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EU accession: A road to fast-track convergence?

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Abstract

This paper investigates the accession-related economic boom in the countries which recently entered the European Union. The analysis tests whether, on top of the standard growth determinants, the period of EU accession made a significant difference to the growth performance of the New Member States (NMS). The paper finds that the period of EU accession is characterised by significantly larger growth rates of per-capita GDP, even after controlling for a wide range of economic and institutional factors. This effect is robust and particularly strong for countries with relatively low initial income levels, weak institutional quality and less advanced financial development, suggesting that EU accession has been speeding up the catching-up process and improved the institutions of the laggards among the NMS. The prospect of EU membership which has triggered large capital inflows seems to have fostered economic growth of those NMS with lower degrees of financial depth.

JEL Classifications: O47, F15.
Key words: EU enlargement, economic growth.

1 Introduction

The economic growth record of the New Member States (NMS) of the European Union after the recovery form transition in the early 1990s has been impressive. The region is widely believed to have benefited from catching-up dynamics as well as economic and institutional integration with the EU. However, the debate is open regarding the degree to which EU integration mattered for catching up and through which channels.

While the empirical growth literature is extensive, only a few studies have used growth regressions to analyse the impact of EU accession on growth. Crespo-Cuaresma et al. (2002) make explicit reference to EU membership in explaining growth, analysing pre-2004 accessions and finding the length of EU membership to have a significantly positive effect on economic growth. Schadler et al. (2006) analyse the growth experience of the NMS and other emerging market countries and find that income levels, population growth, investment, openness and institutional quality determine growth. Falcetti et al. (2006) and Iradian (2007) focus on the growth experience of transition countries and find a significant impact of institutional factors and transition reforms, as well as a significant impact of recovery from transition-related output losses. Cihák and Fonteyne (2009) conduct a cross-section growth regression augmented by a NMS dummy variable and find that economic growth in NMS exceeded that of their remaining sample of developed and developing countries.

We make a step forward compared with the existing literature in two respects. First, we assess the impact of EU accession on the growth performance of NMS in a panel analysis after controlling for a series of institutional factors. This way, we check whether, on top of facilitating institutional convergence, and therefore growth, the prospect of EU accession had an additional significant impact per se. Second, we investigate which factors appear to be associated with stronger growth-enhancing effects of EU accession, testing in particular the effects of initial income levels, institutional quality and financial

development in conjunction with the growth experience of the NMS during the accession stage.

This paper employs a large cross-country dataset to dispose of a significant control group. The panel dataset comprises annual observations of advanced, emerging, and transition economies starting in 1960. In addition to the standard determinants per-capita GDP, population growth, investment, openness and human capital formation, we also include variables related to economic transition and EU integration, namely initial output loss, terms-of-trade growth and institutional quality of the legal system, freedom of trade, and the regulatory environment. The role of institutional quality for growth is stressed, for example, by Acemoglu et al. (2005). Controlling for all these effects, the additional EU accession impact is measured in a difference-in-difference approach. The interaction of an accession time dummy with a NMS region dummy permits to assess whether the prospect of EU accession affected the growth rate of NMS, relative to the pre-accession period and to the old EU-15 member states (OMS).

The results suggest a significant EU accession effect on top of the impact of the remaining explanatory variables. While the NMS growth rates appear significantly lower than those of the OMS during the transition period of the early 1990s, the NMS perform significantly better than the OMS during the EU accession period, as compared to the 1994-99 reference period. The results are basically robust with respect of the definition of the sample. Potential endogeneity of investment as an explanatory variable is addressed by using initial sub-period values and the relative price of investment in a set of instrumental variable regressions.

Interacting the "accession dummy" with various explanatory variables, it is found that the growth effect during the accession period was particularly strong for those NMS with relatively low initial income levels, weak institutional quality and lower degrees of financial development. EU accession seems to have had a fast-track convergence effect particularly on the economic laggards among the NMS. Furthermore, accession is likely

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to have improved institutional quality, further supporting the growth in the NMS. By triggering financial inflows and the reconstruction of the banking system, the prospect of accession may have fostered growth in those NMS with weak financial depth.

The remainder of this paper is structured as follows. Section 2 presents some stylised facts, highlighting the growth performance of the NMS over time and investigating signs of convergence graphically. Section 3 explains the data, methodology and results of various growth regression specifications to investigate growth effects of EU accession. Section 4 concludes.

2 Stylised facts

The growth performance of the NMS has been described as a typical catching-up experience, starting from lower initial per-capita income levels and characterised by higher average growth rates than the mature economies of the OMS.

