alike in terms of physical and human capital endowments than the typical developing country. What fundamentally set them apart from the advanced capitalist world was their distance to the technological frontier (Campos & Kinoshita, 2002). For this reason, the role of FDI in fostering development in former communist countries is likely to differ from the role played in developing countries.

Having in mind the importance of accounting for heterogeneous effects of FDI – as evidenced by previous empirical studies (Carkovic & Levine, 2005; Herzer, 2012; Kottaridi & Stengos, 2010) as well as theoretical developments (Dunning, 1981; Dunning & Narula, 1996; Narula, 1996; Narula & Dunning, 2010) – the analysis is carried out considering that identifying differential effects is as important as estimating "average" effects. For such, the following potential causes of heterogeneous effects of FDI are explored throughout the chapter: institutional development, human capital endowment, conformity to comparative advantage and integration to global value chains (GVCs).

These days it is widely accepted that institutions shape the incentives faced by economic agents (North, 1991), influencing the strategies of incumbents, the entry of foreign MNEs and the creation of new ventures. This issue is particularly relevant in the context of former communist economies since the building of market-friendly institutions constituted one of the core elements of the transition process. The materialization of the potential benefits of FDI, especially the generation of positive spillover effects to domestic actors, is contingent on what Abramovitz (1986) calls social capabilities, which include the political, commercial, industrial and financial institutions required to run a modern market economy. In face of this, it is investigated whether the effect of FDI on productivity growth depended on the level of regulatory quality achieved by the country and whether this differential effect was more relevant among industries that are usually more regulated by the State.

A frequent finding of empirical studies on FDI spillovers is that domestic firms with higher absorptive capacity, defined by Cohen & Levinthal (1990) as "the ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends", are better able to benefit from the presence of foreign MNEs – see Kinoshita (2001), Schoors & Van der Tol (2002), Kolasa (2008) and Damijan *et al.* (2013) for studies covering transition economies. Originally conceived as an attribute of firms, the concept was soon extended to the national level. Dahlman & Nelson (1995) define a country's absorptive capacity as "the ability to learn and implement the technologies and associated practices of already developed countries". Departing from this definition, some cross-country studies have investigated whether a minimum level of absorptive capacity is required to reap the potential benefits of FDI in terms of enhanced growth. An early study in this area is Borenzstein, De Gregorio & Lee (1998), which uses a measure of human capital as a proxy for a country's absorptive capacity[90]. Their results indicate that human capital moderated the effect of FDI on growth within a sample of 69 developing countries during the 1970s and 1980s. In order to test the hypothesis at the industry level, this chapter investigates whether the effect of FDI on productivity growth in CEECs depended on human capital endowments and whether the differential effect was more relevant among industries intensive in high-skilled labour.

One of the main theoretical approaches to FDI, developed by the same group of Japanese economists that proposed the flying-geese model of development (Kojima, 1960; Akamatsu, 1961; 1962), suggests the existence of two types of FDI: one that conforms to both home and host countries' comparative advantages and, thus, is welfare-improving and pro-trade; another which disregards comparative advantages and, more often than not, replaces trade, what reduce the probability of positive welfare effects (Kojima, 1982; Kojima & Ozawa, 1984). To test this conjecture, it is investigated whether the effects of FDI on productivity growth is stronger when FDI takes place in countries that possess comparative advantage in the invested industry.

The increasing integration of productive systems across the world over the last few decades has challenged conventional views on international trade and the economic specialization of nations. Several factors, including falling transportation and communication costs, declining trade barriers and increasing modularity of production stages led to an increasing fragmentation of production across borders (Jones & Kierzkowski, 2005a). This process has been largely led by MNEs, which act as integrators of geographically dispersed production units, not rarely exerting control over the value chain without direct investment (Gereffi, Humphrey & Sturgeon, 2005; Narula, 2014).

[90] Criscuolo & Narula (2008) points out that human capital is not exactly a synonym to absorptive capacity but rather it is one of its constituents. They cite the planned economies of Eastern Europe as good examples of countries in which the existence of large contingents of qualified workers did not translate into efficient absorption of external knowledge. This view is also supported by Romer (1993), who advocates that the institutional framework is a defining factor of a country's absorptive capacity.

Intra-industry trade (of intermediate goods) now accounts for a large share of the world trade[91] and the international division of labour increasingly follows comparative advantage in performing specific tasks within a value chain instead of the old Ricardian notion of comparative advantage in final goods (Jones & Kierzkowski, 2005a; 2005b). A corollary is that efficiency is likely to be associated with the level of within-industry specialization which, in turn, is positively associated with the level of use of outsourced – including imported – inputs. In light of this, it is analysed whether FDI in industries that rely more on imported inputs, or export a larger share of their output, produces better outcomes for a country than FDI in industries that are less integrated into the global economy.

The chapter focuses on 11 countries – Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia and Slovenia – which were selected due to the availability of industry-level FDI data[92]. Considering the highly specific historical context of these countries, the chapter begins with a snapshot of the defining characteristics of the communist mode of economic organization, which is followed by a discussion of the process of transition, including an evaluation of economic performance over the 1990s. Next, a few statistics on the evolution of FDI are presented together with a brief review of the literature on FDI determinants in transition economies. Finally, section 4 brings the results of the empirical exercise performed in the chapter.

Considering that a country's labour productivity can be improved through productivity gains within industries or through the reallocation of the workforce from lower-productivity industries to higher-productivity industries (McMillan & Rodrik, 2014) – the main findings of this chapter can be summarized as: (i) the within-industry component accounts for a large share of the labour productivity growth of CEECs in the period 2000-2014 but the reallocation or structural change component is not negligible in most countries; (ii) FDI is positively associated with labour productivity growth within industries but the "average" effect is small and statistically insignificant; (iii) institutional factors matter: the effects of FDI on productivity growth seems to be stronger in countries with better regulatory quality, but only in the case of traditionally highly regulated

---

[91] In 2011, intra-industry trade accounted for more than 2/3 of total international merchandise trade in developed countries and East Asian countries, according to UNCTAD (2013).

[92] The OECD uses the term "Central and Eastern European countries" (CEECs) to refer to a group of former communist countries, some of which not covered in this chapter, that does not include Russia. Nonetheless, for simplification, the term CEECs is sometimes used in this chapter in reference to the group of 11 countries under analysis.

.

industries; (iv) the effect of FDI on productivity growth seems to be stronger in skilled-labour intensive industries; (v) participation in GVCs matters: the effect of FDI on productivity growth is stronger the higher the export orientation of the industry; (vi) alignment to comparative advantage possibly matters: confining the analysis to the manufacturing sector, results suggest that FDI is more likely to lead to productivity growth when it takes place in countries that have a comparative advantage in the respective industry, but the results are barely statistically insignificant; (vii) FDI seems to attenuate structural change, in the sense that the move of labour from the lower productivity industries to the higher productivity industries tends to be less intense when FDI takes place, partly because FDI is associated with lower job creation in high productivity industries, especially in more advanced countries in terms of institutions and human capital, and partly because it is associated, in certain circumstances, to higher job creation in low productivity industries.

2. Transition, the first ten years

2.1. Primary features of the communist economies and the challenges of transition to capitalism

First and foremost, it is important to bring in the defining elements of the Soviet-type economy. The distinguishing feature of these economies – apart from the omnipresence of the Communist Party in every relevant decision process – was the system of central planning. Another key aspect was the dominant state ownership of the means of production. Production was concentrated in (often excessively) large, often monopolist, and poorly specialized enterprises (Lavigne, 1999; Popov, 2007). Managers had to fulfil output targets, not maximize profits. Prices were rigidly controlled and neither reflected scarcity nor demand.

Economic activity in centrally planned economies (CPEs) was much more concentrated in the manufacturing sector than it would be expected according to their per capita income levels, with a clear preference for heavy industry – according to estimates by Dohrn & Heilemann (1996), the industry of investment goods was typically three times the expected size. The military-industrial complex as well as the intermediate goods industry and the construction sector were also rather oversized, while the services sector – regarded as unproductive in Marxist conception – was considerably undersized. Trade structures were also distorted as a substantial part was realized with other communist countries (members of the Council of Mutual Economic Assistance – Comecon) (Havrylyshyn & Al-Atrash, 1998). Foreign investment was almost non-existent.

CPEs were relatively successful in mobilizing resources for capital formation – investment rates exceeded 30% of the GDP. For this reason, they could sustain relatively high rates of economic growth – at least until the 1960s – but at the expense of increasing inefficiency. Indeed, the system was geared towards full employment of resources, instead of their efficient use (Campos & Coricelli, 2002). For several reasons, the system was poorly suited to foster innovation: firms faced almost no competition (Campos & Coricelli, 2002), innovators barely reaped the economic rewards of their innovations, the links between basic research and applied development were rather weak (Radosevic, 1998; 1999).

On the economic side, the substitution of central planning by market incentives as the mechanism of resource allocation constituted the ultimate objective of the transition process. This would require profound changes in institutions, laws and attitudes. Transition would involve the reallocation of resources from the activities performed under the old centrally planned system to activities performed within the new marked-based economy. An extreme version of Schumpeter's creative destruction would take place, bringing far-reaching changes at all levels – from the product and factor of production levels, passing by the firm and industry level, up to the economy-wide level. Transition would entail the closure of inefficient firms, the restructuring of the surviving firms and the emergence of new firms (Blanchard & Kremer, 1997). Overindustrialized countries would be faced with a difficult choice – if they liberalize their economies, major segments would be exposed as uncompetitive. There should be pressures to subsidize these industries, to sustain output and preserve jobs (Gelb, 1999).

Transition began to be conceived by government officials, scholars and experts of international organizations when the old systems were in their death throes (Fischer & Gelb, 1990; Lipton *et al.*, 1990; Nordhaus, 1990; Przeworski, 1991; Balcerowicz, Blaszczyk & Dabrowski, 1997). The broad range of reforms required by systemic transformation can be divided into two groups. Type I reforms would target the dismantling of the central planning and involve measures like price and international trade liberalization and elimination of subsidies. Type II reforms would be more ambitious and complex as they would involve the introduction of a myriad of laws and regulations as well as the creation of institutions that could ensure the replacement of the old system by a well-functioning market economy. Among the most important type II reforms would be the development of a financial system, especially a viable banking sector, and the transfer of ownership of productive assets from the State to private hands (Svejnar, 2002). Along with the dismantling of the system of central planning, privatization was at the core of the transition process. At the enterprise level, privatization was expected to raise efficiency and profitability. Transfer of ownership should also help to remedy the communist economy's well-known problem of soft budget constraint[93] (Kornai, 1986). At the economy level, privatization was expected to improve the allocation of resources and enhance long term economic growth (Megginson & Netter, 2001).

Defenders of shock therapy argued that reforms should progress as fast and on as many fronts as possible while gradualists prioritized the right sequencing and timing of reforms as they viewed complementarities between them (Bennett, Estrin & Urga, 2007). Some argued that in the absence of appropriate institutions, corruption and rent-seeking could spread out and privatization of former State assets could lead to deleterious concentration of wealth and political power (Godoy & Stiglitz, 2007).

2.2. Transition in practice

Although former communist countries have been grouped under a same label by international organizations, "transition economies" were quite heterogeneous, not only in terms of initial conditions but also in terms of transition strategies. Indeed, reforms have been implemented in different ways, in different sequences and at different speeds in those countries.

Almost all countries adopted a shock therapy approach in respect to type I reforms, which were accompanied by stabilization policies aimed at tackling macroeconomic imbalances. Small firms were privatized, barriers to the creation of new firms were removed and most State subsidies were supressed. Rapid adjustment of domestic prices contributed to improve resource allocation (Svejnar, 2002). By the mid-1990s, most of the potential progress had already been made[94].

[93] The concept of "soft budget constraint" refers to the communist governments' tendency of bailing out chronic loss-making firms with subsidies and other instruments. Managers were little concerned with efficiency as their firms' survival was (almost) guaranteed. According to Kornai (1986), this behaviour helps to understand the low efficiency of the communist economies.

[94] In 2000, almost all the countries of the sample had reached the maximum level in European Bank for Reconstruction and Development's (EBRD) small scale privatization index, what means "complete privatization of small companies with tradable ownership rights". In respect to price liberalization, all the

Regarding type II reforms, the developments have been much more heterogeneous. The speed seems to have been influenced by conditions at the start of transition[95] – countries with less favourable initial conditions tended to progress more slowly (Campos & Coricelli, 2002). By the turn of the century, Central European countries were the most advanced, followed by the Baltic countries, then Bulgaria and Romania, and lastly Russia and other former Soviet republics (Svejnar, 2002)[96].

Selling state-owned enterprises, as fast as possible, to private investors able to restructure and run them efficiently would be desirable from a purely economic point-of-view. However, privatization in former communist countries was also a political process that required public approval while dealing with vested interests. In practice, privatization processes were shaped by systemic characteristics of the soviet-style economies, such as the shortage of private savings, as well as by specificities of each country. Countries resorted to different mixes of privatization methods, depending on factors such as political slant of the government, foreign debt, levels of economic and institutional development as well as firm idiosyncratic factors (Hunya, 2000; Bennett, Estrin & Urga, 2007). Some countries, such as Czechia and Hungary, transferred the ownership of most medium and large sized firms rather fast, while others, such as Poland and Slovenia, privatized at a much slower pace (Hunya, 2000; Svejnar, 2002). The main methods also differed. The so-called mass privatization, through the free distribution of vouchers to the population, allowed a fast transfer of ownership to private hands. This method was largely employed in Czechia, Latvia and Lithuania. Sales to insiders – managers and workers – were common in Croatia, Poland, Romania, Russia, Slovakia and Slovenia. Sales to outsiders were important only in Estonia and Hungary (Havrylyshyn & McGettigan, 2000; Svejnar, 2002). Furthermore, the sequencing of privatization was not random. As shown by Gupta, Ham & Svejnar (2008), in the case of Czechia, firms that were more profitable and had higher market shares tended to be privatized earlier.

Subsequent development of the private sector was impacted by privatization strategies. Takeovers by outsiders seem to have led to superior corporate governance and

countries reached standards compatible with typical advanced economies by 1994. The same occurred with trade and foreign exchange liberalization but, in this case, there was a substantial reversion in Russia after the 1998 financial crisis.

[95] It must be noted that several countries had already realized a bunch of reforms prior to the 1990s in order to bring in some market discipline to the planned economy (Campos & Coricelli, 2002). Hence, countries departed from different points at the outset of transition.

[96] EBRD's transition indexes regarding competition policy and governance and enterprise restructuring shows that there was still considerable progress to be made in most countries in 2000. Countries most advanced in both indexes were Hungary and Slovakia.

performance as compared to buyouts by insiders and, especially, to mass privatization. Indeed, the drawbacks of mass privatization, which led to highly dispersed ownership structures[97], became clear already in the second half of the 1990s (Nellis, 1999; Svejnar, 2002; Megginson, 2005). In general, studies show that privatization improved firm performance in CEECs (Megginson & Netter, 2001; Djankov & Murrell, 2002; Estrin *et al.*, 2009), even though this was not true in the case of firms acquired by their workers (Djankov & Murrell, 2002). Firms whose ownership is more concentrated perform better than firms with dispersed ownership (Commander & Svejnar, 2011). Estrin *et al.* (2009) show that privatization raised efficiency relatively to state-owned enterprises, but the effect was much larger when the firm was acquired by foreign investors instead of domestic ones.

2.3. Aggregate economic performance

The effects of type I reforms were felt very fast. Substantial changes in relative prices took place following price and trade liberalization (Gomulka, 2000). Trade flows were rapidly reoriented from East to West, even before the privatization of large state companies (Havrylyshyn & Al-Atrash, 1998; Svejnar, 1999).

Table 1 - Per Capita Gross Domestic Product (In 2010 Constant Prices)
(1989 or 1990 = 100)

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Croatia		100	79	70	**65**	70	75	80	86	89	89	92
Czechia		100	88	**88**	88	90	96	100	100	99	101	106
Estonia		100	93	75	**72**	72	76	81	91	95	95	105
Hungary	100	97	85	83	**82**	85	86	86	89	93	97	101
Latvia		100	90	59	**51**	52	53	54	60	64	67	71
Lithuania		100	94	74	63	**57**	59	63	68	74	73	77
Poland	100	88	**82**	84	86	91	97	103	109	114	119	125
Romania	100	94	82	**75**	77	80	87	91	87	86	86	89
Russia		100	95	81	74	64	62	60	61	**58**	61	68
Slovakia		100	85	**79**	80	85	90	96	102	106	105	107
Slovenia		100	91	**86**	89	94	98	101	107	110	116	121

Source: United Nations Department of Economic and Social Affairs.
Note: Years in bold indicate the peak of transformational recession in each country.

Removing the distortions accumulated by CPEs was widely seen as growth-enhancing (Blanchard & Kremer, 1997; Campos & Coricelli, 2002; Svejnar, 2002).

[97] In some countries, initially dispersed ownership structures were reverted as ownership centred on insiders or outsiders like investment funds (Havrylyshyn & McGettigan, 2000).

However, growth performance in the first decade of transition was disappointing, to say the least. Central European countries lost about a fifth of their GDP at the start of transition, while Baltic countries and Russia lost more than 40% (on average) – see table 1. Such downfalls were accompanied by major changes in the sectoral composition of output. As shown in table 2, by the middle of the decade overindustrialisation was already largely corrected. Growth only resumed, in a consistent way, after a few years, in the case of Central Europe, and by the end of the decade, in Russia. During the 1990s, all the transition countries had witnessed a widening of their income gaps relatively to the OECD average. In sum, actual depressions were much deeper and lengthier than the "transformational recessions" expected by governments and experts of international agencies at the launch of the transition processes (Kornai, 1994; Svejnar, 2002)[98]. What could explain such a debacle?

Table 2 - Manufacturing share in total value added (In Current Prices)

(In %)

Country	1988	1990	1995	2000
Croatia		29	20.5	18
Czechia		31.8	23.7	25.9
Estonia		32.8	19.8	17.3
Hungary	21.4	20	21.4	22.4
Latvia		33.5	20	15.3
Lithuania		36.2*	18.7	18.9
Poland	31.3	31.4	21.4	18.2
Romania	41.4	36.4	25.2	22.1
Russia		27.1	20.1	22.7
Slovakia		33.5	25.7	23.9
Slovenia		31.3	25.3	24.9

Source: United Nations Department of Economic and Social Affairs.
* 1991.

First of all, it must be stressed that analysing economic performance during the first years of transition is challenging because the official statistics have major measurement problems. On the one hand, output statistics of the communist era are probably overestimated because the firms' managers had incentives for doing so (Campos & Coricelli, 2002). In addition, output was not aggregated using market prices. On the other hand, national statistical offices largely overlooked the production coming from the new small firms that proliferated during the first years of transition, most of them

[98] The term "transformational recession", proposed by Kornai (1994), refers to the large output loss caused by the mere change in economic system, independently of the policies adopted during the transition.

operating in the shadow economy. Thus, statistical illusion could account for part of the measured decline in output during the first years of transition.

Nonetheless, it is more or less consensual that part of the slump was an inevitable consequence of tackling the imbalances of the communist economies, such as the excessive militarization, the overindustrialization and the distorted structure of trade among communist countries (Gomulka, 2000; Lavigne, 2000). Blanchard & Kremer (1997) assign the collapse in output to the disruption in production links between state-owned plants that were not immediately replaced by market-based links.

However, a sounder explanation is offered by Popov (2007), who affirms that the deep recession is intrinsically related to the shock therapy approach adopted by CEECs, in opposition to the gradual approach followed by China. Sudden liberalization of prices and international trade and the elimination of subsidies and trade tariffs led to rapid changes in relative prices and profits. Several industries and enterprises became inviable almost overnight. However, since capital is not homogeneous, it could not be moved easily from those industries and firms to the competitive ones. In turn, savings and investments generated and realized by the competitive firms were not enough to compensate for the capital being rapidly "destroyed" in the inviable firms. Therefore, the deep decline in GDP can be explained by the fact that output fell in uncompetitive industries much faster than the "transfer" of capital to the viable industries[99]. Cross-country regression results indicate that the speed of liberalization, which was determined by political economy factors, had an adverse effect on economic performance initially but had a positive effect on growth during subsequent recovery[100]. Cumulative output loss during transformational recession was larger in countries with greater distortions in industrial structure and trade patterns. However, these initial conditions did not affect growth rates during the recovery stage, what is interpreted by Popov (2007) as an evidence of the shutdown of inefficient industries and firms.

Additional cross-country evidence on the ultimately positive effect of reforms are presented by Berg *et al.* (1999), which find that more liberalized transition economies grew faster in the 1990s; De Melo, Denizer & Gelb (1996) find that countries which liberalized faster had recovered faster; and Campos & Coricelli (2002), which find that

[99] Such transfer is primarily in accounting terms, since depreciated capital in inviable industries was simply not replaced, while almost the whole new capital formation was taking place in the competitive industries.
[100] According to Gomulka (2000), the cumulative fall in manufacturing output was similar across countries, independently of the reform strategy adopted. However, countries that experienced larger declines in manufacturing output at the beginning of transition tended to recover faster, thus indicating that the length of recession is inversely related with its initial harshness.

countries that developed market institutions faster had better economic performance. A feedback relationship between reforms and growth is detected by Falcetti, Lysenko & Sanfey (2006). Havrylyshyn & Van Rooden (2003) provide evidence that economic liberalization had a more significant impact on economic performance than institutional quality in the period 1991-1998, but the importance of the later increased over time. All these findings conflict with Krueger & Ciolko's (1998) results, which indicate that the effects of liberalization on growth becomes insignificant once initial conditions of countries are accounted for. However, more recent work by Eicher & Schreiber (2010) shows that, even though initial conditions are quite important, so is progress in transition. Initial conditions have a level effect on subsequent growth rates but the effects of changes in structural policy on growth does not depend on initial conditions. Moreover, their results suggest that there is no "growth bonus" to early reformers.