NMS growth rates have been volatile, yet mostly above those of the OMS and other mature economies. Graphs 1 and 2 show the growth rates of the ten transition NMS. The Baltics as well as Bulgaria and Romania appear to be strongly affected by the aftermath of the Russian economic crisis of 1998 but exhibit elevated growth rates between 2000 and 2007. Growth rates for the remaining NMS were somewhat lower, fluctuating around 6-7%. In 2008, growth rates generally slumped in the wake of the global financial crisis.

[Graphs 1 and 2]

Catching-up dynamics ("beta convergence") are illustrated in Graph 3 which shows that the average annual per-capita growth rates of those EU countries with lower initial-year income levels (1996) tend to exhibit higher growth rates, indicated by a downward-sloping trend line.[1] The NMS are clearly concentrated in the top-left quadrant of the

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[1] The concept of catching-up convergence stems from the convergence hypothesis of the neoclassical growth literature. A Solow-type production function with non-increasing returns to scale typically implies that the long-term behaviour of the economy will be independent of the initial conditions. Due to the concavity of the production function in the capital stock, capital-poor countries will grow sufficiently

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graph, notably the Baltic countries. Some NMS like Slovenia and the Czech Republic, however, are located not far from OMS countries such as Portugal and Greece. The graph confirms the widely agreed conclusion that regards the EU as a "convergence club" (see Schadler et al. (2006)).

[Graphs 3 and 4]

Sigma convergence is an alternative way of assessing income convergence, i.e. the decrease of cross-country variation of growth rates over time. The NMS have made considerable progress since the beginning of the decade. Graph 4 shows the standard deviation of national per-capita growth rates, in percent of the average. In contrast to the notion of the EU as a "convergence club", sigma convergence is mostly due to developments in the NMS. While the cross-country variation of growth rates among the OMS remained largely stable over time, that of the NMS declined continuously since 2000.

The role of institutional quality is increasingly at the core of growth theory. Graph 5 shows the Fraser Institute's index for the quality of the legal system, ranging from 1 for poor to 10 for optimal systems of legal protection and property rights (see Gwartney and Lawson (2009)). Comparing 1999 to 2005 shows that a majority of NMS, and notably the Baltic countries as well as Cyprus clearly improved their legal system quality. Hungary, Slovenia and Poland, however, appear to have deteriorated in terms of legal system quality. The indices of the other NMS have not changed much over time.

[Graph 5]

Taken together, the descriptive evidence suggests that catching-up dynamics were at work in most NMS. Several key drivers of economic growth, however, point at important cross-country differences. The Baltic countries exhibit particularly strong growth rates in the presence of comparably low initial income levels and large improvements in

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faster, i.e. catch up to the capital-rich countries to offset the initial differences. Catching up is subject to alternative possible factors, including structural transformation, endogenous growth and gains from trade (see Caselli and Tenreyro (2005)).

institutional quality. The aim of the regression analysis in the following section is to shed light on the role of EU accession on top of standard growth determinants and to identify potential channels of this effect.

3 Assessing the EU accession boom

3.1 Data and methodology

To carry out panel regressions, a large cross-country dataset is used to dispose of a significant control group. The dataset comprises annual observations of 62 advanced, emerging, and transition economies from 1960 to 2008.[2] Besides the 27 EU member states and the remaining 11 OECD countries, 24 additional middle-income countries are considered.[3] Explanatory variables include standard growth determinants, namely per-capita GDP, population growth, investment, openness, terms-of-trade growth and human capital formation.[4] This baseline growth regression specification is augmented to take into account explanatory factors specific to the growth performance of transition and NMS. To control for the impact of changing terms of trade following transition-related structural change and developments in world commodity prices, terms of trade changes are included among the set of explanatory variables (Iradian (2007)). To account for catching-up effects after the output break-downs of formerly communist countries in the early 1990s, an output loss variable is constructed as the ratio of current output to the average output during 1990-1995 (akin to Falcetti et al. (2006) and Iradian

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[2]Due to uncertainty about data accuracy, observations of formerly-communist countries prior to 1990 are excluded.

[3]The countries included in the sample were as follows: Albania, Argentina, Australia, Austria, Belgium, Belarus, Brazil, Bulgaria, Canada, Chile, China, P.R.:Hong Kong, China,P.R.: Mainland, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hungary, Indonesia, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Morocco, Mexico, Macedonia: FYR, Malta, Malaysia, Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, Uruguay.

[4]See, e.g., Barro and Sala-i-Martin (2004), Levine and Renelt (1992), and Temple (1999), for an overview of explanatory variables in empirical growth analysis.

(2007)). Furthermore, in light of the shaping view that institutions are key to the development process (e.g., Acemoglu et al. (2005)), and in line with recent analogous analyses on growth in transition economies and NMS, standard specifications of growth regressions are augmented with the inclusion of various indicators are employed to proxy for the institutional quality of the legal system, freedom of trade, and the regulatory environment.

The data on real per-capita GDP in PPP terms, investment and openness ratios are provided by the Penn World Tables. Population growth and terms of trade are taken from the World Bank's World Development Indicators (WDI) while the source of the human capital variable (average years of schooling for the whole population) is Barro and Lee (2000) and the source of the indices on institutional quality is the Fraser Institute.[5]

Following standard practice in the estimation of growth regressions, annual observations are converted into averages over five-year, non-overlapping sub-periods, in order to avoid that short-term disturbances affect results.[6] Dummy variables capture the idiosyncratic effects of time periods and of geographic regions. The interaction between time and geographical effects permits to assess whether a particular group of countries performed above the control country group and time period in a particular period of time. Although accession of the EU-10 was formally completed as of 1 May 2004 (that of Bulgaria and Romania as of 1 January 2007), there is agreement that much of the accession-related growth effects took place already before the official dates, in light of the economic and institutional restructuring associated with the achievement of the 'acquis communautaire', EU transfers related to accession, and sizable investment, FDI, and technology transfer in anticipation of EU accession (e.g., Schadler et al. (2006)). Hence,

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[5]These indicators permit to capture major transition-related and accession-related elements, including change in ownership of financial and non-financial firms and protection and enforcement of property rights. Compared with the EBRD transition indicators (used, for instance, in Falcetti et al., 2006), they are available also for non-transition countries. Compared with the World Bank Governance Indicators (used, e.g., in Iradian (2007)), they are available for a longer time period.

[6]Due to missing data for several variables for the 2007-2009 period, the last sub-period includes the available years between 2005 and 2009.

the interactions of the 2000-04 and the post-2005 dummies with a NMS dummy are used to assess whether accession affected the growth rate of the NMS on top of the impact of the remaining explanatory variables above that of the control group with respect to the reference period.[7]

3.2 Regression results

3.2.1 Baseline results

Basic specifications provide a satisfactory performance, presented in Table 1. Specification (1) includes standard growth regression variables used to assess conditional convergence in large cross-country datasets. Per-capita GDP growth is regressed on the initial sub-period values of the log of per-capita GDP as well as on population growth, investment ratios, openness, and the human capital proxy variable.

[Table 1]

The coefficients are significant and show the expected signs, with the exception of population growth, the significance level of which falls below the 10 percent threshold. Human capital variables, however, are either not available for most of the NMS (Barro and Lee data), or available for only some NMS, and few years (WDI). Hence, to keep a sufficiently large amount of data on NMS, the baseline regressions to assess the impact of accession exclude human capital variables. Of course, as a result of the exclusion of a largely significant explanatory variable, an omitted variable bias issue arises. However, as shown in specification (2), which is based on the same sample as (1) but excludes the schooling variable, it appears that the bulk of the bias is found in the coefficient of initial income per capita (omitting the human capital variable leads to an underestimation of the speed of convergence), while the performance of the remaining explanatory factors is fairly robust.

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[7]In all regressions, the omitted regional dummy is that for the OMS, the omitted period dummy is the 1995-1999 period. Hence, the non-omitted region and time dummies represent the difference to the OMS and with respect to the 1995-1999 period.

The baseline specification is augmented to take into account NMS-specific growth determinants and institutional factors. Specifications (3) and (4) employ the maximum available samples and supplement the regression with relevant additional control variables to test the impact of accession on the NMS. In line with expectations, the NMS perform signficantly worse during the 1990-94 period and significantly better in 2000-04 and post-2005, relative to the omitted reference period 1995-99 and the control group of OMS. The size and significance level of the coefficients for the 2000-04 period are both larger than in the post-2005 period, indicating that the bulk of the accession effect could have materialised already in the run up to the official date of accession.[8]

Specification (4) includes in addition the output loss variable as well as the three institutional indicators, measuring the quality of the legal system, freedom of trade and the quality of regulation in product, labour and financial markets. The coefficient of output loss is positive but not significant. The three institutional variables are positively associated with growth although only freedom of trade is significant at the 5 percent level. As a result of the inclusion of the institutional variables, the impact of accession shrinks somewhat in magnitude, suggesting that improvements in institutional quality themselves were associated with the accession process. The coefficients of population growth and terms of trade growth turn significant on the 10 percent level with the inclusion of the institutional quality variables.