Growth performance seems to have been affected by reforms in ownership structures, although not unconditionally. According to Zinnes, Eilat & Sachs (2001), privatization contributed positively to GDP growth only when accompanied by corporate sector reforms, among a group of 25 countries in the period 1990-1998. Linkage effects are detected by Berkovitz & De Jong (2002), which find that Russian regions with more large-scale privatization had a greater formation of new enterprises, which in turn was strongly associated with economic growth. This finding is relevant because, during the 1990s, growth in the most successful transition economies was driven mostly by new private enterprises, rather than through restructuring of state-owned firms (including privatization). This new private activity was initially strongly concentrated in services and was carried out by local entrepreneurs. By the end of the decade, however, it expanded to the manufacturing sector, with increasing presence of MNE affiliates (Gomulka, 2000).

A few studies analyse the relationship between FDI and economic growth in transition economies. A considerably strong effect is reported by Jimborean & Kelber (2017): using quarterly data for 10 countries over the period 1993-2014, they find that an increase of 1 percentage point (p.p.) in FDI flows/GDP ratio is associated to an increase of 0.17-0.23 p.p. in GDP growth rate. Tondl & Vuksic (2003) use a sample of 36 regions within Czechia, Hungary, Poland, Slovakia and Slovenia over the period 1995-2000 to analyse the effect of FDI and some geographical factors on economic growth. Even controlling for capital areas and European Union (EU) border regions (which outperformed other regions), they detect a strong positive effect of FDI on growth.

Campos & Kinoshita (2002) also find a positive impact of FDI on growth using a panel of 25 transition economies in the period 1990-1998. Interestingly, they detect a negative effect of human capital, measured by average years of schooling, on growth, what they attribute to the fact that human capital measures were artificially high in communist countries and did not reflect the types of skills required by market economies. Weber (2011) uses time-series techniques to distinguish long- from short-run relationships between GDP, exports and FDI within a group of 7 transition economies over the period 1993-2009. Impulse-response functions suggest a strong positive effect of FDI on GDP in the Baltic States and Russia, a negative effect in Czechia, and no significant effect in Poland and Slovenia. Nonetheless, using data of eight transition economies in the period 1994-2001, Mencinger (2003) find that FDI/GDP ratio Granger-causes a negative effect on GDP, a result that he attributes to the character of FDI during this period – mostly privatization instead of greenfield. As underlined by Narula & Guimon (2010), privatization-driven acquisitions tend to imply a higher risk of downsizing and break of linkages with domestic suppliers, that are replaced with MNE's global network of affiliates and partners. Curwin & Mahutga (2014) also find a negative relationship between FDI stock/GDP ratio and GDP growth for a sample of 25 transition economies over the period 1990-2010. Using a fixed-effects model, Nath (2009) fails to find any significant association between FDI flows (as a percentage of GDP) and GDP growth for a sample of 13 transition economies over the period 1990-2005, what suggests that higher FDI inflows bring no growth bonus to host economies. Summing up, the available evidence is inconclusive as the results seem to be quite dependent on the methods and samples employed.

2.4. When is transition over?

The empirical exercise carried out in this chapter uses data from the period 2000-2014. For this reason, it is important to question how far the transition process had gone, or even whether it was already over, by the turn of the century. As highlighted by Fischer, Sahay & Vegh (1996), two sets of forces were governing those countries' economic activity at that moment: the forces arising from the transformational process and the basic (neoclassical) determinants of growth. Therefore, the further the country was in the transition process, the greater the weight of standard determinants in explaining its growth rate.

However, it is not simple to answer this question. Indeed, although transition is a process, what means that is deemed to end in some point in time, the breath of the concept guards a high degree of subjectivity. Not surprisingly, scholars' answers vary considerably. Focusing on the case of Hungary, Kornai (1999) employs three criteria – i) the loss of Communist Party's political monopoly power; ii) the private sector accounting for the majority of output; iii) the market's role as the dominant coordinator of economic activity – to conclude that *while transformation was not yet over, transition certainly was*. In common with this view, Svejnar (1999) attributes a key importance to the abolition of central planning as the allocation mechanism in the economy. However, his definition of the end of transition goes further, claiming the substitution of central planning by an efficiently functioning market system capable of generating rapid and sustainable rates of economic growth. In turn, Gelb (1999, p. 39) claims that "transition is over when the problems and the policy issues confronted by today's 'transition countries' resemble those faced by other countries at similar levels of development". Based on this definition, transition was not over in any country by the end of the 1990s, even though it implies different endpoints for countries at different levels of development. To conclude, it is interesting to note that Lavigne (1999) considers that the question "*is transition over?*" is unanswerable, but she recognizes that meeting the criteria for EU accession is a meaningful one[101]. Based on this criterion, the countries analysed in this chapter were not too far from the endpoint of transition in 2000 since most of them concluded negotiations for EU accession two years later[102].

3. FDI in transition economies

In principle, former communist economies seemed to hold location advantages for both horizontal (market-seeking) and vertical (resource-seeking) FDI. The underdeveloped services sector offered a great opportunity for foreign investors, even in small countries. In turn, the relatively well-educated work force, that could be employed for a fraction of the wages paid in advanced economies, offered opportunities for labour cost-minimizing

[101] Lavigne (1999) considers that most transition economies were well behind advanced economies in issues like bankruptcy procedures, corporate governance rules, prudential rules for the banking system, regulation of the capital markets, tax collection effectiveness and labour market flexibility.
[102] Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia concluded negotiations in 2002 and acceded in 2004. Romania became EU member in 2007, while Croatia acceded in 2013. As underlined by Damijan, Kostevc & Rojec (2013, pp. 11), transition cannot be dissociated from the prospects of EU accession, as the later influenced the reforms, laws and institutions chosen during transition.

FDI. However, the establishment of export-oriented plants would certainly depend on an improvement of the business environment.

During the communist era, FDI was almost nil. The launch of transition did not change the picture very much as FDI inflows remained low at least until 1997 – the only exception was Hungary, whose privatization scheme had given preference, since 1993, to foreign exchange generating methods as a way of countering its high foreign debt (Svejnar, 1999). Despite the unique opportunity to acquire potentially lucrative assets at bargain prices, the attractiveness of privatization was substantially reduced by the severe institutional uncertainty that foreign investors faced especially in first years of transition. Privatization-related FDI was initially concentrated in manufacturing. Nonetheless, from the late-1990s, it directed increasingly to regulated industries such as banking, utilities and telecommunications (Meyer & Jensen, 2005). In some countries, like Czechia, Hungary and Poland, the foreign share in the banking sector jumped in the second half of the 1990s[103].

By the turn of the 21st century, foreign MNEs were dominant in several medium and high-tech industries, such as automotive and electronics, but were less present in low-tech and resource intensive industries (Hunya, 2000; Landesmann, 2003). Nonetheless, their dominance was much stronger in Hungary than in other countries – according to Hunya (2000), they accounted for 70% of manufacturing sales in 1998, while in Czechia and Poland their shares were 25% and 32%, respectively. Such discrepancy partially results from differences in FDI motivations across countries. Inward FDI in Hungary was initially privatization-related with a focus on domestic market but became increasingly export-oriented and concentrated in more technology-intensive industries over the years. In turn, FDI in Poland remained more domestic market oriented (Hunya, 2000).

In 2000, several CEECs were already displaying larger FDI stocks than countries at similar levels of development. The economy with the highest FDI stock as a fraction of GDP was Hungary, but Estonia was not far behind – see table 3. FDI stocks kept growing fast throughout the following years, but this trend was suddenly aborted by the 2008 global financial crisis – in the case of Russia, FDI stock declined substantially after 2008. In 2014, Estonia and Hungary were still at the top of the ranking, with about two times Poland's and Romania's FDI/GDP stock ratios and three times of Slovenia's.

[103] The need of repeated bailouts of the myriad of inviable small banks that emerged right after the abolition of the monobank systems led governments to privatize them to large western banks (Svejnar, 2002).

Table 3 - Inward FDI stock - 1995-2014
(In % of GDP)

Country	1995	2000	2005	2010	2014
Croatia	2.2	12.2	29.4	52.7	50.3
Czechia	12.3	35.2	44.6	62.1	58.5
Estonia	15.2	46.5	79.9	79.7	79.7
Hungary	24.3	48.3	54.1	69.4	71.1
Latvia	11.4	21.3	29.0	46.0	48.0
Lithuania	5.3	20.2	30.0	36.1	31.9
Poland	5.5	19.5	28.2	39.1	38.8
Romania	2.2	18.6	25.5	40.9	36.6
Russia	1.4	11.5	23.4	30.4	14.5
Slovakia	6.5	33.7	60.4	56.2	49.3
Slovenia	8.5	11.7	19.4	22.2	24.8
Greece	8.0	10.7	11.8	11.7	9.1
Portugal	15.7	28.9	33.8	48.3	52.4
Spain	17.2	26.3	33.2	43.9	43.4

Source: UNCTAD, *World Investment Report* , Statistical Annex.

As shown in table 4, most foreign investors are from EU member States, particularly Austria, France, Germany and Netherlands, and this prominence did not change substantially over time. The important role played by Cyprus as a source country is due almost exclusively to Russia[104].

[104] Nonetheless, the equally high stocks of Russian FDI in Cyprus suggest that a significant share of the Cypriot investments in Russia is probably just round-tripping FDI.

Table 4 - Inward FDI stock in transition economies, by country of origin - 2000-2014
(in % of total)

Partner	2000	2005	2010	2014
EU-15	66.34	68.21	56.57	64.65
Austria	6.99	9.30	6.74	7.90
Belgium	1.96	1.99	1.60	1.88
Denmark	1.78	1.52	0.96	0.95
Finland	1.41	1.60	1.33	1.14
France	6.25	6.61	5.26	5.58
Germany	19.67	16.05	9.93	11.23
Italy	2.51	3.14	2.00	2.43
Luxembourg	0.89	2.70	5.25	7.64
Netherlands	17.53	20.76	14.95	17.05
Spain	0.75	1.84	1.47	1.99
Sweden	3.06	3.58	3.35	2.44
United Kingdom	2.59	3.70	2.18	2.89
Bahamas	0.01	0.21	2.20	2.24
Bermuda	0.00	0.02	4.45	1.71
British Virgin Islands	0.06	0.58	4.71	1.33
Cyprus	1.04	4.94	17.59	14.04
Switzerland	2.28	2.73	2.77	3.19
United States	6.89	5.48	2.63	1.96
Other	23.38	17.84	9.09	10.89

Source: The Vienna Institute for International Economic Studies (WIIW), FDI Database. Author's calculations.

Table 5 presents the evolution of the distribution of FDI stocks across industries[105]. In general, the importance of the manufacturing sector has declined over time while the importance of the services sector has increased. Within the latter, the main recipient of FDI is the financial industry, but the importance of business services has been growing. In most countries, the share of transportation and telecommunications in total FDI stocks has decreased over time. Notwithstanding some common trends across countries, remarkable differences persist. In countries like Hungary, Slovakia and Slovenia, the manufacturing sector has twice the importance it has in Estonia and Latvia. Russia is the only country where natural resource extraction is a major recipient of FDI.

[105] For each country, table 5 presents the first and the last year considered in subsequent regression analyses. Tables A.1 and A.2, in the appendix, describe the activities encompassed by each industry.

Table 5 - Distribution of FDI by industry

(In %)

	Czechia		Estonia		Croatia		Hungary		Lithuania		Latvia	
	2000	2013	2000	2014	2000	2014	2000	2014	2000	2009	2000	2014
A-B	0.2	0.2	0.9	1.9	1.1	0.9	0.8	0.6	0.5	0.9	1.3	4.3
C	1.9	1.7	0.5	0.4	0.2	0.8	0.3	0.2	1.1	0.5	0.4	0.8
D	38.1	32.2	20.6	12.2	34.6	26.3	40.2	25.0	28.8	26.6	16.3	12.3
DA	4.8	3.2	3.7	2.6	6.9	2.1	7.0	2.1	11.5	4.8	4.8	1.6
DB-DC	1.3	0.5	3.4	0.7	0.2	1.4	1.4	0.4	4.7	1.2	1.6	0.3
DD-DE	3.1	1.4	3.0	2.6	2.3	0.5	2.1	1.0	2.5	2.3	3.5	3.2
DF	1.1	0.3	0.0	0.0	0.0	9.8	0.0	0.0	-0.1	9.0	0.0	0.0
DG	3.1	2.1	1.8	1.0	7.1	6.0	4.8	4.9	1.9	5.9	1.8	0.4
DH-DI	8.2	4.3	3.5	1.7	10.8	3.2	4.0	3.6	2.8	2.1	1.7	0.0
DJ	3.6	3.4	0.9	0.8	0.6	1.1	1.9	1.9	0.5	0.5	1.2	0.8
DK	1.7	2.7	0.4	0.3	1.7	0.5	1.8	1.4	0.3	0.2	1.0	0.1
DL	4.0	3.5	1.1	1.6	3.8	1.0	9.0	3.7	2.3	0.8	0.2	0.1
DM	6.5	9.7	1.5	0.4	0.8	0.2	7.9	4.7	2.1	1.5	0.1	0.6
DN-OTHER	0.6	1.2	1.2	0.4	0.5	0.5	0.3	1.2	0.3	0.7	0.4	5.3
E	6.6	5.7	2.7	2.2	1.1	1.1	6.4	2.6	2.5	5.3	5.2	4.3
F	1.5	1.3	3.1	1.0	1.3	1.2	1.3	0.8	0.7	2.0	1.9	3.4
G	15.0	10.1	12.2	14.1	9.8	8.6	9.3	9.5	22.7	14.0	20.3	12.7
H	0.3	0.4	2.2	0.5	6.4	4.2	1.3	0.5	2.3	0.7	1.7	1.1
I	11.2	6.2	6.2	7.3	14.4	6.4	16.5	7.0	18.7	11.4	20.4	6.8
J	14.7	27.9	43.1	29.1	27.1	27.6	10.1	15.9	16.2	18.0	23.0	28.2
K	9.2	11.3	8.2	28.8	3.7	21.3	11.3	31.5	5.2	17.6	7.5	17.2
OTHER-SERV	1.2	3.2	0.5	2.5	0.3	1.6	2.4	6.5	1.2	3.1	2.0	8.9

	Poland		Romania		Russia		Slovakia		Slovenia	
	2000	2014	2008	2014	2005	2013	2000	2014	2000	2014
A-B	0.5	0.5	1.5	2.5	1.0	1.6	0.1	0.4	0.0	0.2
C	0.4	0.4	4.4	5.6	25.9	16.5	1.1	0.5	0.0	0.4
D	38.6	29.3	31.2	32.0	39.0	36.7	53.0	33.4	43.2	32.4
DA	8.4	5.4	4.5	4.0	7.5	6.8	6.4	1.7	3.6	1.6
DB-DC	0.7	0.3	1.6	1.6	0.3	0.2	1.0	0.6	2.2	0.7
DD-DE	4.4	2.8	2.0	2.5	2.9	3.4	3.4	1.2	6.8	3.4
DF	0.1	0.0	1.4	1.0	7.2	1.6	4.2	3.3	0.0	0.0
DG	4.1	3.0	1.8	2.2	1.2	2.6	3.3	1.7	6.0	9.4
DH-DI	2.4	2.6	4.7	5.1	3.3	4.3	3.6	4.7	7.5	5.5
DJ	2.0	3.8	6.9	4.5	13.3	8.8	22.9	6.0	3.1	1.6
DK	1.3	1.0	2.0	2.4	0.8	2.2	2.3	2.7	1.1	2.1
DL	1.2	0.7	1.4	2.4	0.5	1.6	2.3	3.5	6.7	2.7
DM	6.4	5.2	4.0	5.4	1.5	4.7	3.4	7.1	5.3	4.9
DN-OTHER	7.8	4.5	0.8	0.9	0.5	0.4	0.2	1.1	0.9	0.5
E	1.2	3.4	5.6	11.1	0.5	3.9	0.2	4.0	0.8	3.8
F	6.6	4.5	8.8	4.2	1.1	2.2	1.2	1.1	0.2	0.8
G	16.7	14.0	12.4	11.7	6.6	9.6	11.6	9.1	15.2	22.8
H	0.5	0.3	0.4	0.9	0.5	0.3	0.8	0.6	0.6	0.3
I	8.0	7.4	7.8	7.7	7.3	5.8	16.8	6.7	2.9	9.1
J	20.0	22.6	20.5	13.0	7.2	5.0	11.9	24.5	30.5	15.6
K	7.0	13.8	7.1	10.8	10.2	17.7	2.9	19.3	6.6	12.2
OTHER-SERV	0.5	3.8	0.3	0.6	0.8	0.7	0.4	0.5	0.1	2.4

Source: The Vienna Institute for International Economic Studies (WIIW). Author's calculations.

By the turn of the century, cross-country studies on the determinants of inward FDI in former communist countries began to pop up. Early studies, such as Campos & Kinoshita (2003), employ aggregate FDI data. They find that institutions, natural resources endowment, agglomeration economies and labour costs were the main determinants of per capita FDI stocks within a group of 25 transition countries in the period 1990-1998. In turn, market size and educational level were not important. When the sample is split between Eastern European plus Baltic countries and CIS countries, agglomeration economies remain statistically significant only for the first group, natural resources seems to matter only for the later, while labour costs becomes insignificant within both groups of countries.

More recently, influenced by gravity models of international trade, studies began to rely more on bilateral FDI data when looking for FDI determinants. Bevan & Estrin (2004) find that gravity factors (market size and proximity) and unit labour costs were the most important determinants of bilateral FDI flows between 18 advanced home countries and 11 transition host countries in the period 1994-2000. They also detect a positive effect of announcements of proposals for EU accession in the final years of the sample. Using a panel of 7 advanced home countries and 8 transition host countries over the period 1995-2003, Bellak, Leibrecht & Riedl (2008) confirm that FDI flows are influenced by labour costs as well as labour productivity, but these factors are less important than market size and distance. They also find that countries that raised more revenues from privatization received more FDI. For the same group of countries, Bellak, Leibrecht & Damijan (2009) find that lower corporate tax rates and better infrastructure are associated with higher bilateral FDI flows. An interactive term suggests that better infrastructure alleviate the negative effect induced by higher taxes. Focusing on the role of institutional factors, which theoretically influence strategic decisions such as location, entry mode and establishment mode of foreign operations, Bevan, Estrin & Meyer (2004) find a positive association between institutional development and FDI receipts within a sample of 12 transition economies over the period 1994-1998. Among the several measures of institutional development used in the study, the most strongly associated with FDI inflows are the share of private sector in GDP, the development of the banking sector, legal development and liberalization of trade and foreign exchange. They also find a positive association between FDI inflows and progress in privatization, but the main method of privatization seems to be unimportant, what is interpreted as an indication that countries that do not sell firms directly to foreign investors receive an equivalent amount of FDI in other forms, such as greenfield or the acquisition of already private firms.

4. FDI, labour productivity growth and structural change in the period 2000-2014

After reviewing the developments of the first ten years since the launch of transition, it can be assumed that most of the adjustments needed to rebalance the economies had already taken place, so that the growth process of those economies resembled the growth process of a "normal" country, even though progress in institutional development was in some instances rather sluggish. For this reason, the period starting in 2000 seems appropriate to an analysis of the relationship between FDI, productivity growth and structural change in CEECs as growth tended to be less volatile and FDI determinants tended to be less dependent on transition-related developments.

The main objectives of the following empirical exercise are: (i) decomposing aggregate labour productivity growth of CEECs, in the period 2000-2014, into the *within*, *static shift* and *dynamic shift* components, using standard shift-share analysis; (ii) investigating how FDI relates to each of these components. The latter is the main contribution of this chapter as it enables the simultaneous treatment of the effect of FDI on within-industry labour productivity and on structural change. Complementing the basic analysis, the chapter also investigates whether the effect of FDI on labour productivity and structural change is influenced by the level of institutional development and the human capital endowment of the host country, the level of participation of the industry in GVCs and the alignment of FDI to host country's comparative advantage.

4.1. Data description

In this study, each observation refers to a specific industry of a specific country in a specific year. Most variables are taken at the country-industry level but a few is measured either at the country level or at the industry level. Data on nominal value added, prices and employment, all at the country-industry level, come from the Socio-Economic Accounts of the World Input-Output Database (WIOD) (Timmer *et al.*, 2015). This is also the source of data on employment by skill level in the United States (U.S.), which is used to benchmark the skill intensity of industries, a procedure used by other studies such as Ciccone & Papaioannou (2009). Data on inward FDI stocks by country-industry are provided by the Vienna Institute for International Economic Studies (WIIW). The OECD's Trade in Value Added (TiVA) database is the source of the two measures of GVC participation used – foreign value added in gross exports and dependency on exports

– both expressed at the country-industry level. Data on regulatory quality come from the World Bank's Worldwide Governance Indicators (WGI) whereas the human capital index is sourced from the Penn World Table 9.0. Both variables are measured at the country level. Finally, data on exports, used to calculate Revealed Comparative Advantage indexes, come from the UN Comtrade. They are originally expressed in country-product level but were rearranged to reflect the country-industry classification employed in the study.

An important preliminary task was the compatibilization of the industry level data provided by these different sources. An initial effort was made to put all the FDI data under a same classification because they are provided by WIIW under two different classifications (EU's NACE Rev. 1 and NACE Rev. 2), depending on country and year. Given that NACE Rev. 1 is less disaggregated than NACE Rev. 2, it was taken as reference. Particularly relevant was the correspondence between WIOD and WIIW datasets since WIOD is considerably more disaggregated than the FDI database – see table A1 in the appendix A. A similar procedure was employed to bring the indicators on GVC participation to the same classification system. Finally, correspondence tables between ISIC Rev. 3 (NACE Rev. 1) and SITC Rev. 3 were used for compatibilization with trade data. At the end, two datasets were created: one comprised by 11 manufacturing industries only; the other comprised by these plus 10 other industries of the primary, secondary and tertiary sectors (see tables A1 and A2 in the appendix A). To avoid distortions in labour productivity estimations, real estate activities (industry L68 in WIOD's classification) are disregarded in the analysis since this industry's value added comes mainly from imputed rent, what is hardly associated with any measure of sectoral employment.

For all the 11 economies, the shift-share analysis covers the period 2000-2014. Nonetheless, the panels used next in regression analyses are unbalanced because disaggregated FDI data is not available for the whole period for every country, as shown in table 6.

Table 6 - Periods included in the regression analyses, by country

Country	Period
Croatia	2001-2014
Czechia	2001-2013
Estonia	2001-2014
Hungary	2001-2014
Latvia	2001-2014
Lithuania	2001-2009
Poland	2001-2014
Romania	2009-2014
Russia	2006-2013
Slovakia	2001-2014
Slovenia	2001-2014

4.2 Decomposition of labour productivity growth in the period 2000-2014

There are two ways through which an economy can achieve higher labour productivity. *Productivity gains can be obtained within industries as a result of capital deepening, technological change or reduction of misallocation across plants* (McMillan & Rodrik, 2014) *or via labour moves from lower-productivity industries to higher-productivity industries*. This can be expressed in the following decomposition:

$$\Delta Y_t = \sum_{j=1}^{n} \theta_{j,t-k} \Delta y_{j,t} + \sum_{j=1}^{n} y_{j,t-k} \, \Delta\theta_{j,t} + \sum_{j=1}^{n} \Delta y_{j,t} \, \Delta\theta_{j,t}$$

Where Y and y_j refer to economy-wide and industry ($j=1 \ldots n$) labour productivity levels, respectively, and Θ_j is the share of industry j in total employment. The operator Δ denotes changes in y_j or Θ_j between t-k and t. It is easy to note that the first term is a weighted sum of labour productivity growth within industries, where the weights are industries' shares in total employment in the base period. This term is commonly called the *within* component. The other two terms relate to changes in the structure of employment. The second term captures the productivity effect of labour reallocations, holding constant the initial labour productivity at the industry level. This term is commonly known as the *structural change* component but, in this chapter, it is referred to as the *static shift* component, following the nomenclature used by Peneder (2001) and Havlik (2004), among others. The static shift term is positive when labour moves preponderantly from industries with below the average labour productivity to industries with above the average labour productivity. Finally, the third term captures the joint effect of changes in employment shares and industry-level productivity. It is positive when industries with above-average productivity growth increase their share in total employment. In this chapter it is referred to as *dynamic shift* component, though it is also known as *covariance* or *cross* term.

Table 7 - Decomposition of Labour Productivity Growth, 2000-2014
(In % per year)

Country	Within	Structural change		Total
		Static shift	Dynamic shift	
Croatia	0.96	0.82	-0.39	1.39
Czechia	1.52	0.01	0.07	1.59
Estonia	3.32	0.07	-0.28	3.10
Hungary	1.09	0.58	-0.20	1.47
Latvia	3.08	0.49	-0.16	3.42
Lithuania	4.28	0.57	-0.11	4.74
Poland	1.83	0.92	-0.06	2.70
Romania	3.34	1.34	0.17	4.85
Russia	2.16	0.56	0.29	3.01
Slovakia	3.19	0.14	-0.35	2.98
Slovenia	1.39	0.60	-0.30	1.70
Average	2.38	0.55	-0.12	2.81

Source: World Input-Output Database (WIOD), Socio Economic Accounts. Author's calculations. Note: The real estate industry is not included in the calculations.

Table 7 presents the decomposition of labour productivity growth in the period 2000-2014, using 21 industries. The numbers indicate a strong convergence as the least productive countries grew much faster than the most productive ones over the period under analysis[106]. However, there is no association between the static shift component and the initial labour productivity of the country[107].

The within component is the most important in all countries, but the structural change component is far from negligible in most of them. To have an order of magnitude, it is useful to compare these results with McMillan & Rodrik’s (2014) findings for developing Asia: over the period 1990-2005, labour productivity grew, on average, 3.87% annually in that region, of which 0.57 p.p. was due to structural change. These numbers are akin to the figures displayed in table 7 – except for Czechia, Estonia and Slovakia.

[106] A regression of labour productivity growth (from table 7) on the natural logarithm of the initial per worker GDP (in PPP) indicates a semi-elasticity of -0.0295 (t-stat = -4.05 and R-squared = 0.65).
[107] A regression of the static shift component (from table 7) on the natural logarithm of the initial per worker GDP (in PPP) indicates a semi-elasticity of -0.0059 (t-stat = -1.86 and R-squared = 0.20). Nonetheless, this result is entirely driven by Romania.

The dynamic shift component is negative in most cases, indicating that industries whose share in employment is shrinking are the ones with the highest labour productivity growth (or, alternatively, industries whose share in employment is expanding are the ones with lowest labour productivity growth). As shown in table 8, this result is mainly due, on the one hand, to labour moving out of agriculture and manufacturing and, on the other hand, to labour moving to hotels and restaurants, business services and other services, which include education and health services (respectively industries H, K and OTHER-SERV in table 8). It must be noted that labour move to business services brings a strong contribution to the static shift component, as this industry was initially much more productive than the average, but as this industry's productivity growth is significantly lower than the average growth rate, it affects negatively the dynamic shift component.

Table 8 - Employment share and relative labour productivity by industry, 2000-2014

Industry	Employment share (%)				Relative labour productivity (ratio of the economy's labour productivity)			
	2000		2014		2000		2014	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
A-B	16.62	11.44	9.99	7.36	0.35	0.16	0.55	0.39
C	0.92	0.53	0.65	0.48	2.41	2.21	2.45	2.12
D	21.44	4.18	18.51	3.94	0.88	0.20	1.13	0.16
DA	3.35	0.77	2.66	0.76	1.18	0.58	1.17	0.64
DB-DC	3.80	1.03	1.85	0.93	0.44	0.18	0.48	0.12
DD-DE	2.46	0.92	2.02	0.72	0.68	0.12	0.92	0.23
DF	0.34	0.49	0.15	0.11	5.91	7.71	4.76	4.30
DG	0.90	0.44	0.73	0.30	1.76	0.82	2.00	1.13
DH-DI	1.73	0.72	1.71	0.64	0.87	0.20	1.21	0.23
DJ	2.44	1.34	2.70	1.22	0.97	0.38	1.01	0.23
DL	1.76	1.02	1.67	0.95	0.78	0.49	1.38	0.33
DK	1.35	0.90	1.20	0.72	0.70	0.42	1.19	0.44
DM	1.27	0.69	1.76	1.11	1.09	0.36	1.38	0.65
DN-OTHER	2.03	0.80	2.04	0.73	0.76	0.36	0.89	0.17
E	2.43	0.58	2.02	0.24	2.50	0.69	2.17	0.55
F	6.43	1.08	7.43	0.68	1.10	0.23	0.96	0.21
G	13.35	1.70	15.50	2.28	0.92	0.30	0.96	0.21
I	6.79	1.45	7.03	1.24	1.56	0.41	1.47	0.31
H	2.58	1.07	3.36	1.35	0.93	0.36	0.64	0.23
J	1.57	0.52	1.92	0.51	2.88	1.35	2.54	0.84
K	3.68	1.83	6.07	2.72	1.81	0.59	1.46	0.65
OTHER-SERV	24.17	5.14	27.51	4.50	1.18	0.60	0.81	0.13

Source: World Input-Output Database (WIOD), Socio Economic Accounts. Author's calculations.
Note: The real estate industry is not included in the calculations.

Table 9 - Industry contribution to the dynamic shift component of structural change, by country, 2000-2014

Industry	Contribution to Dynamic Shift		Relative real value added growth and relative employment growth			
	(+)	(-)	(+) (+)	(+) (-)	(-) (+)	(-) (-)
A-B		**CZE**, **EST**, **HRV**, **HUN**, **LTU**, **LVA**, **POL**, **ROU**, RUS, **SVK**, **SVN**	SVK			CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVN
C	**LVA**, POL, ROU, **RUS**	CZE, **EST**, **HRV**, **HUN**, LTU, **SVK**, **SVN**	LVA, RUS	EST,HUN	LTU	CZE, HRV, POL, ROU, SVK, SVN
D	**POL**	**CZE**, **EST**, **HRV**, **HUN**, **LTU**, LVA, **ROU**, **RUS**, **SVK**, **SVN**	POL	CZE, EST, HUN, LTU, ROU, SVK, SVN		HRV, LVA, RUS
DA	HUN, LVA, **POL**	CZE, EST, **HRV**, LTU, **ROU**, **RUS**, **SVK**, SVN	POL	HRV, ROU, SVK		CZE, EST, HUN, LTU, LVA, SVN, RUS
DB-DC		**CZE**, **EST**, **HRV**, **HUN**, **LTU**, LVA, **POL**, ROU, RUS, **SVK**, **SVN**				CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVK, SVN
DD-DE		**CZE**, **EST**, HRV, **HUN**, **LTU**, **LVA**, **POL**, **ROU**, **RUS**, **SVK**, **SVN**		CZE, EST, LTU, POL, ROU, SVK, RUS		HRV, HUN, LVA, SVN
DF	**EST**	CZE, **HRV**, HUN, **LTU**, **LVA**, POL, ROU, **RUS**, **SVK**, **SVN**	EST	LTU, LVA, RUS	HUN, POL	CZE, HRV, ROU, SVK, SVN
DG	**LTU**, **LVA**, POL, **SVN**	**CZE**, EST, **HRV**, **HUN**, ROU, **RUS**, **SVK**	LTU, LVA, POL, SVN	RUS	EST	CZE, HRV, HUN, ROU, SVK
DH-DI	**LTU**, **LVA**, **POL**, **ROU**	**CZE**, **EST**, **HRV**, **HUN**, **RUS**, **SVK**, **SVN**	LTU, LVA, POL, ROU	CZE, HUN, SVK, RUS		EST, HRV, SVN
DJ	CZE, EST, **HRV**, HUN, **LTU**, LVA, **POL**, RUS, **SVK**	ROU, **SVN**	EST, HRV, LTU, LVA, POL, SVK	SVN	CZE, RUS	HUN, ROU
DK	**CZE**, **EST**, **HUN**, **LTU**, **SVN**	HRV, **LVA**, **POL**, **ROU**, **RUS**, **SVK**	CZE, EST, HUN, LTU, SVN	POL, SVK	HRV	LVA, ROU, RUS
DL	**CZE**, **EST**, **LVA**, **POL**, ROU	HRV, **HUN**, **LTU**, **RUS**, **SVK**, **SVN**	CZE, EST, LVA, POL	HUN, LTU, SVK, SVN	ROU	HRV, RUS
DM	**CZE**, **EST**, **HUN**, LVA, **POL**, **ROU**, **SVK**, **SVN**	HRV, **LTU**, RUS	CZE, EST, HUN, LVA, POL, ROU, SVK, SVN	LTU	HRV	RUS
DN-OTHER	**HRV**, **LTU**, **POL**, **ROU**, RUS	**CZE**, **EST**, **HUN**, **LVA**, **SVK**, **SVN**	HRV, LTU, POL, ROU	CZE, EST, HUN, LVA, SVK		SVN, RUS
E	CZE, HUN, POL, ROU	**EST**, **HRV**, **LTU**, LVA, RUS, SVK, SVN	ROU		POL, SVN	CZE, EST, HRV, HUN, LTU, LVA, SVK, RUS
F	EST, HUN, **LTU**, LVA, **ROU**, RUS, SVK, SVN	CZE, HRV, POL	LTU, LVA, ROU, RUS		EST, HRV, HUN, SVK	CZE, POL, SVN
G	**CZE**, **HRV**, HUN, LTU, POL, **ROU**, RUS, SVK, **SVN**	EST, **LVA**	CZE, HRV, HUN, LTU, ROU, SVN, RUS	LVA	POL, SVK	EST
H	EST, **HRV**, LTU, LVA, POL, ROU, RUS	CZE, HUN, SVK, SVN	EST, HRV, LVA, POL, ROU, RUS		CZE, HUN, LTU, SVK, SVN	
I	CZE, HRV, LTU, LVA, POL, ROU, RUS, **SVN**	**EST**, **HUN**, SVK	HRV, LTU, POL, SVN, RUS	EST, HUN	LVA, ROU	CZE, SVK
J	EST, LTU, **LVA**, POL, ROU, **RUS**, **SVK**, **SVN**	**CZE**, HRV, HUN	HRV, LVA, POL, ROU, SVK, SVN, RUS	CZE	HUN, LTU	EST
K	CZE, **EST**, LTU, **ROU**, SVK	HRV, HUN, LVA, POL, SVN	CZE, EST, HRV, HUN, LTU, LVA, ROU, SVK, SVN		POL	
OTHER	EST, HRV, HUN, LTU, LVA, POL	CZE, ROU, SVK, SVN, RUS	HUN		CZE, EST, HRV, LTU, LVA, POL, ROU, SVN, RUS	SVK

Source: World Input-Output Database (WIOD), Socio Economic Accounts. Author's calculations. Notes: The real estate industry is not included in the calculations. Countries in which an industry had labour productivity growth above the country's average are in bold. Country codes are: Croatia (HRV), Czechia (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Poland (POL), Romania (ROU), Russia (RUS), Slovakia (SVK), Slovenia (SVN).

To help clarify what is behind the different patterns of dynamic shift, table 9 presents, for each country, the (signal of the) contribution of each industry, as well as industries' relative performances in terms of real value added growth and employment growth. It is possible to identify what could be called "virtuous" cases – those in which above average productivity growth is accompanied by increases in industry's shares in value added and employment. Virtuous cases are more common in services, especially in financial services. In almost every country, business services became more important both in terms of value added and employment but its contribution to dynamic shift was positive in only half of the cases[108]. The only virtuous case in the manufacturing sector is Poland although some other examples can be found in specific manufacturing industries. In all countries except Latvia, manufacturing's labour productivity grew above the country's average but employment grew below average (except in Poland), giving a negative contribution to dynamic shift. For the two countries with the highest positive dynamic shifts – Russia and Romania – the main contributors to the results are financial services, in the former, and construction, trade and business services, in the later. In turn, for Croatia, the country with the most negative dynamic shift, the largest contributions to this result came from the shrinking (but with above average productivity growth) manufacturing sector and the expanding financial and business services, industries whose productivity growth were below the country's average.

Manufacturing sector's statistical contribution to both the static shift and dynamic shift components is probably affected by the so-called process of servitisation of manufacturing. This process is defined by Vandermerwe & Rada (1988, p. 314) as the increased offering, by manufacturing firms, of "fuller market packages or 'bundles' of customer focused combinations of goods, services, support, self-service and knowledge" in order to "add value to core corporate offerings"[109]. The driver of this process has been the wish to gain competitive edge, through product differentiation, the creation of customer dependency and the setting up of barriers to competitors. Oliva & Kallenberg (2003) and Gebauer (2007) points out that the incorporation of services tends enhance profit margins. If labour productivity is higher in service-related activities, increased servitisation will mean increased labour productivity in firms classified in the manufacturing sector by official bodies. However, due to its very nature, it is difficult to

[108] It must be noted that an industry's individual contribution to the dynamic shift component is positive if its labour productivity grows (lessens) and its share in total employment increases (decreases).
[109] It must be noted that this definition encompasses only the output of manufacturing firms, leaving aside intermediate services that those firms develop internally such as accounting and human resource management.

see the process of servitisation in input-output tables. The "packages" offered by manufacturing firms, which may include, for example, technical assistance, are usually classified as manufacturing output in official statistics, what means that the services share in output is not properly accounted for. In fact, a study by Dachs *et al.* (2005) conclude, based on input-output data, that services accounted for less than 2% of manufacturing firms output in most European countries in 2005. However, when using firm-level information, they find a much higher contribution of services to manufacturing firms' turnover, reaching, for example, about 12% in Croatian firms, of which almost 3/5 are indirect services (packed with physical products). Therefore, part of the contribution of the manufacturing sector to structural change may be due to the process of servitisation which is not properly captured by official statistics.

4.3. FDI, labour productivity growth and structural change

To what extent FDI contributed to economic development in CEECs in the period 2000-2014? More precisely, *can higher labour productivity growth at the industry level be associated to higher additions to FDI stocks? Had FDI helped countries to change their employment structures in direction of more productive industries, that is, has FDI catalysed positive structural change?*

It can be noted that these questions are closely related to the previous shift-share analysis. Indeed, the second question mirrors the within component, while the third question refers to the static shift component. The following econometric analysis addresses these issues, trying to explain whether changes in productivity, employment and value added can be associated with changes in FDI stocks.

The models are estimated at the country-industry level using annual data. Both the dependent variables (labour productivity and employment) and the variable of interest (FDI stock) enter the models in logarithmic (log) growth rates as to assure symmetry[110]. The models also include interactions between FDI and other variables that reflect: i) the institutional development of the country; ii) the level of regulation of the industry; iii) the

[110] The log growth rate is a symmetric measure of relative change whereas the ordinary growth rate is not. For instance, if a variable increases from 10 to 20, the respective log growth rate is ln (20/10) = 0.693 whereas the ordinary growth rate is (20-10)/10 = 1. If the same variable decreases from 20 to 10, the log growth rate is ln (10/20) = -0.693 whereas the ordinary growth rate is (10-20)/20 = -0.5. Additivity is another desirable property of log growth rate, what means that the log growth rate over a period equals the sum of the log growth rates of its subperiods (Ang, 2004). Tornqvist, Vartia & Vartia (1985) recommend the use of the term *log percent* when referring to log growth rates in percentage terms. In the following regressions, all growth rates are log growth rates.

human capital endowment of the country; iv) the skill-intensity of the industry; v) country-industry's reliance on imported inputs; vi) country-industry's dependency on exports; vii) country's revealed comparative advantage in that industry. The inclusion of these variables as moderating factors of the effect of FDI is justified in the following section. In addition, the models include time and country dummies, to control for economic cycle and spillover effects. The models for structural change also include interactions of all the continuous variables with the relative productivity of the industry in the respective country-year. To attenuate endogeneity problems, FDI growth rate is lagged one period and the other explanatory variables are observed at their initial levels. The models are estimated for 20 industries[111] using ordinary least squares (OLS) with robust standard errors.

4.3.1. FDI and within-industry labour productivity growth

To investigate how FDI relates to within productivity growth, the following model is estimated:

$$
\begin{aligned}
&\text{labour productivity growth}_{jct} = \\
&\quad = \alpha + \beta_1 \text{FDI growth}_{jct} + \beta_2 \text{relatory quality}_{ct} \\
&\quad + \beta_3 \text{dummy regulated industries} + \beta_4 \text{FDI growth}_{jct} X \text{relatory quality}_{ct} \\
&\quad + \beta_5 \text{FDI growth}_{jct} X \text{dummy regulated industries} \\
&\quad + \beta_6 \text{relatory quality}_{ct} X \text{dummy regulated industries} \\
&\quad + \beta_7 \text{FDI growth}_{jct} X \text{relatory quality}_{ct} X \text{dummy regulated industries} \\
&\quad + \beta_8 \text{human capital index}_{ct} + \beta_9 \text{skill intensity}_{jt} \\
&\quad + \beta_{10} \text{FDI growth}_{jct} X \text{human capital index}_{ct} \\
&\quad + \beta_{11} \text{FDI growth}_{jct} X \text{skill intensity}_{jt} \\
&\quad + \beta_{12} \text{human capital index}_{ct} X \text{skill intensity}_{jt} \\
&\quad + \beta_{13} \text{FDI growth}_{jct} X \text{human capital index}_{ct} X \text{skill intensity}_{jt} \\
&\quad + \beta_{14} \text{foreign value added in exports}_{jct} \\
&\quad + \beta_{15} \text{FDI growth}_{jct} X \text{foreign value added in exports}_{jct} \\
&\quad + \beta_{16} \text{dependency on exports}_{jct} \\
&\quad + \beta_{17} \text{FDI growth}_{jct} X \text{dependency on exports}_{jct} + \delta_c + \delta_t + \varepsilon_{jct}
\end{aligned}
$$

[111] The petroleum products industry (DF) had to be excluded from the econometric analysis because the dependent variable cannot be calculated for several country-years in which value added was zero.

where the last three terms are, respectively, country and year dummies and the error term. As both the dependent variable and the explanatory variable of interest are log growth rates, it is important to clarify how the coefficients must be interpreted. If, instead of growth rates, both productivity and FDI stock were expressed in levels, a positive (negative) coefficient would signify that a marginal increase in FDI stock would be associated to a productivity level above (below) the conditional mean. Differently, the regression that focuses on the within component can be interpreted as an analysis of deviations from average growth rates. If the sum of the effects of the FDI coefficients is positive (negative) – note that there are several interaction terms in the regression – it indicates that labour productivity grows faster (slower) than would be expected – given the values of all the other variables – when FDI stock grows marginally faster. Given the high number of interactions, the results are presented preferably in charts as to facilitate understanding[112].

The panel is unbalanced, with a total of 2,512 observations. The dependent variable is expressed in log percent, while the FDI variable is presented in decimals. The estimated effect of FDI growth, holding all the other variables at their respective means, is 1.38. This means that an increase of 10 log percent in FDI stock is associated with productivity growth 0.14 log percent above the expected, given the values of the other variables. Considering that the unconditional mean of the dependent variable is 3.08, this "average" effect can be considered relatively small. In addition, it is statistically insignificant at conventional levels (t-statistic = 1.47). The influence of the interacting factors on the effect of FDI is investigated in the next subsections.

4.3.1.1. Institutions

Several cross-country studies find that institutional factors were relevant determinants of aggregate growth in former communist economies during the initial decade of transition (Berg *et al.*, 1999; Campos & Coricelli, 2002; Eicher & Schreiber, 2010). Countries that moved faster in the direction of western-type institutions may have suffered larger GDP losses initially but recovered faster (De Melo, Denizer & Gelb, 1996; Popov, 2007). In most CEECs, type-I reforms were largely concluded by the turn of the century. Nonetheless, when it comes to type-II reforms, precisely those which are related to

[112] The results are presented in appendix B.

institution-building, progress was then much more heterogeneous and remained so in subsequent years.

The materialisation of the potential benefits of FDI, especially the generation of positive spillover effects to domestic actors, is contingent on a country's social capabilities (Criscuolo & Narula, 2008). This concept, popularised by Abramovitz (1986), encompasses, among other things, the political, commercial, industrial and financial institutions required to run a modern market economy. However, the way institutions shape the incentives faced by economic agents is likely to differ across industries. Long-term contracts, prevalent in industries like mining and infrastructure, are necessarily incomplete as it is impossible to foresee all the possible contingencies, let alone cover them. This fact enhances the chances of opportunistic behaviour by the contracting parts, not to mention corruption by State agents. A well-functioning regulatory system helps to mitigate the uncertainty faced by economic agents and, consequently, contribute to reduce the transaction costs they need to incur in. Empirical studies suggest that industries that are traditionally more regulated by the State are likely to be particularly affected by the quality of regulation of a country[113].

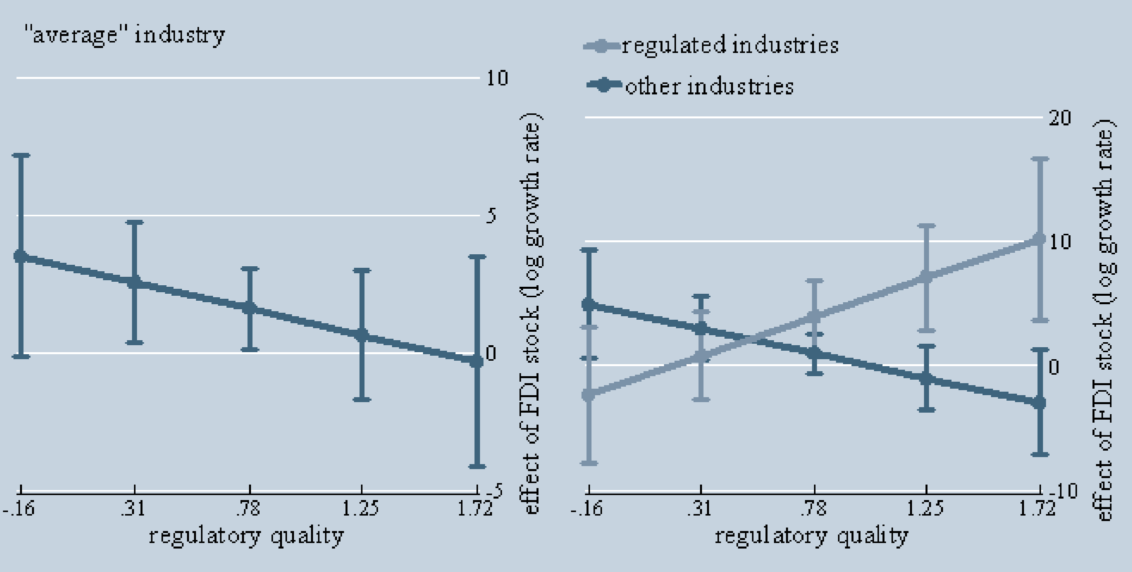
Figure 1 presents the effect of FDI on productivity growth in different institutional settings. The horizontal axis displays countries' regulatory quality, sourced from the WGI[114]. The average regulatory quality in the sample is 0.78 and the standard deviation is 0.47. The chart on the left shows the effect on the "average" industry. FDI seems to have stronger growth effects in poorer institutional settings, but the differences are not statistically significant.

---

[113] Delis, Molyneux & Pasiouras (2011) find that the level of political stability (which is used as a proxy for countries' governance quality) is positively associated with banks' total factor productivity growth in transition economies. In a study covering 28 developing countries over the period 1980-2001, Cubbin & Stern (2006) find that a country's electricity generation capacity is positively affected by the quality of the industry's regulatory governance. Similarly, Wallstein (2001) finds that the existence of an independent regulator enhanced the impact of privatization on telecom performance measures in Latin American and African countries.

[114] According to the World Bank, this indicator reflects perceptions of the ability of governments to formulate and implement sound policies and regulations that permit and promote private sector development.

Figure 1 - FDI, regulatory quality and labour productivity growth
(Marginal effects)



Notes: All the continuous variables held at sample means. Vertical bars are 90% confidence intervals.

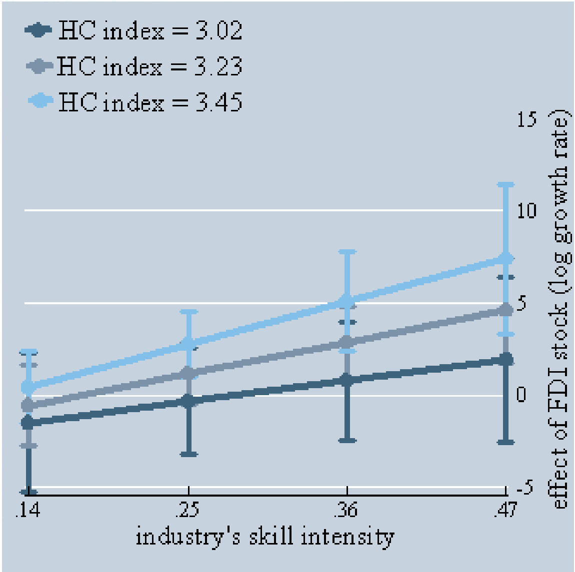
Things change considerably in the right chart, in which industries are classified according to the level of regulation they are subject to. Based on Coates (2012), the following industries are classified as (heavily) regulated: mining (C), utilities (E), transportation and communication (I) and financial (J). The results indicate that a good regulatory quality enhances the effect of FDI in regulated industries but has no significant effect on other industries. For regulated industries, the effect of FDI on productivity growth is particularly strong at higher levels of regulatory quality. In turn, for the lightly regulated industries, the effect of FDI on productivity growth was positive and statistically significant only for countries with weaker institutional setting. Therefore, the growth effects of FDI tended to be larger in countries in which a large regulated sector was accompanied by better regulatory quality and in countries with weaker regulatory quality but a large lightly regulated sector. These differential effects have gone unnoticed by studies using aggregate data.

4.3.1.2. Human capital

The empirical evidence on the relationship between human capital and aggregate economic growth is mixed at best. As discussed in Chapter Two, this striking situation may be due to multiple causes such as the inadequacy of the educational proxies usually used to measure human capital and the failure of most studies in taking the demand for skilled labour into consideration. Nonetheless, even if one accepts that the real direct effect may be small, this does not mean that human capital does not play a role in economic growth. Considering that most countries are well behind the technological frontier, a well-educated population may be crucial to potentialize catching-up through the absorption of knowledge created elsewhere (Nelson & Phelps, 1966). Given that FDI constitutes one of the main vehicles of international knowledge diffusion, its effect on host economy tends to be higher where the absorptive capacity is higher. Although absorptive capacity does not boil down to human capital, this is certainly one of its key constituents. Cross-country studies using aggregate data, such as Borenzstein, De Gregorio & Lee (1998), Li & Liu (2005) and Solomon (2011), ratify that the effect of FDI on growth is moderated by human capital, within large samples of both developed and developing countries. Nonetheless, such moderating role is not detected by Jimborean & Kelber (2017) within a sample of 10 CEECs. Can an industry-level approach change such results?

Figure 2 presents the results. The horizontal axis displays the skill intensity of the industries. Following previous studies, such as Ciccone & Papaioannou (2009), that use the U.S. as reference, this variable captures the share of high-skilled workers in the total workforce employed by that country's industries. The three lines refer to the mean human capital index (3.23) of CEECs and one standard-deviation below and above. As the lines never cross each other, it can be said that the effect of FDI on productivity growth is possibly higher in countries with higher stocks of human capital, independently of the skill intensity of the industry, but the differences are not statistically significant. This result is, however, not surprising given that CEECs are not too different in terms of educational attainment as indicated by the relatively small standard deviation of human capital index.

Figure 2 - FDI, human capital and labour productivity growth
(Marginal effects)



Notes: All the continuous variables held at sample means.
Vertical bars are 90% confidence intervals.

A different picture emerges in respect to the skill intensity of the industry. The results indicate that the effects of FDI on productivity growth was significantly higher among industries intensive in high-skilled labour, especially among countries with higher human capital stocks. What can explain such differences? Studies has shown that technical change is not neutral, in the sense that the productivity of high-skilled workers tends to be considerably more (positively) impacted than the productivity of low-skilled workers[115] (Kahn & Lim, 1998; Berman & Machin, 2000). As a corollary, technical change tends to lead to higher labour productivity growth among industries that employ larger shares of high-skilled workers (Kahn & Lim, 1998). Considering that technological upgrading constituted the crucial contribution brought by FDI to former communist countries, it is plausible that the differential effects of FDI partially reflect differences in potential for productivity growth through technological assimilation. Therefore, countries in which skill-intensive industries responded for a larger share of economic activity tended to benefit more from FDI. In turn, FDI in industries that employ few skilled workers tended to pay no productivity growth dividend, regardless of the human capital endowment of the country.

[115] For example, the productivity of engineers and barbers was not equally affected by the introduction of personal computers.

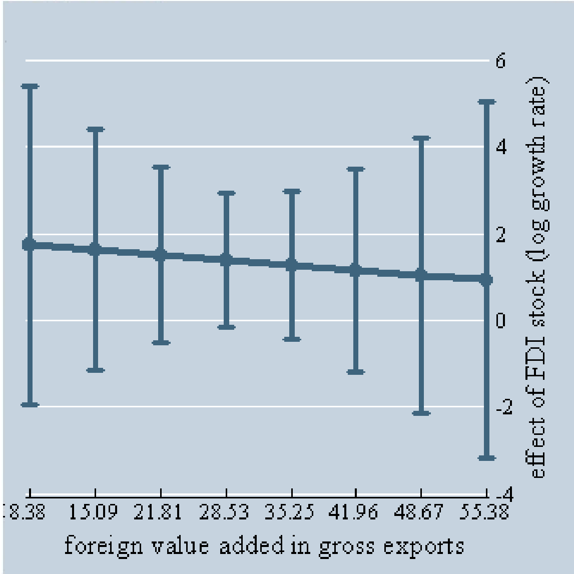
4.3.1.3. Participation in GVCs

Since the publication of David Ricardo's (1817) seminal work on comparative advantage, it has been argued that international trade is mutually beneficial to the countries involved even when one of the countries has no absolute cost advantage in the production of any good. Countries should simply specialize in the production (and export) of goods in which they had the least comparative cost disadvantage and import the rest. Welfare would improve in all trading partners as they could reap the benefits of specialization.

However, the world economy has changed a lot since Ricardo's days. Several factors, including falling transportation and communication costs, declining trade barriers and increasing modularity of production stages led to an increasing fragmentation of production across borders over the last few decades (Jones & Kierzkowski, 2005a). Intra-industry trade (of intermediate goods) now accounts for a large share of the world trade and the international division of labour increasingly follows comparative advantage in performing specific tasks within a value chain, instead of comparative advantage in producing (final) goods (Jones & Kierzkowski, 2005a; 2005b). A corollary is that efficiency is likely to be associated with the level of within-industry specialization which, in turn, is positively associated with the level of use of outsourced – including imported – inputs[116]. If higher efficiency enhances the effect of FDI on productivity, it can be expected that this effect will be larger if the industry uses more imported inputs. To test whether this hypothesis holds for CEECs, foreign value added in gross exports is used as a moderator of the effect of FDI on productivity. In addition, it is investigated whether the growth effect of FDI varies according to the level of dependency of the country-industry on exports. In both cases, the subjacent idea is that industries that are more integrated into the global economy tend to make more efficient use of production factors. Both indicators are sourced from the OECD's TiVA database.

[116] Halpern, Koren & Szeidl (2015) find a positive association between the use of imported inputs and productivity gains at the firm-level. According to their estimates, one-quarter of Hungary's productivity growth between 1993 and 2002 can be attributed to the use of imported inputs.

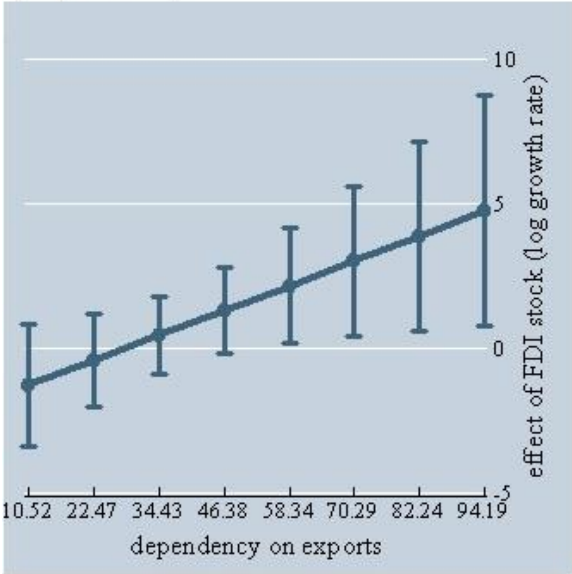
Figure 3 - FDI, foreign value added in gross exports and labour productivity growth
(Marginal effects)



Notes: All the continuous variables held at sample means.
Vertical bars are 90% confidence intervals.

The results presented in Figure 3 provide no indication that the growth effects of FDI is greater when the use of imported inputs is higher. The line connecting the point estimates is almost flat and the confidence intervals do not exclude the hypothesis of no effect. A different picture, however, emerges from Figure 4. FDI seems to have translated into productivity growth in more export-oriented industries but may had even harmed productivity growth in more domestic-oriented industries. Summing up, the export channel seems to be more relevant than the import channel to explain heterogenous effects of FDI on productivity growth.

Figure 4 - FDI, dependency on exports and labour productivity growth
(Marginal effects)



Notes: All the continuous variables held at sample means.
Vertical bars are 90% confidence intervals.

These mixed results are not surprising. Indeed, the development impact of GVCs is still a controversial issue. For small countries, catching-up may become easier as they can efficiently specialise in a few production stages within a GVC. Nonetheless, scholars like Baldwin (2012) are sceptical about the development impact of GVC-related FDI because the high fragmentation of production stages often leads to minimal transfer of technological know-how to foreign affiliates. A recent study by Fagerberg, Lundvall & Srholec (2018) reinforces the scepticism as it finds that higher participation in GVCs, proxied by foreign value added in gross exports, is negatively associated with GDP growth within a sample of 125 countries over the period 1997-2013[117].

4.3.1.4. Comparative advantage

Up to this point, the relationship between FDI and productivity growth has been investigated disregarding the role of comparative advantage. However, the so-called "dynamic comparative advantage theory of FDI", put forth by Japanese economist Kiyoshi Kojima and developed in a series of papers (Kojima, 1973; 1982; 2000; Kojima

[117] When they allow for heterogeneous effects across groups of countries (according to level of development, income level, region and size), they fail to find a positive effect of GVC participation in any group but detect significant negative effects for small countries, low and middle-income countries, developing and transition countries, and African countries (Fagerberg, Lundvall & Srholec, 2018).

& Ozawa, 1984; Lee, 1990), grants comparative advantage a central role in explaining the development impact of FDI. According to Kojima's macroeconomic approach to FDI, which can be viewed as an extension of the neoclassical trade theory based on factor endowments, FDI contributes to enhance efficiency and, thus, promote growth in both home and host countries, when it is driven by changes in production factor costs differentials. More precisely, FDI contributes to raise productivity and foster positive structural change when it is made by a firm whose home country presents a comparative disadvantage (due to rising costs) in a host country where the same industry has a comparative advantage (Kojima, 1973;1982). This type of FDI is viewed by Kojima as beneficial to economic development because it does not replace but promotes trade (in intermediate goods)[118]. In turn, the development impact of market-seeking FDI is uncertain, possibly negative, if driven by excessive trade barriers under oligopolistic structures, as countries forego the gains arising from trade and specialization according to comparative advantage[119].

Alignment to comparative advantage is the defining element of Kojima's approach to FDI. To investigate whether this matters for the relationship between FDI and productivity growth, the empirical model is re-estimated, for the manufacturing industries only, with the inclusion of a dummy variable that classify the observations according to Balassa's (1965) revealed comparative advantage (RCA) index. If RCA index is larger than 1, it is assumed that such a country had (revealed) comparative advantage in that industry in that year[120]. The RCA variable enters the model individually and in interaction with FDI. Nonetheless, before commenting the results, it is important

---

[118] East Asia is a good example of a region where trade-creating FDI has been dominant over the last decades. The constitution of several value chains, such as the textile/apparel and the electronic consumer goods ones, followed a pattern of transmission consistent with the so-called flying-geese model (Kojima, 1960; Akamatsu, 1961;1962), in which FDI played a key role in enabling the sequential move of labour-intensive activities, away from countries that were facing rising labour costs, in direction of countries with labour surplus118. Although the flying-model is usually employed to explain the industrialization of developing countries, it can also be employed to countries more advanced in the catching-up process as its main feature is the cost differentials between the lead goose (or geese) and the followers. Indeed, Rojec & Damijan (2008) identify a flying-geese pattern in the EU, in which production is relocated from old to new members through FDI, giving rise to substantial increases in MNE affiliates' imports from parent companies. They also detect FDI-related shifts in new EU members' comparative advantages, as the share of low-tech industries in the total value added by MNE affiliates decreased over time, while the shares of medium and high-tech industries increased.

[119] Kojima (2000, p.384) is highly critical about the import substitution regimes set up in labour-surplus and capital scarce developing countries as they induced a severe form of anti-trade FDI. He affirms that these countries could do better liberalizing trade instead of allowing an "oligopolistic intrusion of multinationals".

[120] Balassa's RCA index for a given good/industry *j* is obtained simply dividing the country's share in the world's exports of good/industry *j* by the country's share in world's exports of all goods/industries. It is assumed that the country's comparative advantage in such good/industry is "revealed" by the RCA index when it exceeds 1 (Balassa, 1965).

to underline that this is not a perfect test of Kojima's conjecture because his model is a general equilibrium one, what means that the effects derived from a given foreign investment are not confined to the invested industry.

The model with manufacturing industries only has 1,260 observations. The estimated marginal effect of the FDI variable, holding all the interactive variables at their respective means, is -0.09 (t-statistic = -0.06). When this effect is broken down according to RCA groups, the estimated marginal effect drops to -3.33 (t-statistic = -1.30) for the observations without comparative advantage but increases to 2.71 for the observations with comparative advantage (t-statistic = 1.65). Considering that the unconditional mean of the dependent variable is 4.31 (4.40 for observations with RCA>1 and 4.21 for observations with RCA≤1), the "average" effect is nil but the effects within each group is not negligible. Nonetheless, despite the differences between the estimated effects, it is not possible to affirm that a statistically significant role for RCA is detected in the sample due to the existence of a small overlap between the two groups' confidence intervals.

Considering that the effect of RCA may be masked by the inclusion of other trade-related variables in the model, other specifications are tested – see table 10 – but the results remain qualitatively similar. In addition, specifications in which RCA enters interacting not only with FDI but also with human capital index, foreign value added in gross exports and dependency on exports (one at a time) were also tested but the results are not substantially different from the basic specification – for this reason, they are not shown.

Table 10 - FDI, comparative advantage and labour productivity growth

model/group	marginal effect of FDI	confidernce interval (90%)	
with foreign VA in gross exports and dependency on exports			
"average"	-0.089	-2.492	2.313
RCA≤1	-3.334	-7.542	0.873
RCA>1	2.714	0.012	5.416
without foreign VA in gross exports			
"average"	0.044	-2.318	2.406
RCA≤1	-3.090	-7.261	1.081
RCA>1	2.751	0.061	5.442
without dependency on exports			
"average"	-0.071	-2.465	2.324
RCA≤1	-3.584	-7.740	0.573
RCA>1	2.964	0.431	5.496
without foreign VA in gross exports and dependency on exports			
"average"	0.075	-2.292	2.442
RCA≤1	-3.379	-7.521	0.763
RCA>1	3.059	0.556	5.562

Notes: All the continuous variables held at sample means.

4.3.2. FDI and structural change

As seen in the shift-share analysis, the static shift component of aggregate labour productivity growth is positive when industries with higher initial productivity levels increase their shares in employment. Thus, *FDI promotes positive structural change, through the static shift component, if it is associated with increases in the employment share of the most productive industries or, alternatively, with decreases in the employment share of the least productive industries*. Identifying such relationship is relatively straightforward. One just need to find out whether the effect of FDI on employment growth in industries with above-the-average initial relative productivity is statistically different from the effect on industries with below-the-average initial relative productivity.

In turn, the dynamic shift component of aggregate labour productivity growth is positive when the industries that increase their shares in total employment have above-the-average productivity growth. Linking FDI to dynamic shift is not trivial because, in this case, the dependent variable would be the arithmetic product of employment growth and productivity growth. Using employment growth as control variable in a regression in which productivity growth is the dependent variable is also inadequate because that variable is endogenous. For this reason – and given that dynamic shift accounts for only a small fraction of CEECs' labour productivity growth in the period 2000-2014 –, the following analysis is confined to the static shift part of structural change.

To address this issue empirically, it is necessary, first, to differentiate the effects of FDI according to industries' initial relative productivity. Since structural change takes place within countries, this measure needs to reflect productivity comparatively to the country's average productivity. So, in this subsection, all the FDI variables, including the interactions with other variables, are interacted with initial relative productivity. Values below 1 means initial productivity below the country's average in that year.

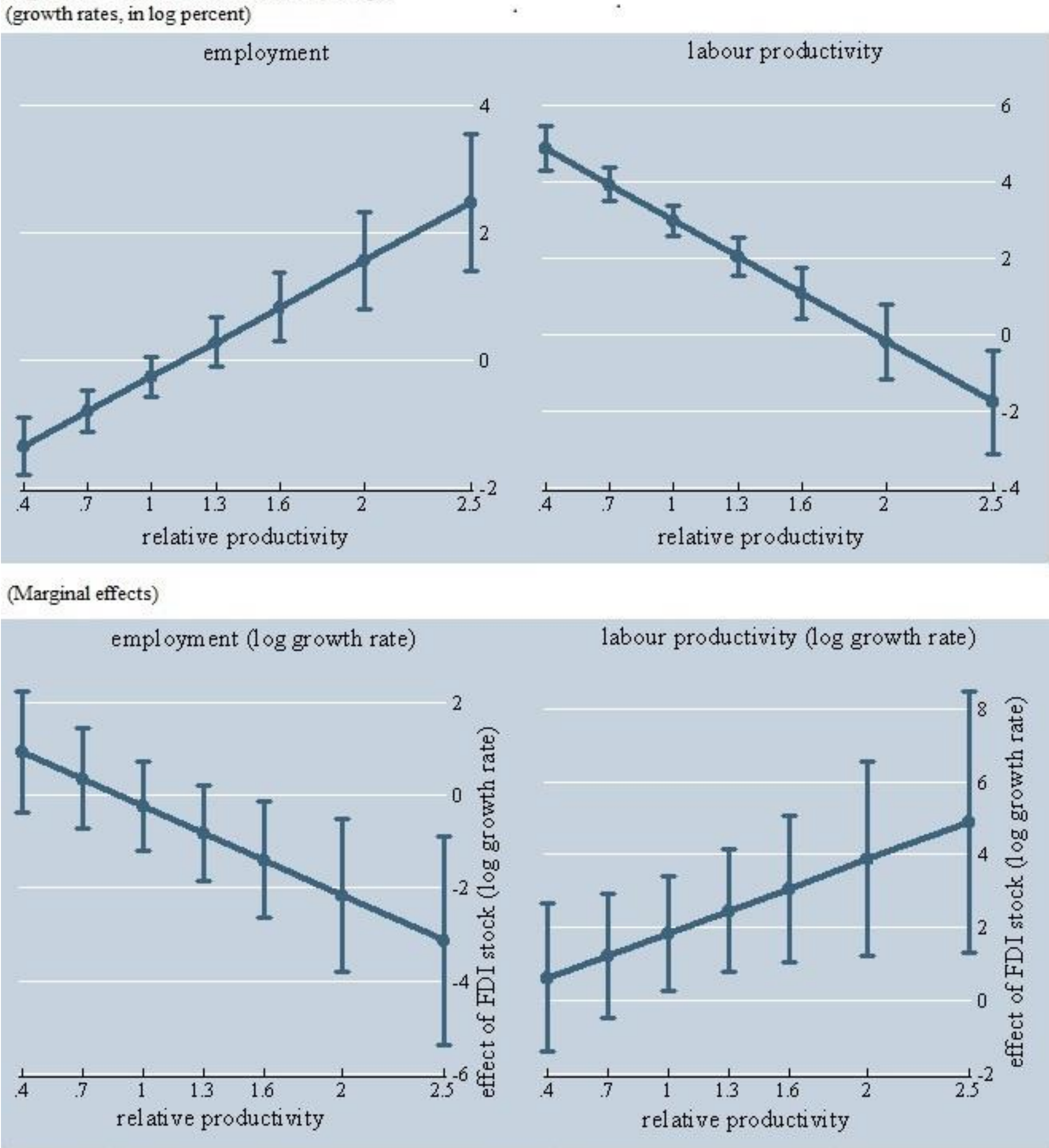
The empirical model is presented below. It is quite similar to the model used for within productivity, except for the inclusion of initial relative productivity and the exclusion of the dummy for regulated industries and the skill-intensity variable – this is needed because the fact that they are correlated with initial relative productivity could mask the latter's effect.

$$
\begin{aligned}
&\text{employment growth}_{jct} = \\
&= \alpha + \beta_1 \text{FDI growth}_{jct} + \beta_2 \text{relative productivity}_{jct} \\
&+ \beta_3 \text{FDI growth}_{jct} X \text{relative productivity}_{jct} + \beta_4 \text{relatory quality}_{ct} \\
&+ \beta_5 \text{FDI growth}_{jct} X \text{relatory quality}_{ct} + \beta_6 \text{relative productivity}_{jct} X \text{relatory quality}_{ct} \\
&+ \beta_7 \text{FDI growth}_{jct} X \text{relative productivity}_{jct} X \text{relatory quality}_{ct} \\
&+ \beta_8 \text{human capital index}_{ct} + \beta_9 \text{FDI growth}_{jct} X \text{human capital index}_{ct} \\
&+ \beta_{10} \text{relative productivity}_{jct} X \text{human capital index}_{ct} \\
&+ \beta_{11} \text{FDI growth}_{jct} X \text{relative productivity}_{jct} X \text{human capital index}_{ct} \\
&+ \beta_{12} \text{foreign value added in exports}_{jct} \\
&+ \beta_{13} \text{FDI growth}_{jct} X \text{foreign value added in exports}_{jct} \\
&+ \beta_{14} \text{relative productivity}_{jct} X \text{foreign value added in exports}_{jct} \\
&+ \beta_{15} \text{FDI growth}_{jct} X \text{relative productivity}_{jct} X \text{foreign value added in exports}_{jct} \\
&+ \beta_{16} \text{dependency on exports}_{jct} + \beta_{17} \text{FDI growth}_{jct} X \text{dependency on exports}_{jct} \\
&+ \beta_{18} \text{relative productivity}_{jct} X \text{dependency on exports}_{jct} \\
&+ \beta_{19} \text{FDI growth}_{jct} X \text{relative productivity}_{jct} X \text{dependency on exports}_{jct} + \delta_c + \delta_t + \varepsilon_{jct}
\end{aligned}
$$

A model in which employment growth is replaced by labour productivity growth is also estimated. Although it does not have an analytical purpose, its results may serve to complement the analysis of the effect of FDI on the static shift.

As before, the results are presented in charts to facilitate the analysis of the interactions. Figures 5 to 9 display four charts each. The top charts show the log growth rates of employment and labour productivity predicted by models without FDI, that is, models that include all the mentioned variables except FDI and its interactions with other variables. Therefore, they are viewed as growth rates disregarding the potential effect of FDI. The bottom charts show the marginal effects of FDI on employment and productivity growth, derived from models that include FDI and its interactions with other variables. Thus, they can be interpreted as the extent to which FDI accentuate or attenuate the trends identified in the top charts. As previously, the dependent variables are expressed in log percent, while FDI growth rate is expressed in decimals. Therefore, if a chart displays a marginal effect equal to 1 it means that an increase of 1 log percent in FDI stock relates to an increase of 0.01 log percent in employment or productivity.

Figure 5 - FDI and structural change

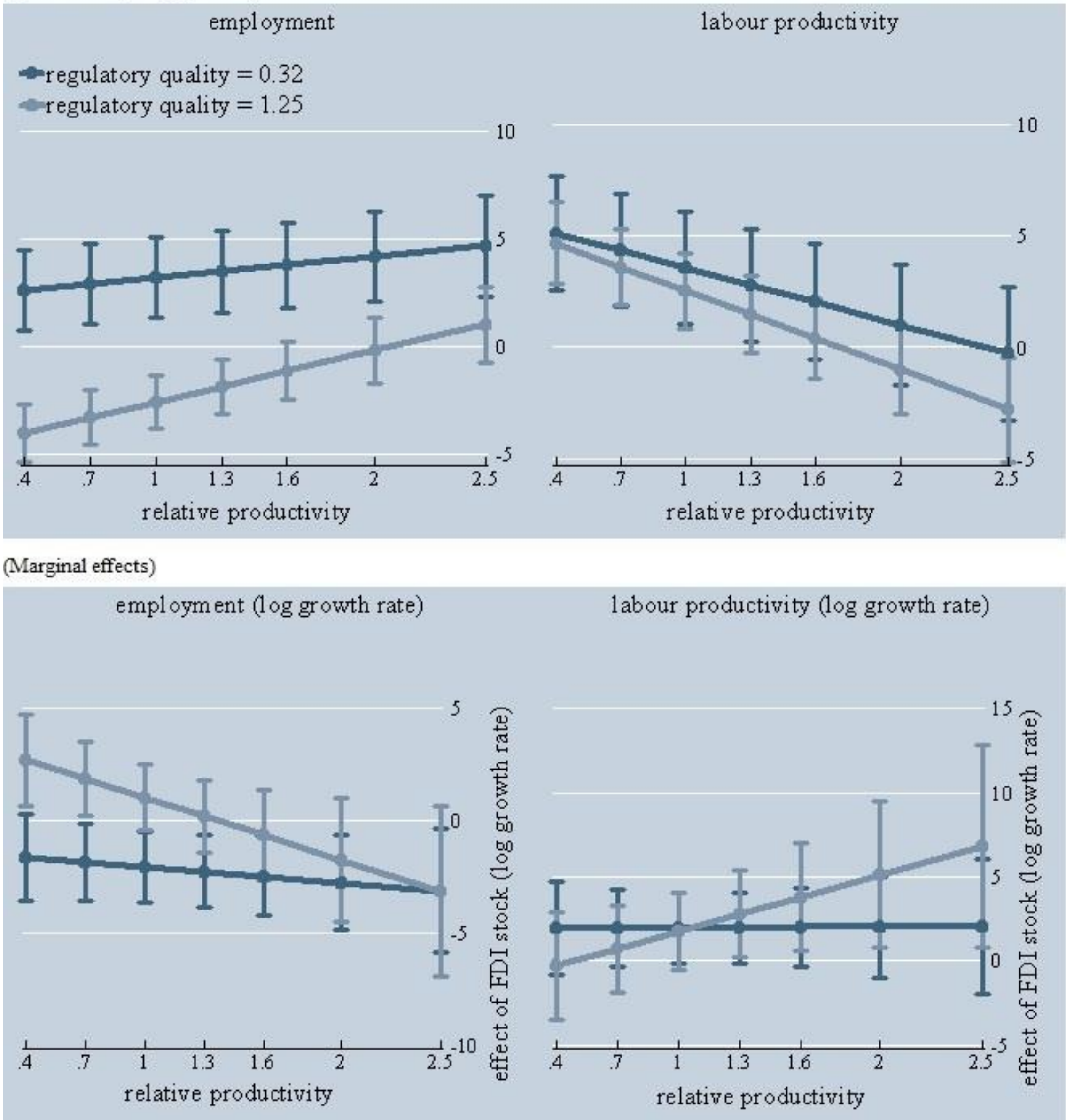


Notes: All the continuous variables held at sample means. Vertical bars are 90% confidence intervals.

The top charts in figure 5 show the predicted employment and labour productivity growth rates holding all the variables, except initial relative productivity, at sample means. Employment growth tends to be positive for country-industries with initial relative productivity 15% above country's average. The difference in terms of employment growth rates between high productivity and low productivity industries is statistically significant, thus ratifying the positive static shift found in the shift-share analysis. The bottom charts in figure 5 display the marginal effects of FDI on employment and productivity growth, holding all the other variables at their sample means. The left chart indicates that in high productivity industries, employment tends to grow less when FDI stock increases. This negative effect is statistically significant. For the low productivity industries, the estimated effect of FDI is positive but it is statistically insignificant. What is most important, however, is that the effect of FDI on employment growth among low productivity industries is statistically different from the effect among very high productivity industries. Therefore, if FDI plays any role in structural change through the static shift component, it is by attenuating the employment growth in high productivity industries. This result suggest that foreign affiliates bring labour saving technologies to high productivity industries and help to enhance productivity – as shown in the bottom right chart.

Figure 6 shows the effects of FDI according to the regulatory quality of the country. The mean regulatory quality index in the sample is 0.78. The charts display the results for (relatively) low and high regulatory quality environments, using one standard deviation from the mean (0.47) as parameter. Looking first to the top left chart, (positive) static shift seems to be more pronounced in countries with higher regulatory quality. In countries with lower regulatory quality, the differences in employment growth rates across levels of initial relative productivity are not statistically significant. Moving to the bottom left chart, it is possible to note distinct patterns. In countries with lower regulatory quality, increase in FDI stock almost always means lower employment growth, with insignificant differences across industries with different relative productivities. This suggest that in these countries, foreign affiliates bring labour saving technologies to all industries. The results for countries with high regulatory quality have large variance but point estimates suggest that only high productivity industries receive labour saving technologies from foreign affiliates as compared to local firms. Summing up, FDI does not seem to influence static shift in countries with lower regulatory quality but possibly exert an attenuation effect in countries with higher regulatory quality.

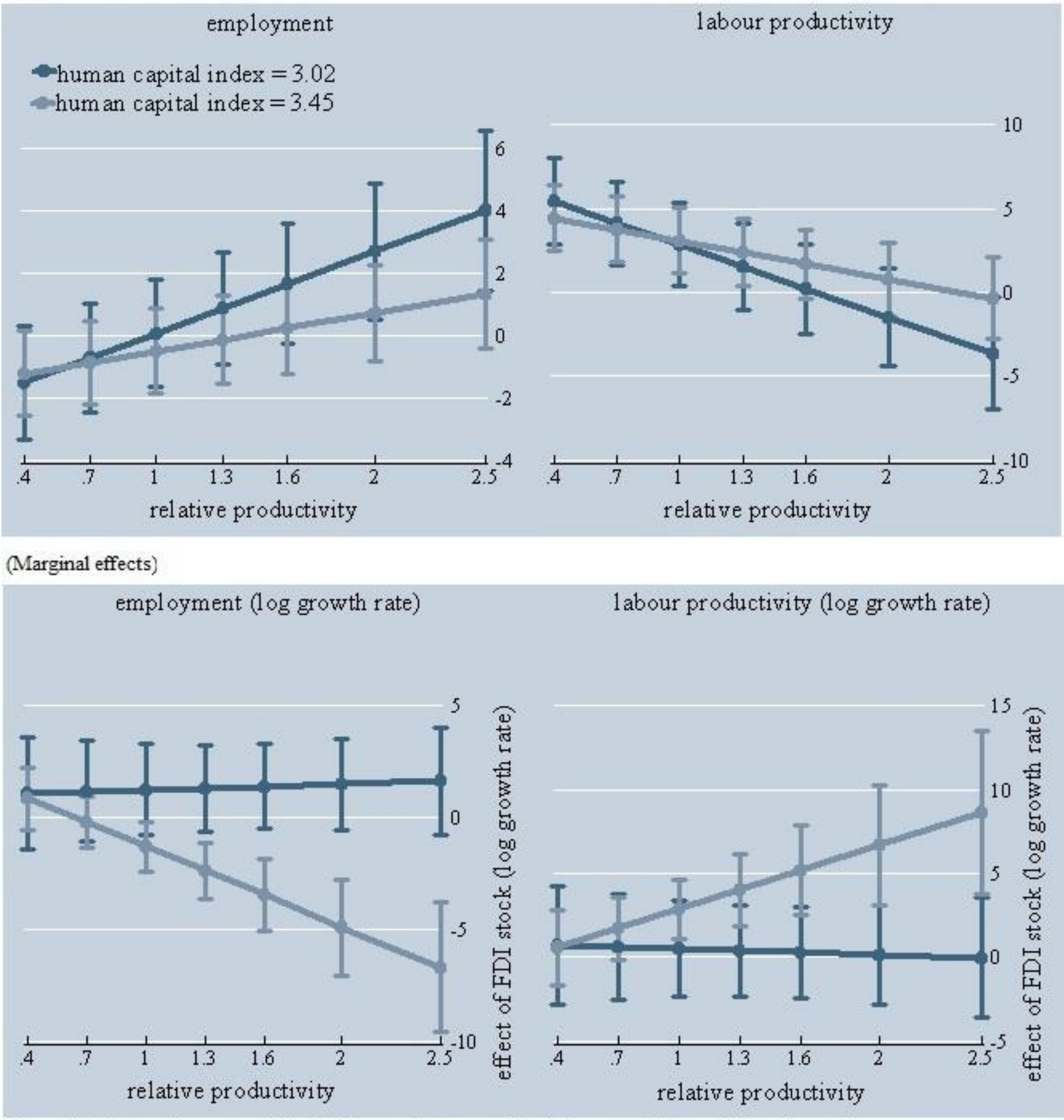
Figure 6 - FDI, regulatory quality and structural change
(growth rates, in log percent)



Notes: All the continuous variables held at sample means. Vertical bars are 90% confidence intervals.

The effects of FDI on structural change, according to the human capital endowment of the country, are shown in figure 7. The mean human capital index in the sample is 3.23 and the standard deviation is 0.21. Static shift seems stronger among countries with lower human capital stocks but in these countries the effect of FDI on employment growth is almost constant across industries with different productivity levels. In turn, the effect of FDI on employment seems to be very negative in high productivity industries in countries with higher human capital stocks. The effect of FDI on productivity growth in these industries – shown in the bottom right chart – is, therefore, largely driven by the effect on employment instead of the effect on value added. Summing up, FDI does not seem to be related to static shift in countries with lower human capital stock but seems to have a significant attenuating effect in countries with higher human capital stocks.

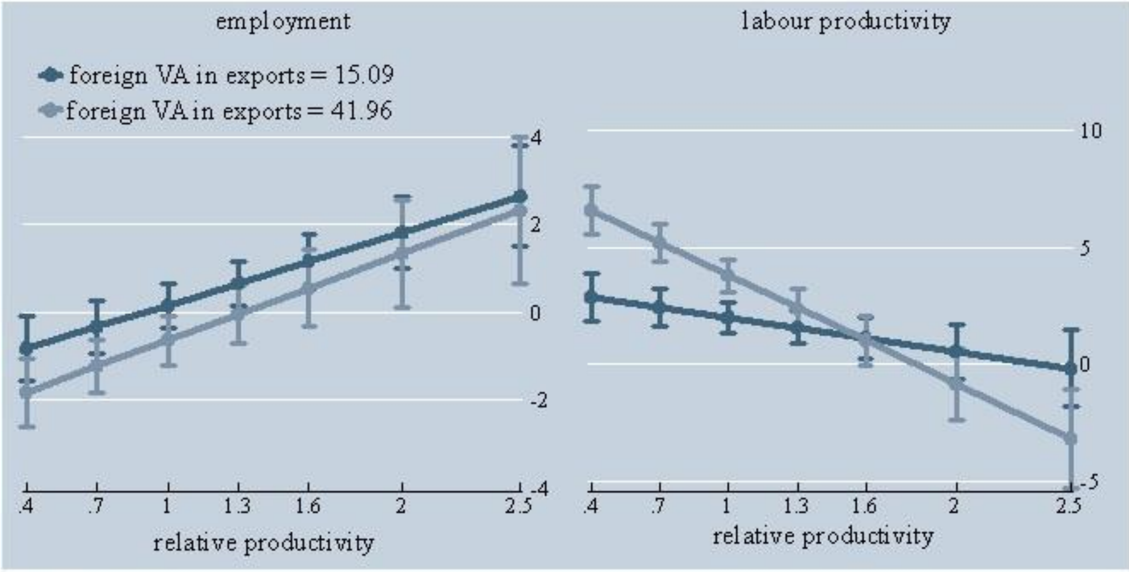
Figure 7 - FDI, human capital and structural change
(growth rates, in log percent)



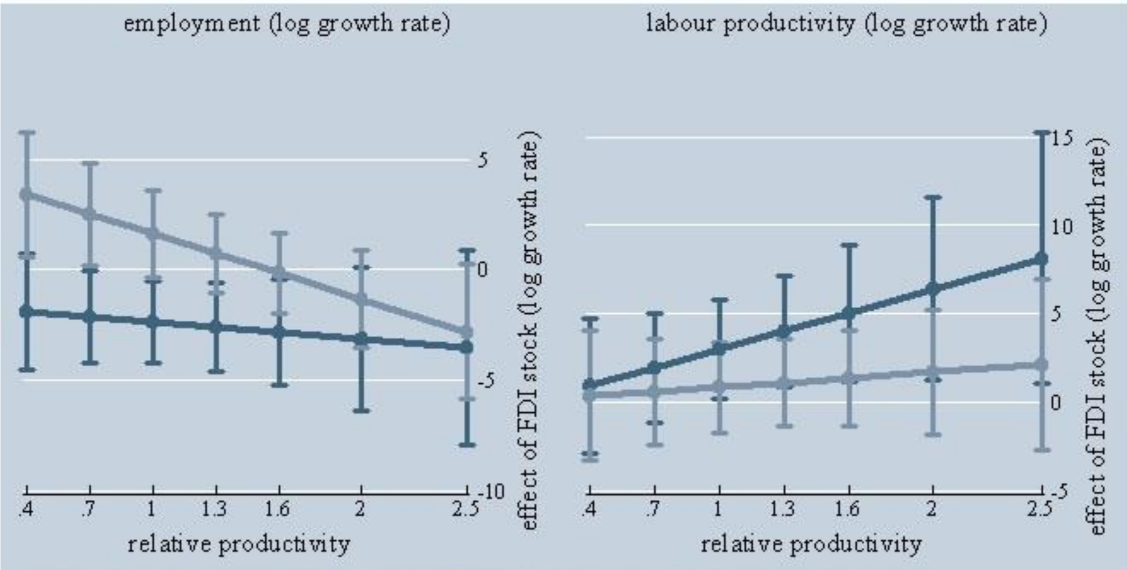
Notes: All the continuous variables held at sample means. Vertical bars are 90% confidence intervals.

Figures 8 and 9 show how integration to the global economy interferes on the effect of FDI on structural change. The top right chart in figure 8 shows that more intense use of imported inputs is associated to higher productivity growth among low productivity industries while in high productivity industries it is just the opposite. The interpretation of the differential effects of FDI is more intricate in this case because the interacting variable is measured at the country-industry level. Comparing the effect of FDI at same productivity level is more meaningful than comparing the effect of FDI at a same level of use of imported inputs (the connecting lines). The sample mean of foreign value added in gross exports is 28.53 and the standard deviation is 13.44. Looking at the bottom left chart, the biggest difference between the connecting lines in found in the region of low productivity industries. For these industries, FDI seems to counteract the positive static shift if it is accompanied by a high use of imported inputs. In low productivity industries, FDI is associated with employment and value added growth when accompanied by high use of imported inputs but it is associated with employment and value added reduction when accompanied by low use of imported inputs. At first sight this result is intriguing because a higher proportion of imported inputs is usually linked with fewer linkages with the domestic economy and, thus, fewer jobs. However, higher use of imported inputs may also signal higher efficiency, what increases the probability of serving as a hub for exports and enhances the ability to compete with imports. In the case of high productivity industries, the effect of FDI on employment is not dependent on the level of use of imported inputs.

Figure 8 - FDI, foreign value added in gross exports and structural change
(growth rates, in log percent)



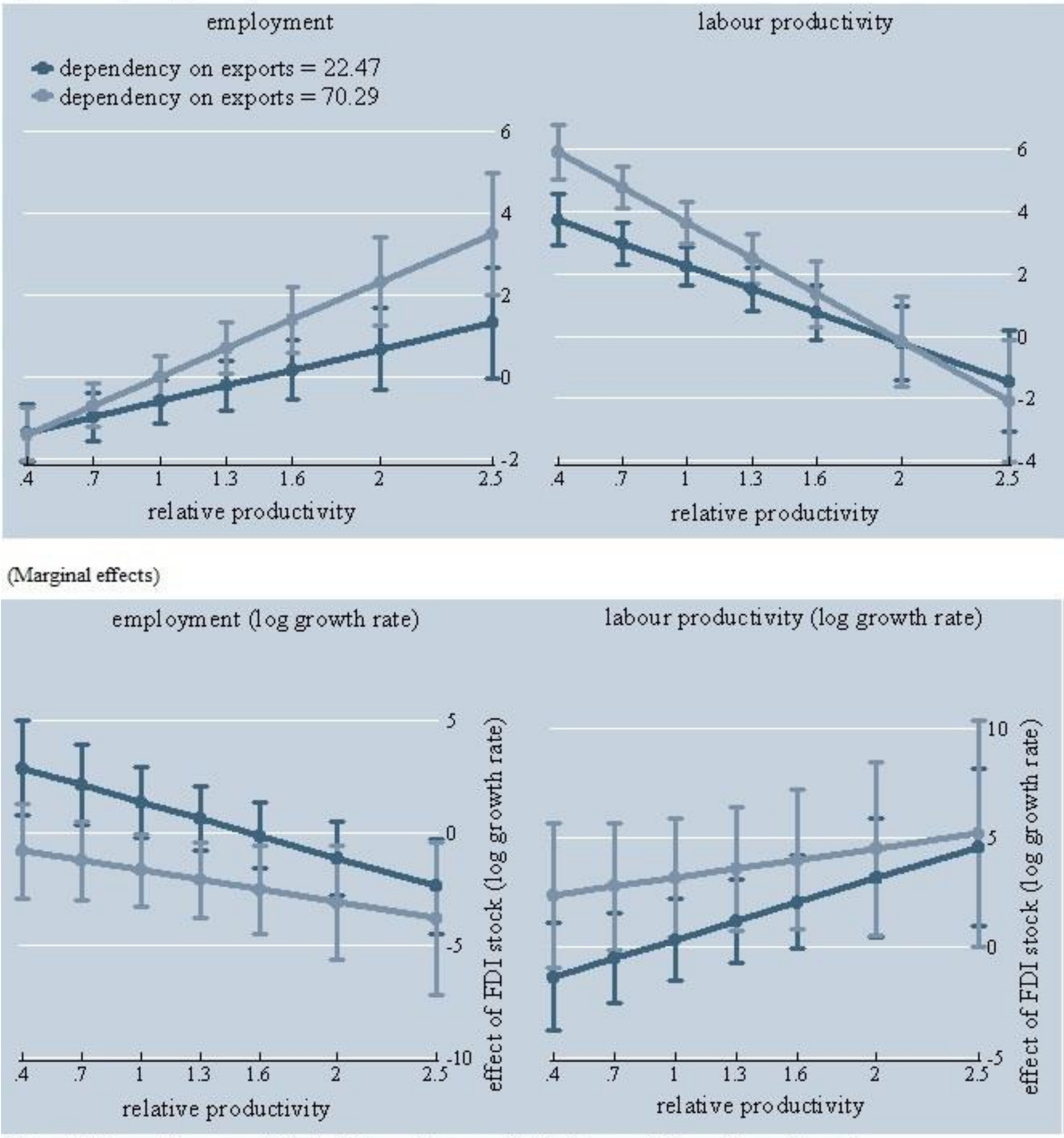
(Marginal effects)



Notes: All the continuous variables held at sample means. Vertical bars are 90% confidence intervals.

Figure 9 shows the effects of FDI according to country-industry's dependency on exports. The sample mean of this variable is 46.38 and the standard deviation is 23.91. Export orientation possibly strengthens static shift, especially due to the employment effects in high productivity industries, but the difference between the two connecting lines in the top left chart is not statistically significant. According to the bottom left chart, a lower integration to the international economy through exports leads to higher employment effects of FDI at any level of initial relative productivity, although the difference is not statistically significant for high productivity industries. Such results are as expected because domestic-market oriented industries are less urged to keep costs down than industries that are more export-oriented. Summing up, the attenuating effect of FDI on the (positive) static shift term tends to disappear the higher is the export orientation of the low productivity industries.

Figure 9 - FDI, dependency on exports and structural change
(growth rates, in log percent)



Notes: All the continuous variables held at sample means. Vertical bars are 90% confidence intervals.

5. Conclusion

In the introduction of this chapter, it was asserted that microeconomic studies have contributed, over the last decades, to considerably extend our knowledge about how the presence of MNEs affect other economic agents in host countries. The same can be said, to some extent, in respect to cross-country macroeconomic studies and our understanding about the relationship between FDI and aggregate economic growth. Clearly lagging behind is our knowledge about how FDI influences the way the economies evolve, through differential growth rates and reallocation of factors of production across sectors and industries.

The main contribution of this chapter is the bridge it begins to build between the micro- and the macroeconomic literatures on FDI, drawing on a well-known technique that decomposes aggregate labour productivity growth into the within, static shift and dynamic shift components – the shift-share analysis. Using industry-level data, it was possible to untangle the relationship between FDI and aggregate labour productivity growth. More specifically, it was possible to investigate whether FDI helps to explain differential growth rates in labour productivity as well as labour force reallocations across industries for a sample of 11 former communist countries.

This chapter also contributes to the literature on the development effects of FDI in former communist countries. To this date, the evidence provided by studies using aggregate data is rather inconclusive as their results seem to be quite dependent on samples and methods employed. Furthermore, they seldom look for heterogeneous effects. This study demonstrates that the actual impact of FDI in these countries may go unnoticed if the analysis does not go below the aggregate level and does not pay attention to potential moderating factors.

This chapter's basic result suggests that additions to FDI stock are positively associated with industry's labour productivity growth – what is in accordance with Bijsterbosch & Kolasa's (2010) findings that, within a group of 8 transition economies over the period 1995-2005, productivity growth was higher in country-industries with higher FDI flows/value added ratios and that increases in FDI flows/value added ratios were positively associated with productivity increases. However, the estimated "average" effect is economically small and statistically insignificant.

Building on previous studies that have found an erratic relationship between FDI and aggregate growth, the analysis was extended as to incorporate potential sources of heterogeneity. The suspicion was confirmed in some cases. Institutional development seems to influence the productivity growth effect of FDI, especially among heavily regulated industries. In turn, in poorer institutional settings, FDI tends to generate most favourable results when it is directed to slightly regulated industries. It was not possible to statistically detect a moderating role for human capital, possibly due to the high convergence of CEECs in terms of educational attainment, but there is evidence that FDI produce stronger productivity growth effects when directed to industries that are more intensive in skilled-labour. Sceptical views about the potential development impact of GVCs were corroborated by the lack of evidence about a moderating role for foreign value added in gross exports. However, there is some indication that the productivity growth effects of FDI are larger in more export-oriented industries. The hypothesis that the productivity growth effect of FDI is stronger when it takes place in countries in which the invested industry has comparative advantage came close to find statistical support in the data.

According to shift-share analysis, static shift was positive in CEECs during the period 2000-2014, what means that labour moved out of the least productive industries to the most productive industries. This study reveals that FDI tended to attenuate static shift. Compared to a situation of no growth in FDI stock, an increase in FDI stock is associated to lower employment growth in high productivity industries. At the same time, productivity growth in these industries tended to be higher when FDI grew. These results suggest that MNEs bring labour-saving technologies to host countries as compared to local firms. *MNEs contribute to shift output structures in direction of the most productive industries but do not play the same role in respect to employment. On the contrary, higher MNE activity tends to weaken the static shift component of structural change.*

The effects of FDI on structural change seems to be stronger in countries with better institutional development – proxied by regulatory quality – and higher human capital stocks. In the former, FDI attenuates static shift mainly because it is associated with employment growth in low productivity industries, while in the latter it is because it is associated with strong decrease in employment in high productivity industries[121]. Furthermore, the attenuation effect of FDI seems to be influenced by the extent to which the low productivity industries use imported inputs and by these industries' dependency on export markets. Greater domestic orientation and higher use of imported inputs by low productivity industries tends to amplify the attenuating effect of FDI on the static shift. While the former result is expected, the latter is striking, although it may be capturing the

[121] Taking into consideration the specificities of the investors' home countries could enrich the analysis. Extant studies indeed indicate that the level of similarity between host and home countries affects the development impact of FDI. Piscitello & Rabbiosi (2005), for example, show that the productivity of acquired Italian firms is negatively affected by the institutional distance of the acquirer's home country. Similarly, D'Amelio, Garrone & Piscitello (2016) find that FDI from institutionally weaker countries produce better development effects in equally institutionally weak Subsaharan African countries. However, given the structure of the FDI data used in this chapter, which allow the visualisation of FDI stocks either by industry or by country of origin – but not both at the same time – the possible of effects of "distance" could not be investigated.

effect of increased efficiency on the competitiveness of the industry in both domestic and export markets.

Such findings have important policy implications. Once again, it is shown that positive effects of FDI cannot be taken for granted. Most important, however, is the evidence that the effects in terms of employment growth, output growth and productivity growth do not necessarily go hand in hand. If the aim is to increase aggregate labour productivity growth, the evidence of higher positive effects of FDI in more export-oriented industries makes a case to promote this type of inward FDI. Best results in terms of productivity growth tend to be obtained when countries' attributes are aligned to industries' requirements. Thus, additional efforts to improve the regulatory quality are necessary to magnify the productivity growth impact of FDI in regulated industries. To some extent, the same can be said in respect to human capital formation: positive marginal gains may be reaped especially if combined with FDI in industries intensive in high-skilled labour. The results also bring some light on what to expect from FDI in terms of job creation and labour force reallocation. FDI in low productivity industries tends to create more jobs when it targets the domestic market. The potential for job creation is higher when these industries use more imported inputs, what may be an indication of greater efficiency. In high productivity industries, FDI is usually associated with lower job creation, especially in more advanced countries, but it is also associated with higher productivity growth[122].

Among the limitations of the study, the most problematic is certainly the use of annual data because output can be highly volatile in the short-run. A future extension could be the application of its empirical approach to lower frequency data – possibly to a larger group of countries.

References

Abramovitz, M. (1986) Catching up, forging ahead, and falling behind. *Journal of Economic History*, 46(2), 385-406.

Akamatsu, K. (1961) A theory of unbalanced growth in the world economy. *Weltwirtschaftliches Archiv*, 86, 196-217.

[122] It is worth to note that in a study of 19 Asian economies in the period 1970-2012, Vu (2017) finds that structural change has a positive impact on labour productivity growth but has a negative effect on employment growth.

Akamatsu, K. (1962) Historical pattern of economic growth in developing countries. *Developing Economies*, 1, 3-25.

Alfaro, L.; Charlton, A. (2013) Growth and the quality of foreign direct investment. In: Stiglitz, J.; Lin, J. (Eds.) *The industrial policy revolution I: The role of government beyond ideology*. Basingstoke: Palgrave Macmillan.

Ang, B. (2004) Decomposition analysis for policymaking in energy: which is the preferred method? *Energy Policy*, 32, 1131-1139.

Balassa, B. (1965) Trade liberalisation and 'revealed comparative advantage'. *Manchester School*, 33, 99-123.

Balcerowicz, L.; Blaszczyk, B.; Dabrowski, M. (1997) The Polish way to the market economy 1989-1995. In: Woo, W.; Parker, S.; Sachs, J. (Eds.) *Economies in transition: Comparing Asia and Europe.* Cambridge, MA: MIT Press.

Bellak, C.; Leibrecht, M.; Damijan, J. (2009) Infrastructure endowment and corporate income taxes as determinants of foreign direct investment in Central and Eastern European countries. *World Economy*, 32(2), 267-290.

Bellak, C.; Leibrecht, M.; Riedl, A. (2008). Labour costs and FDI flows into Central and Eastern European countries: A survey of the literature and empirical evidence. *Structural Change and Economic Dynamics*, 19, 17-37.

Bennett, J.; Estrin, S.; Urga, G. (2007) Methods of privatization and economic growth in transition economies. *Economics of Transition*, 15(4), 661-683.

Berg, A.; Borensztein, E.; Sahay, R.; Zettelmeyer, J. (1999) The evolution of output in transition economies: Explaining the differences. Washington, DC: International Monetary Fund (Working Paper 99/73).

Berkowitz, D.; Dejong, D. (2002) Accounting for growth in post-Soviet Russia. *Regional Science and Urban Economics*, 32(2), 221-239.

Berman, E.; Machin, S. (2000) Skilled-biased technology transfer: Evidence of factor biased technical change in developing countries. *Oxford Review of Economic Policy*, 16(3), 12-22.

Bevan, A.; Estrin, S. (2004) The determinants of foreign direct investment into European transition economies. *Journal of Comparative Economics*, 32, 775-787.

Bevan, A.; Estrin, S.; Meyer, K. (2004) Foreign investment location and institutional development in transition economies. *International Business Review*, 13(1), 43-64.

Bijsterbosch, M.; Kolasa, M. (2010) FDI and productivity convergence in Central and Eastern Europe: An industry-level investigation. *Review of World Economics*, 145(4), 689-712.

Blanchard, O.; Kremer, M. (1997) Disorganization. *Quarterly Journal of Economics*, 112(4), 1091-1126.

Borensztein, E.; De Gregorio, J.; Lee, J. (1998) How does foreign direct investment affect economic growth? *Journal of International Economics*, 45, 115-135.

Campos, N.; Coricelli, A. (2002) Growth in transition: What we know, what we don't, and what we should. *Journal of Economic Literature*, 40(3), 793-836.

Campos, N.; Kinoshita, Y. (2002) Foreign direct investment as technology transferred: Some panel evidence from the transition economies. *Manchester School,* 70(3), 398-419.

Campos, N.; Kinoshita, Y. (2003) Why does FDI go where it goes? New evidence from the transition economies. Washington, DC: International Monetary Fund (Working Paper no. 03/228).

Carkovic, M.; Levine, R. (2005) Does foreign direct investment accelerate economic growth? In: Moran, T.; Graham, E.; Blomstrom, M. (2005) *Does Foreign Direct Investment Promote Development?* Washington, DC: Institute for International Economics.

Ciccone, A.; Papaioannou, E. (2009). Human capital, the structure of production and growth. *Review of Economics and Statistics,* 91(1), 66-82.

Coates, J. (2012) Corporate politics, governance, and value before and after *Citizens United*. *Journal of Empirical Legal Studies*, 9(4), 657-696.

Cohen, W.; Levinthal, D. (1990) Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128-152.

Commander, S.; Svejnar, J. (2011) Business environment, exports, ownership, and firm performance. *Review of Economics and Statistics*, 93(1), 309-337.

Criscuolo, P.; Narula, R. (2008) A novel approach to national technological accumulation and absorptive capacity: aggregating Cohen and Levinthal. *European Journal of Development Research*, 20(1), 56-73.

Cubbin, J.; Stern, J. (2006) The impact of regulatory governance and privatization on electricity industry generation capacity in developing economies. *World Bank Economic Review*, 20(1), 115-141.

Curwin, K.; Mahutga, M. (2014) Foreign direct investment and economic growth: New evidence from post-socialist transition countries. *Social Forces*, 92(3), 1159-1187.

Dachs, B.; Biege, S.; Borowiecki, M.; Lay, G.; Jager, A.; Schartinger, D. (2012) The servitization of European manufacturing industries. Vienna: Austrian Institute of Technology.

Dahlman, C.; Nelson, R. (1995) Social Absorption capability, national innovation systems and economic development. In: Koo, B.; Perkins, D. (Eds.) *Social capability and long-term economic growth.* London: Palgrave.

Damijan, J.; Kostevc, C.; Rojec, M. (2013) FDI, structural change and productivity growth: Global supply chains at work in Central and Eastern European countries. Zagreb: Institute for Development and International Relations – IRMO (Occasional Paper no. 01/2013).

Damijan, J.; Rojec, M.; Majcen, B.; Knell, M. (2013) Impact of firm heterogeneity on direct and spillover effects of FDI: Micro-evidence from ten transition countries. *Journal of Comparative Economics*, 41(3), 895-922.

Delis, M.; Molyneux, P.; Pasiouras, F. (2011) Regulations and productivity growth in banking: Evidence from transition economies. *Journal of Money, Credit and Banking*, 43(4), 735-764.

De Melo, M.; Denizer, C.; Gelb, A. (1996) From plan to market: patterns of transition. *World Bank Economic Review*, 10(3), 397-424.

Djankov, S.; Murrell, P. (2002) Enterprise restructuring in transition: A quantitative survey. *Journal of Economic Literature*, 40(3), 739-792.

Dohrn, R.; Heilemann, U. (1996) The Chenery hypothesis and structural change in Eastern Europe. *Economics of Transition*, 4(2), 411-425.

Dunning, J. (1981) Explaining the international direct investment position of countries: Towards a dynamic or developmental approach. *Weltwirtschaftliches Archiv*, 177, 30-64.

Dunning, J.; Narula, R. (1996) The investment development path revisited: some emerging issues. In: Dunning, J.; Narula, R. (Eds.) *Foreign Direct Investment and Governments: Catalysts for Economic Restructuring.* Basingstoke: Edward Elgar.

Eicher, T.; Schreiber, T. (2010) Structural policies and growth: Time series evidence from a natural experiment. *Journal of Development Economics*, 91, 169-179.

Estrin, S.; Hanousek, J.; Kocenda, E.; Svejnar, J. (2009) The effects of privatization and ownership in transition economies. *Journal of Economic Literature*, 47(3), 699-728.

Fagerberg, J.; Lundvall, B.; Srholec, M. (2018) Global value chains, national innovation systems and economic development. *European Journal of Development Research*, 30(3), 533-556.

Falcetti, E.; Lysenko, T.; Sanfey, P. (2006) Reforms and growth in transition: Re-examining the evidence. *Journal of Comparative Economics*, 34, 421-445.

Fernandes, A. (2007) Structure and performance of the services sector in transition economies. Washington, DC: World Bank. (Policy Research Working Paper no. 4357).

Fischer, S.; Gelb, A. (1990) Issues in socialist economy reform. Washington, DC: World Bank (Working Paper no. 565).

Fischer, S.; Sahay, R.; Vegh, C. (1996) Economies in transition: The beginnings of growth. *American Economic Review (Papers and Proceedings)*, 86(2), 229-233.

Gebauer, H. (2007) The logic for increasing service revenue in product manufacturing companies. *International Journal of Services and Operations Management*, 3(4), 394-410.

Gelb, A. (1999) The end of transition. In: Brown, A. (Ed.) *When is transition over?* Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Gereffi, G.; Humphrey, J.; Sturgeon, T. (2005) The governance of global value chains. *Review of International Political Economy*, 12(1), 78-104.

Godoy, S.; Stiglitz, J. (2007) Growth, initial conditions, law and speed of privatization in transition countries: 11 years later. In: Estrin, S.; Kolodko, G.; Uvalic, M. (Eds.) *Transition and beyond: Studies in economic transition.* London: Palgrave Macmillan.

Gomulka, S. (2000) *Macroeconomic policies and achievements in transition economies, 1989-1999*. London: Centre for Economic Performance, London School of Economics and Political Science.

Gupta, N.; Ham, J.; Svejnar, J. (2008) Priorities and sequencing in privatization: Evidence from Czech firm panel data. *European Economic Review*, 52, 183-208.

Halpern, L.; Koren, M.; Szeidl, A. (2015) Imported inputs and productivity. *American Economic Review*, 105(12), 3660-3703.

Havlik, P. (2005) Structural change, productivity and employment in the new EU member States. Vienna: Vienna Institute for International Economic Studies (WIIW). (Research Report no. 313).

Havrylyshyn, O.; Al-Atrash, H. (1998) Opening up and geographic diversification of trade in transition economies. Washington, DC: International Monetary Fund (Working Paper 98/22).

Havrylyshyn, O.; McGettigan, D. (2000) Privatization in transition countries. *Post-Soviet Affairs*, 16(3), 257-286.

Havrylyshyn, O.; Van Rooden, R. (2003) Institutions matter in transition, but so do policies. *Comparative Economic Studies*, 45, 2-24.

Herzer, D. (2012) How does foreign direct investment really affect developing countries' growth? *Review of International Economics*, 20(2), 396-414.

Hunya, G. (2000) International competitiveness impacts of FDI in CEECs. Vienna: Vienna Institute for International Economic Studies – WIIW (Research Report no. 268).

Jimborean, R.; Kelber, A. (2017) Foreign direct investment drivers and growth in Central and Eastern Europe in the aftermath of the 2007 global financial crisis. *Comparative Economic Studies*, 59(1), 23-54.

Jones, R.; Kierzkowski, H. (2005a) International fragmentation and the new economic geography. *North American Journal of Economics and Finance*, 16(1), 1-10.

Jones, R.; Kierzkowski, H. (2005b) International trade and agglomeration: An alternative framework. *Journal of Economics*, 86, 1-16.

Kahn, J.; Lim, J. (1998) Skilled labour-augmenting technical progress in U.S. manufacturing. *Quarterly Journal of Economics*, 113(4), 1281-1308.

Kinoshita, Y. (2001) R&D and technology spillovers through FDI: Innovation and absorptive capacity. Center for Economic Policy Research (CEPR) (Discussion Paper no. 2775).

Kojima, K. (1960) Capital accumulation and the course of industrialisation, with special reference to Japan. *Economic Journal*, 70, 757-768.

Kojima, K. (1973) A macroeconomic approach to foreign direct investment. *Hitotsubashi Journal of Economics*, 14(1), 1-21.

Kojima, K. (1982) Macroeconomic versus international business approach to foreign direct investment. *Hitotsubashi Journal of Economics*, 23, 630-640.

Kojima, K. (2000) The "flying-geese" model of Asian economic development: origin, theoretical extensions, and regional policy implications. *Journal of Asian Economics*, 11, 375-401.

Kojima, K.; Ozawa, T. (1984) Micro and macro economic models of foreign direct investment: Towards a synthesis. *Hitotsubashi Journal of Economics*, 25(2), 1-20.

Kolasa, M. (2008) How does FDI inflow affect productivity of domestic firms? The role of horizontal and vertical spillovers, absorptive capacity and competition. *Journal of International Trade and Economic Development*, 17(1), 155-173.

Kornai, J. (1986) The soft budget constraint. *Kyklos*, 39(1), 3-30.

Kornai, J. (1994) Transformational recession: The main causes. *Journal of Comparative Economics*, 19(3), 39-63.

Kornai, J. (1999) Reforming the welfare state in postsocialist economies. In: Brown, A. (Ed.) *When is transition over?* Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Kottaridi, C.; Stengos, T. (2010) Foreign direct investment, human capital and non-linearities in economic growth. *Journal of Macroeconomics*, 32, 858-871.

Krueger, G.; Ciolko, M. (1998) A note on initial conditions and liberalization during transition. *Journal of Comparative Economics*, 26(4), 718-734.

Lavigne, M. (1999) What is still missing? In: Brown, A. (Ed.) *When is transition over?* Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Lavigne, M. (2000) Ten years of transition: A review article. *Communist and Post-Communist Studies*, 33, 475-483.

Lee, C. (1990) Direct foreign investment, structural adjustment, and international division of labor: A dynamic macroeconomic theory of direct foreign investment. *Hitotsubashi Journal of Economics*, 31(2), 61-72.

Li, X.; Liu, X. (2005) Foreign direct investment and economic growth: An increasingly endogenous relationship. *World Development*, 33(3), 393-407.

Lipton, D.; Sachs, J.; Fischer, S.; Kornai, J. (1990) Creating a market economy in Eastern Europe: The case of Poland. *Brookings Papers on Economic Activity*, 1, 75-147.

McMillan, M.; Rodrik, D. (2014) Globalization, structural change, and productivity growth, with an update on Africa. *World Development*, 63, 11-32.

Megginson, W.; Netter, J. (2001) From state to market: A survey of empirical studies on privatization. *Journal of Economic Literature*, 39(2), 321-389.

Meyer, K.; Jensen, C. (2005) Foreign direct investment and government policy in Central and Eastern Europe. In: Grosse, R. (Ed.) *International business and government relations in the 21st century*. New York: Cambridge University Press.

Narula, R. (1996) *Multinational Investment and Economic Structure: Globalisation and Competitiveness*. London and New York: Routledge.

Narula, R. (2014) Exploring the paradox of competence-creating subsidiaries: Balancing bandwidth and dispersion in MNEs. *Long Range Planning*, 47(1-2), 4-15.

Narula, R.; Dunning, J. (2010) Multinational enterprises, development and globalization: Some clarifications and a research agenda. *Oxford Development Studies*, 38(3), 263-287.

Narula, R.; Guimon, J. (2010) The investment development path in a globalised world: Implications for Eastern Europe. *Eastern Journal of European Studies*, 1(2), 5-19.

Narula, R.; Pineli, A. (2019) Improving the development impact of multinational enterprises: Policy and research challenges. *Journal of Industrial and Business Economics* (*Economia e Politica Industriale*), 46(1), 1-24.

Nath, H. (2009) Trade, foreign direct investment, and growth: Evidence from transition economies. *Comparative Economic Studies*, 51(1), 20-50.

Nellis, J. (1999) Time to rethink privatization in transition economies? Washington, DC: International Finance Corporation (Discussion Paper 38).

Nelson, R.; Phelps, E. (1966) Investment in humans, technical diffusion, and economic growth. *American Economic Review*, 56(2), 69-75.

Nordhaus, W. (1990) Soviet economic reform: The longest road. *Brookings Papers on Economic Activity*, 1, 287-318.

North, D. (1991) Institutions. *Journal of Economic Perspectives*, 5(1), 97-112.

Oliva, R.; Kallenberg, R. (2003) Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172.

Peneder, M. (2002) Structural change and aggregate growth. Vienna: Austrian Institute of Economic Research (WIFO). (Working Paper no. 182).

Piscitello, L.; Rabbiosi, L. (2005) The impact of inward FDI on local companies' labour productivity: Evidence from the Italian case. *International Journal of the Economics of Business*, 12(1), 35-51.

Popov, V. (2007) Shock therapy versus gradualism reconsidered: Lessons from transition economies after 15 years of reforms. *Comparative Economic Studies*, 49, 1-31.

Przeworski, A. (1991) *Democracy and the market: Political and economic reforms in Eastern Europe and Latin America.* Cambridge: Cambridge University Press.

Radosevic, S. (1998) The transformation of national systems of innovation in Eastern Europe: Between restructuring and erosion. *Industrial and Corporate Change*, 7(1), 77-108.

Radosevic, S. (1999) Transformation of science and technology systems into systems of innovation in central and eastern Europe: The emerging patterns and determinants. *Structural Change and Economic Dynamics*, 10(3-4), 277-320.

Ricardo, D. (1817) *On the principles of political economy and taxation.* London: John Murray.

Rojec, M.; Damijan, J. (2008) Relocation via foreign direct investment from old to new EU member states: Scale and structural dimension of the process. *Structural Change and Economic Dynamics*, 19, 53-65.

Romer, P. (1993) Idea gaps and object gaps in economic development. *Journal of Monetary Economics*, 32, 543-573.

Schoors, K.; Van de Tol, B. (2002) Foreign direct investment spillovers within and between sectors: Evidence from Hungarian data. Gent: Faculteit Economie en Bedrijfskunde, Universiteit Gent. (Working Paper 02-157).

Solomon, E. (2011) Foreign direct investment, host country factors and economic growth. *Ensayos Revista de Economía*, 30(1), 41-70.

Svejnar, J. (1999) The transition is not over, but note the merits of the Central European model. In: Brown, A. (Ed.) *When is transition over?* Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Svejnar, J. (2002) Transition economies: performance and challenges. *Journal of Economic Perspectives*, 16(1), 3-28.

Timmer, M.; Dietzenbacher, E.; Los, B.; Stehrer, R.; de Vries, G. (2015) An illustrated user guide to the world input-output database: The case of global automotive production. *Review of International Economics*, 23, 575-605.

Tondl, G.; Vuksic, G. (2003) What makes regions in Eastern Europe catching up? The role of foreign direct investment, human resources and geography. Bonn: Rheinische Friedrich-Wilhelms-Universität Bonn, Zentrum für Europäische Integrationsforschung – ZEI (Working Paper no. B 12-2003).

Tornqvist, L.; Vartia, P.; Vartia, Y. (1985) How should relative changes be measured? *American Statistician*, 39(1), 43-46.

UNCTAD – United Nations Conference on Trade and Development (2013) *Key trends in international merchandise trade.* United Nations: New York and Geneva.

Vandermerwe, S.; Rada, J. (1988) Servitization of business: Adding value by adding services. *European Management Journal*, 6(4), 314-324.

Vu, K. (2017) Structural change and economic growth: Empirical evidence and policy insights from Asian economies. *Structural Change and Economic Dynamics*, 41, 64-77.

Wallstein, S. (2001) An econometric analysis of telecom competition, privatization, and regulation in Africa and Latin America. *Journal of Industrial Economics*, 49(1), 1-19.

Weber, E. (2011) Foreign and domestic growth drivers in Eastern Europe. *Economic Systems*, 35, 512-522.

Zinnes, C.; Eilat, Y.; Sachs, J. (2001) The gains from privatization in transition economies: Is “change of ownership” enough? *IMF Staff Papers*, 48(special issue), 146-170.

Appendix A

Table A1 - Correspondence table of NACE Rev. 1, NACE Rev. 2 and ISIC Rev. 3

WIIW (NACE Rev. 1)	(NACE Rev. 2)	WIOD (ISIC Rev. 3)
A-B	A	A01-A02-A03
C	B	B
D	C	C
DA	CA	C10-C11-C12
DB-DC	CB	C13-C14-C15
DD-DE	CC	C16-C17-C18
DF	CD	C19
DG	CE-CF	C20-C21
DH-DI	CG	C22-C23
DJ	CH	C24-C25
DK	CK	C28
DL	CI-CJ	C26-C27
DM	CL	C29-C30
DN-OTHER	CM-OTHER	C31-C32-C33
E	D-E	D-E
F	F	F
G	G	G
H	I	I
I	H-J	H-J61
J	K	K
K	L-M-N	L-M-J58-J59-J60-J62-J63
OTHER	OTHER	N-O-P-Q-R-S-T-U

Table A2 - Industry classification, description of activities

Description	WIOD (ISIC Rev. 3)
Crop and animal production, hunting and related service activities	A01
Forestry and logging	A02
Fishing and aquaculture	A03
Mining and quarrying	B
Manufacture of food products, beverages and tobacco products	C10-C12
Manufacture of textiles, wearing apparel and leather products	C13-C15
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	C16
Manufacture of paper and paper products	C17
Printing and reproduction of recorded media	C18
Manufacture of coke and refined petroleum products	C19
Manufacture of chemicals and chemical products	C20
Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21
Manufacture of rubber and plastic products	C22
Manufacture of other non-metallic mineral products	C23
Manufacture of basic metals	C24
Manufacture of fabricated metal products, except machinery and equipment	C25
Manufacture of computer, electronic and optical products	C26
Manufacture of electrical equipment	C27
Manufacture of machinery and equipment n.e.c.	C28
Manufacture of motor vehicles, trailers and semi-trailers	C29
Manufacture of other transport equipment	C30
Manufacture of furniture; other manufacturing	C31-C32
Repair and installation of machinery and equipment	C33
Electricity, gas, steam and air conditioning supply	D35
Water collection, treatment and supply	E36
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	E37-E39
Construction	F
Wholesale and retail trade and repair of motor vehicles and motorcycles	G45
Wholesale trade, except of motor vehicles and motorcycles	G46
Retail trade, except of motor vehicles and motorcycles	G47
Land transport and transport via pipelines	H49
Water transport	H50
Air transport	H51
Warehousing and support activities for transportation	H52
Postal and courier activities	H53
Accommodation and food service activities	I
Publishing activities	J58
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	J59-J60
Telecommunications	J61
Computer programming, consultancy and related activities; information service activities	J62-J63
Financial service activities, except insurance and pension funding	K64
Insurance, reinsurance and pension funding, except compulsory social security	K65
Activities auxiliary to financial services and insurance activities	K66
Real estate activities	L68
Legal and accounting activities; activities of head offices; management consultancy activities	M69-M70
Architectural and engineering activities; technical testing and analysis	M71
Scientific research and development	M72
Advertising and market research	M73
Other professional, scientific and technical activities; veterinary activities	M74-M75

cont.

Table A2 - Industry classification, description of activities

Description	WIOD (ISIC Rev. 3)
Administrative and support service activities	N
Public administration and defence; compulsory social security	O84
Education	P85
Human health and social work activities	Q
Other service activities	R-S
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T
Activities of extraterritorial organizations and bodies	U

Source: World Input-Output Database (WIOD), Socio Economic Accounts.

Table A3 - Industry contribution to the dynamic shift component of structural change, by country, 2000-2014

Industry	Contribution to Dynamic Shift		Relative real value added growth and relative employment growth			
	(+)	(-)	(+) (+)	(+) (-)	(-) (+)	(-) (-)
A-B		CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVK, SVN	SVK			CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVN
C	LVA, POL, ROU, RUS	CZE, EST, HRV, HUN, LTU, SVK, SVN	LVA, RUS	EST,HUN	LTU	CZE, HRV, POL, ROU, SVK, SVN
D	POL	CZE, EST, HRV, HUN, LTU, LVA, ROU, RUS, SVK, SVN	POL	CZE, EST, HUN, LTU, ROU, SVK, SVN		HRV, LVA, RUS
DA	HUN, LVA, POL	CZE, EST, HRV, LTU, ROU, RUS, SVK, SVN	POL	HRV, ROU, SVK		CZE, EST, HUN, LTU, LVA, SVN, RUS
DB-DC		CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVK, SVN				CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVK, SVN
DD-DE		CZE, EST, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVK, SVN		CZE, EST, LTU, POL, ROU, SVK, RUS		HRV, HUN, LVA, SVN
DF	EST	CZE, HRV, HUN, LTU, LVA, POL, ROU, RUS, SVK, SVN	EST	LTU, LVA, RUS	HUN, POL	CZE, HRV, ROU, SVK, SVN
DG	LTU, LVA, POL, SVN	CZE, EST, HRV, HUN, ROU, RUS, SVK	LTU, LVA, POL, SVN	RUS	EST	CZE, HRV, HUN, ROU, SVK
DH-DI	LTU, LVA, POL, ROU	CZE, EST, HRV, HUN, RUS, SVK, SVN	LTU, LVA, POL, ROU	CZE, HUN, SVK, RUS		EST, HRV, SVN
DJ		ROU, SVN	EST, HRV, LTU, LVA, POL, SVK	SVN	CZE, RUS	HUN, ROU
DK	CZE, EST, HUN, LTU, SVN	HRV, LVA, POL, ROU, RUS, SVK	CZE, EST, HUN, LTU, SVN	POL, SVK	HRV	LVA, ROU, RUS
DL	CZE, EST, LVA, POL, ROU	HRV, HUN, LTU, RUS, SVK, SVN	CZE, EST, LVA, POL	HUN, LTU, SVK, SVN	ROU	HRV, RUS
DM	CZE, EST, HUN, LVA, POL, ROU, SVK, SVN	HRV, LTU, RUS	CZE, EST, HUN, LVA, POL, ROU, SVK, SVN	LTU	HRV	RUS
DN-OTHER	HRV, LTU, POL, ROU, RUS	CZE, EST, HUN, LVA, SVK, SVN	HRV, LTU, POL, ROU	CZE, EST, HUN, LVA, SVK		SVN, RUS
E	CZE, HUN, POL, ROU	EST, HRV, LTU, LVA, RUS, SVK, SVN	ROU		POL, SVN	CZE, EST, HRV, HUN, LTU, LVA, SVK, RUS
F	EST, HUN, LTU, LVA, ROU, RUS, SVK, SVN	CZE, HRV, POL	LTU, LVA, ROU, RUS		EST, HRV, HUN, SVK	CZE, POL, SVN
G	CZE, HRV, HUN, LTU, POL, ROU, RUS, SVK, SVN	EST, LVA	CZE, HRV, HUN, LTU, ROU, SVN, RUS	LVA	POL, SVK	EST
H	EST, HRV, LTU, LVA, POL, ROU, RUS	CZE, HUN, SVK, SVN	EST, HRV, LVA, POL, ROU, RUS		CZE, HUN, LTU, SVK, SVN	
I	CZE, HRV, LTU, LVA, POL, ROU, RUS, SVN	EST, HUN, SVK	HRV, LTU, POL, SVN, RUS	EST, HUN	LVA, ROU	CZE, SVK
J	EST, LTU, LVA, POL, ROU, RUS, SVK, SVN	CZE, HRV, HUN	HRV, LVA, POL, ROU, SVK, SVN, RUS	CZE	HUN, LTU	EST
K	CZE, EST, LTU, ROU, SVK	HRV, HUN, LVA, POL, SVN	CZE, EST, HRV, HUN, LTU, LVA, ROU, SVK, SVN		POL	
OTHER	EST, HRV, HUN, LTU, LVA, POL	CZE, ROU, SVK, SVN, RUS	HUN		CZE, EST, HRV, LTU, LVA, POL, ROU, SVN, RUS	SVK

Source: World Input-Output Database (WIOD), Socio Economic Accounts. Author's calculations. Note: The real estate industry is not included in the calculations. Country codes are: Croatia (HRV), Czechia (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Poland (POL), Romania (ROU), Russia (RUS), Slovakia (SVK), Slovenia (SVN).

Appendix B

Table B1 - Determinants of within productivity growth - 20 industries

	Coef.	t-statistic
FDI growth	-5.675	-0.19
regulatory quality	-0.191	-0.07
FDI growth*regulatory quality	-4.218	-1.64
dummy regulated industries	0.292	0.24
FDI growth*dummy regulated industries	-5.567	-1.54
regulatory quality*dummy regulated industries	-0.930	-0.67
FDI growth*regulatory quality*dummy regulated industries	10.899	2.64
dependency on exports	0.026	2.01
FDI growth*dependency on exports	0.072	1.83
human capital index	-1.990	-0.30
FDI growth*human capital index	0.902	0.10
skill intensity	-34.694	-0.97
FDI growth*skill intensity	-65.795	-0.62
human capital index*skill intensity	10.223	0.94
FDI growth*human capital index*skill intensity	25.208	0.78
foreign VA in exports	0.082	3.01
FDI growth*foreign VA in exports	-0.017	-0.19
country dummies		
Estonia	1.965	1.09
Croatia	0.010	0.00
Hungary	0.179	0.06
Lithuania	4.562	1.31
Latvia	2.827	0.69
Poland	2.654	0.90
Romania	2.800	0.66
Russia	2.125	0.46
Slovakia	2.080	1.91
Slovenia	0.200	0.10
year dummies		
2003	0.402	0.32
2004	0.224	0.17
2005	0.750	0.58
2006	1.205	0.85
2007	-0.562	-0.41
2008	-4.019	-2.56
2009	-10.631	-6.23
2010	3.048	1.70
2011	-2.287	-1.34
2012	-4.695	-2.80
2013	-3.477	-1.96
2014	-3.406	-1.81
constant	6.694	0.29
R-squared	0.10	
N	2,512	

Note: Figures 1 to 4 are based on this estimation.

Table B2 - Determinant of within productivity - 10 industries (manufacturing)

	Model 1		Model 2		Model 3		Model 4	
	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
FDI growth	-6.668	-0.12	-6.260	-0.11	-7.576	-0.14	-7.491	-0.13
regulatory quality	-3.331	-0.91	-3.421	-0.93	-3.106	-0.85	-3.170	-0.86
FDI growth*regulatory quality	-3.636	-0.71	-2.644	-0.55	-2.793	-0.56	-1.488	-0.35
human capital index	0.276	0.03	-5.783	-0.61	0.193	0.02	-6.507	-0.68
FDI growth*human capital index	-2.731	-0.16	-2.197	-0.13	-1.995	-0.12	-1.198	-0.07
skill intensity	430.720	1.17	253.540	0.71	33.317	0.11	-219.932	-0.81
FDI growth*skill intensity	-46.892	-0.20	-59.026	-0.25	-49.588	-0.21	-63.066	-0.27
human capital index*skill intensity	0.595	0.03	10.326	0.51	-1.567	-0.08	8.830	0.44
FDI growth*human capital index*skill intensity	25.306	0.34	29.289	0.40	27.021	0.36	31.637	0.43
foreign VA in exports	0.166	2.07			0.181	2.27		
FDI growth*foreign VA in exports	0.098	0.50			0.105	0.58		
dependency on exports	0.066	1.67	0.074	1.89				
FDI growth*dependency on exports	0.056	0.51	0.069	0.71				
dummy RCA>1	-1.041	-1.02	-0.772	-0.76	-0.555	-0.59	-0.190	-0.20
FDI growth*dummy RCA>1	6.048	1.97	5.841	1.90	6.547	2.25	6.438	2.21
country dummies								
Estonia	1.348	0.49	0.727	0.26	1.224	0.44	0.517	0.19
Croatia	0.027	0.00	-4.357	-0.83	-1.941	-0.35	-7.057	-1.37
Hungary	-1.562	-0.37	-2.651	-0.63	-1.255	-0.30	-2.410	-0.58
Lithuania	7.671	1.41	3.117	0.64	6.206	1.16	0.972	0.20
Latvia	1.567	0.26	-1.954	-0.34	0.862	0.14	-3.125	-0.54
Poland	3.970	0.88	0.267	0.06	3.208	0.72	-0.985	-0.24
Romania	2.300	0.36	-3.131	-0.54	1.226	0.19	-4.915	-0.86
Russia	0.241	0.03	-4.645	-0.72	-1.365	-0.20	-6.972	-1.09
Slovakia	1.160	0.70	1.180	0.71	1.664	1.03	1.764	1.09
Slovenia	-1.547	-0.54	-3.112	-1.13	-1.376	-0.48	-3.074	-1.11
year dummies								
2003	1.381	0.73	1.325	0.70	1.240	0.66	1.153	0.61
2004	1.243	0.63	1.335	0.68	1.168	0.59	1.264	0.64
2005	0.970	0.50	1.339	0.69	0.922	0.47	1.316	0.68
2006	3.213	1.47	3.725	1.70	3.290	1.50	3.866	1.76
2007	-0.291	-0.14	0.597	0.30	-0.222	-0.11	0.765	0.39
2008	-5.495	-2.28	-4.695	-1.99	-5.545	-2.29	-4.673	-1.97
2009	-13.254	-4.86	-12.386	-4.63	-13.234	-4.85	-12.273	-4.59
2010	10.398	3.83	10.752	3.98	10.560	3.92	10.968	4.09
2011	-2.848	-1.09	-2.166	-0.84	-2.504	-0.96	-1.701	-0.66
2012	-6.198	-2.46	-5.166	-2.11	-5.890	-2.36	-4.711	-1.94
2013	-4.638	-1.74	-3.337	-1.31	-4.198	-1.60	-2.702	-1.08
2014	-4.784	-1.69	-3.441	-1.26	-4.238	-1.52	-2.679	-0.99
industry dummies								
DB-DC	13.187	1.04	8.717	0.70	-0.493	-0.05	-7.419	-0.76
DD-DE	-12.167	-1.18	-8.559	-0.85	-0.220	-0.03	5.499	0.72
DG	-121.323	-1.25	-81.003	-0.86	-10.298	-0.14	50.344	0.71
DH-DI	5.317	1.17	4.446	0.99	0.488	0.13	-1.179	-0.32
DJ	9.473	0.96	6.836	0.70	-1.298	-0.16	-5.778	-0.74
DK	-19.446	-1.15	-11.769	-0.72	0.433	0.03	11.797	0.97
DL	-100.557	-1.12	-64.637	-0.80	-5.485	-0.09	47.979	0.79
DM	-46.029	-1.29	-29.358	-0.85	-5.415	-0.20	18.884	0.74
constant	-75.852	-1.02	-24.579	-0.35	-3.715	-0.06	63.343	1.15
R-squared	0.20		0.19		0.20		0.19	
N	1,260		1,260		1,260		1,260	

Note: Table 9 is based on this estimation.

Table B3 - Determinants of structural change - 20 industries

	Model 1		Model 2		Model 3		Model 4	
	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
FDI growth					-15.738	-1.10	11.962	0.56
relative productivity	9.878	1.71	-12.991	-1.80	4.459	0.74	-9.522	-1.21
FDI growth*relative productivity					30.663	4.28	-28.493	-2.30
regulatory quality	-7.656	-3.70	-0.053	-0.02	-8.636	-4.10	1.023	0.35
FDI growth*regulatory quality					5.502	2.08	-3.794	-0.96
relative productivity*regulatory quality	1.499	2.17	-1.053	-1.09	1.824	2.63	-1.609	-1.60
FDI growth*relative productivity*regulatory quality					-2.209	-1.08	3.563	1.10
dependency on exports	-0.010	-0.57	0.057	2.89	-0.001	-0.04	0.050	2.49
FDI growth*dependency on exports					-0.086	-1.70	0.090	1.41
relative productivity*dependency on exports	0.022	1.61	-0.028	-1.64	0.022	1.66	-0.028	-1.65
FDIgrowth*relative productivity*dependency on exports					0.022	0.75	-0.031	-0.79
human capital index	1.974	0.44	-4.212	-0.65	0.867	0.19	-2.728	-0.42
FDI growth*human capital index					3.044	0.65	-4.169	-0.61
relative productivity*human capital index	-3.290	-1.89	4.770	2.15	-1.751	-0.98	3.690	1.55
FDI growth*relative productivity*human capital index					-8.972	-3.94	9.704	2.44
foreign VA in exports	-0.041	-1.13	0.186	3.73	-0.067	-1.83	0.183	3.55
FDI growth*foreign VA in exports					0.230	1.66	0.017	0.09
relative productivity*foreign VA in exports	0.012	0.41	-0.119	-3.01	0.018	0.64	-0.106	-2.56
FDI growth*relative productivity*foreign VA in exports					-0.081	-0.87	-0.096	-0.68
country dummies								
Estonia	1.330	0.97	2.009	1.13	1.310		2.068	1.16
Croatia	-5.215	-1.97	-0.644	-0.17	-5.674		0.272	0.07
Hungary	-1.538	-0.76	0.264	0.09	-1.651		0.711	0.24
Lithuania	-2.097	-0.83	4.451	1.28	-2.349		5.066	1.46
Latvia	-1.928	0.67	2.129	0.52	-2.277		2.875	0.70
Poland	-0.751	-0.36	1.853	0.63	-0.990		2.424	0.82
Romania	-4.652	-1.57	2.181	0.51	-4.919		2.875	0.67
Russia	-10.803	-3.08	1.134	0.24	-11.055		2.005	0.43
Slovakia	-0.772	-1.24	2.139	1.98	-0.941		2.169	2.02
Slovenia	-3.191	-2.21	-0.001	0.00	-3.405		0.468	0.23
year dummies								
2003	2.043	1.92	0.469	0.38	2.010		0.372	0.30
2004	1.671	1.42	0.531	0.41	1.568		0.488	0.38
2005	1.761	1.55	0.762	0.59	1.620		0.676	0.53
2006	2.879	2.33	1.332	0.94	2.844		1.242	0.88
2007	3.182	2.72	-0.053	-0.04	3.240		-0.195	-0.14
2008	1.635	1.32	-3.608	-2.33	1.635		-3.792	-2.42
2009	-6.682	-4.88	-10.314	-6.12	-6.539		-10.332	-6.07
2010	-2.774	-1.99	3.331	1.87	-2.775		3.388	1.89
2011	3.365	2.44	-1.882	-1.11	3.371		-1.843	-1.08
2012	-0.095	-0.07	-4.152	-2.49	-0.166		-4.250	-2.53
2013	-0.290	-0.21	-3.058	-1.72	-0.416		-2.999	-1.68
2014	1.607	1.06	-3.130	-1.67	1.425		-2.938	-1.56
constant	1.507	0.10	12.029	0.53	6.474		6.233	0.27
R-squared	0.11		0.12		0.12		0.12	
N	2,512		2,512		2,512		2,512	

Notes: Figures 5 to 9 are based on these estimations. Model 1 - top left charts. Model 2 - top right charts. Model 3 - bottom left charts. Model 4 - bottom right charts. The dependent variable in Models 1 and 3 is employment growth. The dependent variable in Models 2 and 4 is labour productivity growth.

CHAPTER 5:
CONCLUSION

Economic development is, to a certain extent, idiosyncratic. Stressing this fact of life is the main contribution of this Thesis. Along the development ladder, some factors become more relevant for economic development while others lose importance. History matters, geography matters. For this reason, any one-size-fits-all recipe for development is illusory.

If this is true, conventional research on cross-country economic development is doing wrong. Not surprisingly, notwithstanding the voluminous production of cross-countries studies over the last three decades we still know very little about *what drives economic development*.

The three empirical chapters of this Thesis highlight the importance of looking beyond *average* effects. Indeed, in all chapters the *average* effect of the variable of interest is statistically and/or economically insignificant. However, further examination reveals that the *average* effect masks quite heterogenous effects across parts of the samples.

Bringing structural change back to comparative development studies is the other key contribution of this Thesis. Even though the theme never ceased to be central for (the few) structuralist scholars, it has remained largely disregarded by mainstream economists, which have tended to treat economic development as synonym of GDP growth. This is even more important for the field of international business (IB) studies, which have become extremely MNE-centred over the last few decades, leaving behind concerns about the development impacts of MNE activity that were dear to pioneers such as Stephen Hymer, John Dunning, Raymond Vernon, Kiyoshi Kojima and Terutomo Ozawa.

1. Key findings

The main findings of the Thesis can be summarised as follows:

Chapter Two recalls the series of cross-country studies that have attempted to identify the role played by human capital in economic growth. Despite the widespread belief that education is good, or even indispensable, for development, the issue remains quite controversial from the empirical point-of-view as several studies find no relationship (or even a negative relationship) between the average education level of the adult population and economic growth. One of the possible causes of the disappointing results is the failure in taking the demand for skilled labour into consideration. The chapter challenges the existence of an education Say's law, advocating that the effect of human capital on growth depends on the demand for skilled labour which, in turn, depends on the type of economic specialisation of the country, proxied in the chapter by the Economic Complexity Index (ECI). The empirical work suggests that economic specialisation does not affect the economic growth rate but influence the effect of human capital on growth. The interaction effect is evidenced by nonparametric regression and ratified by OLS models. Human capital is not a growth determinant in countries highly specialised in natural-resource based goods. In countries with a mid-complexity specialisation, the effect of human capital is large and statistically significant, what suggests the occurrence of occupations in which productivity can be enhanced by the accumulated human capital. In countries specialised in high-complexity goods, the marginal effect of human capital is positive only when the investment rate is relatively low. A possible interpretation for this result is that human capital is relevant for countries more specialised in services, which tend to be less capital intensive than manufacturing. The chapter also indicates that economic specialisation is a significant predictor of physical and human capital accumulation.

Chapter Three discusses the two main streams of literature that deals with the development impacts of FDI. The microeconomic literature mostly deals with the spillover effects on domestic actors generated by the presence of foreign MNEs. The macroeconomic literature revolves around the effect of FDI on aggregate economic growth. The chapter contributes to this literature by directly analysing the effect of FDI on structural change. This is done substituting GDP growth by the share of the adult population employed in the modern sector of the economy as the dependent variable in typical growth regression. Following theoretical contributions such as the investment development path (IDP) framework and Ozawa's stages-of-development approach to FDI, the chapter tests whether the development impact of FDI depends on its sectoral concentration and whether this relationship varies according to the stage of development of the country. For such, it uses an unconventional two-stages econometric approach that better reflects both the theoretical propositions and the empirical evidence that the FDI-growth nexus is highly country-specific. In the first stage, long-run coefficients relating FDI and employment structure is estimated for each of the 28 developing countries of the sample using a panel-time series method. In the second stage, a set of variables, borrowed from the empirical literature on FDI and growth, are employed to explain the cross-country differences in the FDI-structural change nexus. The cross-country *average* effect of FDI on employment structure is very small but, as expected, the results indicate a high degree of heterogeneity across countries. The second stage reveals that the degree of matching between the stage of development of a country and the type of FDI it receives affects the capacity of FDI to promote structural change. At initial development stages, a higher concentration of FDI in manufacturing strengthens the FDI-structural change nexus. At later stages of development, a higher concentration of FDI in the non-manufacturing modern sector of the economy is more strongly associated with structural change. Based on the IDP and Ozawa's approach, it is possible to conclude that the estimated effects reflect crucial differences in the ability of countries to provide the capabilities required by these broadly defined sectors. In addition, cross-country differences in the FDI-structural change nexus are associated with the financial development and the (lack of) control of corruption of the countries. A possible interpretation of such unexpected finding is that FDI tends to be produce larger effects where it is rarer because crowding-out is less likely.

Chapter Four uses industry-level data of 11 former communist countries to untangle the relationship between FDI and aggregate labour productivity growth. For such, it decomposes aggregate labour productivity growth into the within-industry labour productivity growth and the labour reallocation (structural change) components. The basic result is that growth in FDI stock is positively associated with labour productivity growth in the same industry, but the effect is economically small and statistically insignificant. Nonetheless, further investigation indicates that substantial heterogeneity is hidden by the negligible average effect. The level of institutional development seems to influence the productivity growth effect of FDI, especially among heavily regulated industries. There is also evidence that FDI produce stronger productivity growth effects when directed to industries that are more intensive in skilled-labour and are more export-oriented. The shift-share analysis done in the chapter shows that, in the period 2000-2014, labour tended to move out of the least productive industries towards the most productive industries but FDI tended to attenuate this movement. Compared to a situation of no growth in FDI stock, an increase in FDI stock is associated to lower employment growth in high productivity industries. At the same time, productivity growth in these industries tended to be higher when FDI grew, thus suggesting that MNEs bring labour-saving technologies to host countries as compared to domestic firms. MNEs contribute to shift output structures in direction of the most productive industries but do not play the same role in respect to employment – on the contrary, MNE activity tends to weaken the static shift component of structural change. The attenuating effect of FDI seems to be stronger in countries with better institutional development and higher human capital stocks. There is also some indication that a greater domestic orientation of the least productive industries tends to amplify the attenuating effect of FDI on structural change.

2. Implications for academia

The Thesis brings some important messages to the academic community:

Economic structure matters!

Leaving aside the small community of structuralist scholars, economic structure is still largely disregarded by researchers on economic growth. As shown in Chapter Two, this practice may be partially responsible for the disappointing results reached by the research agenda on cross-country growth that was very popular during the 1990s and early 2000s.

FDI affects the economic structure of host countries!

Over the last two decades, studies on the development impacts of FDI were largely circumscribed to two issues: i) spillover effects to domestic actors; ii) effects on aggregate economic growth. The finding that FDI affects, under certain conditions, the economic structure of host countries, opens up new directions for researchers interested in the relationship between FDI and development. This is especially relevant for the IB community, which have devoted major efforts to the study of MNEs but have remained largely apart, in recent years, from the discussions about the development consequences of their activity.

Heterogeneity matters!

The third key point elicited by the Thesis is the necessity of looking beyond average effects in comparative development studies. Whenever possible, researchers should resort to estimation methods, as well as model specifications, that allow variable effects across units.

3. Implications for policy

The policy implications of the findings of this Thesis are relatively straightforward. Chapter Two has a clear message: the growth dividends of investments in human capital depend on the economic specialisation of the country. Complimentary policies may be needed to move the economic structure towards activities in which the economic returns of human capital are higher, otherwise the country may end up in a situation of overeducation.

Both Chapter Three and Chapter Four suggest that positive development effects of FDI cannot be taken for granted. Certain types of FDI produce better results in certain contexts. Chapter Three suggests that the extent to which FDI promotes structural change depends on the alignment between the type of investments a country receives and its stage of development. Some activities may require a set of capabilities that the country is not yet able to provide, what reduce the chances of positive effects of FDI. Initiatives to expand and deepen local financial markets may increase the development effects of FDI. The chapter also suggests that FDI is particularly relevant for countries with poor business environments, what could justify higher concessions to foreign investors because the risk of crowding out domestic investment is low in such contexts.

The key policy implication of Chapter Four is that the effects of FDI in terms of employment growth, output growth and productivity growth do not necessarily go hand in hand. Policies aiming at attracting FDI to certain industries may produce frustrating results in terms of employment growth even when they induce output growth. Another important policy implication of Chapter Four is that best results in terms of productivity growth tend to be obtained when countries' attributes are aligned to industries' requirements. Considering that FDI is increasingly directed to regulated industries, efforts to improve regulatory quality are necessary to magnify the productivity growth impact of FDI. Similarly, efforts to increase human capital endowment may help to potentialize the productivity effect of FDI in skill-intensive industries. If the aim is to enhance labour productivity, there is a case for promoting FDI in export-oriented industries. If the aim is to create jobs, there is a case for promoting FDI in low productivity industries that target the domestic market. The results also suggest that, at least in the short-run, targeting manufacturing industries in which the country already has comparative advantage possibly produce better results in terms of productivity growth.

5. Limitations and areas for future research

The main merit of this Thesis is to address an issue that have remained largely ignored by the academia over the last decades (with few exceptions) – that is, structural change – in a cross-country context. Its main weakness is the necessity of adapting several indicators due to data unavailability.

Chapter Two uses the ECI as indicator of countries' economic specialisation. This index is based on merchandise trade and tends to underestimate the "true" economic structure of high-income countries whose export structures are concentrated in mineral and agricultural products. It would be preferable to use a synthetic measure of economic specialisation based on output, value added or employment. However, sufficiently disaggregated data to construct such a measure is available only for a small number of countries. It must be noted, however, that the results are not significantly altered by the exclusion of the "problematic" countries from the empirical analysis. A possible future extension of this work is, when data permit, to use an improved synthetic measure of economic structure to investigate both its direct effect on economic growth and its indirect effects through other growth determinants.

Strong data limitations make Chapter Three the less robust in terms of empirical findings. As highlighted in the chapter, some analytical categories employed by structuralism – such as the Lewisian definition of the traditional and the modern sectors – require a level of detail that is simply non-existent in available data. The same can be said in respect to stocks of foreign capital and the sectoral distribution of FDI. For this reason, some important adaptations were needed in order to be able to make the estimations. The extent to which this may have affected the results is unknown.

The use of annual data is the main limitation of Chapter Four. It is well known that output can be very volatile in the short run, a problem that is magnified when disaggregated data is used. For this reason, whenever possible, it is preferable to use 5-year or even 10-year averages in any variant of growth regression. However, industry-level FDI data of former communist countries are available only for a relatively short period of time – in some cases, only for a few years. Using annual data clearly restrains the capacity of the econometric model in capturing the total effect of FDI in host economies because the indirect effects of FDI – linkages formation, knowledge spillovers, etc. – certainly take more time to fully materialise. A possible future extension of this work is to apply the same empirical approach to lower frequency data.