For some countries actual growth rates diverged quite considerably from the prediction of the empirical model as illustrated by Graph 6. The graph plots the actual and predicted average growth rates over the three 5-year periods between 1995 and 2009

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[8] The difference-in-difference approach quantifies the effect of the difference in time periods and country groups. The accession dummy "NMS during 2000-2004" therefore refers to the difference between the accession period (2000-04) and the reference period (1994-99) for the NMS, minus the same difference for the OMS, controling for other factors. The actual average growth rates were as follows.

Average growth rates of real per-capita GDP, in %

	1990-94	1995-99	2000-04	post-2005
NMS	-3.4	3.6	4.9	2.7
OMS	1.3	3.1	2.1	0.3

for the transition NMS based on specification (4) of Table 1. The actual growth rates exceed model-predicted rates in several countries, most notably in Estonia, Latvia and Lithuania and during the accession period (2000-2004). A detailed analysis of the factors driving growth in the Baltics is provided by the European Commission (2009b) and Lendvai and Roeger (2009).

[Graph 6]

Regression results appear to be robust with respect to the definition of the sample. Specification (5) focuses on the post-1990 period, yielding a more balanced panel. The emerging picture is broadly similar to that of the baseline specification. Terms of trade growth seems less relevant as a driver of growth while the positive accession impact for the NMS during the 2000-04 and the post-2005 periods are still significant.

Finally, specification (6) repeats the specification in (5) but restricting the sample to transition economies. In spite of the limited number of observations, this check permits to obtain a further control for transition-related factors. Not surprisingly, the coefficient of initial per capita GDP is larger than in the full country sample, due to stronger catching-up effects in transition economies. However, the explanatory power of investment ratios is lower, a phenomenon common to previous studies, which reflects over-capitalisation of previously planned economies and capital scrapping during transition. Institutional quality appears to have played a more prominent role, highlighted by the significance of now two out of three institutional indexes, namely legal system quality and freedom of trade. Also the size of the coefficients is larger, pointing at stronger growth effects of good institutions in transition economies. The NMS dummies are not significant, except when interacted with the 1990-94 period. A possible interpretation of this result is that, during the reference period (1995-99), growth in the NMS was higher than in other transition economies at that time which may have been more affected by the Russian crisis of the late 1990s.[9] In the early 2000s, however, growth was strong in both

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[9]Indeed, actual growth rates of real per-capita GDP were larger in the NMS in 1995-99 than in the

country groups. For comparison, regression specification (7) employs the period 1990-94 as baseline, showing a large and significant positive coefficient of the NMS*(1995-94) interaction term. Compared to the transition recession period in the early 1990s, the NMS grew significantly faster in the late 1990s than the other transition countries. During the period of anticipated accession in the early 2000s, the NMS interaction term is borderline significant, indicating that growth in the NMS was stronger as compared to the other transition countries, relative to the early 1990s.

An important robustness issue in growth regressions pertains to the possible endogeneity of explanatory variables. Most notably the investment ratio is likely to be subject to endogeneity, given that investment not only favours growth but growth also tends to boost savings and thus investment, see e.g. Carroll and Weil (1994). One popular strategy to account for simultaneity of investment suggests using initial values of sub-periods, see Temple (1999). Alternatively, it has been suggested to use the relative price of investment goods as proxy and instrumental variables.[10] Table 2 presents specifications aimed at checking robustness of the baseline regression specifications (4) and (5) in Table 1 with respect to possible endogeneity of the investment variable.

[Table 2]

The first two columns of Table 2 use the initial sub-period values of the investment ratio rather than the average. Columns (3) and (4) replace the investment ratio by the relative price of investment as a proxy variable. The last two columns report instrumental variable regression results, using initial sub-period investment as well as the relative investment price to instrument the investment ratio. All three approaches yield very similar results and underscore the robustness of the estimates. The relative price of

other transition countries.

Average growth rates of real per-capita GDP, in %

	1990-94	1995-99	2000-04	post-2005
New member states	-3.4	3.6	4.9	2.7
Other transition economies	-4.5	2.5	7	5.5

[10] See Schadler et al. (2006). Sala-i-Martin et al. (2004) show that the relative price of investment is a more robust and less endogenous determinant of growth than the investment ratio.

investment delivers the expected negative, significant coefficents. Population growth and output loss turn significant in most specifications. The first-stage coefficients of the IV estimations are highly significant and the F test statistics are above the critical values, indicating no weak instrument problem. Table A.1 in the Annex reports further robustness results, using initial values in OLS and IV regressions also for the other explanatory variables (akin to Rousseau and Wachtel (2009)). The results are largely confirmed.

3.2.2 What did contribute to growth effects of EU accession?

To shed light on the channels through which the accession effect may have influenced economic growth, Table 3 presents regression results with interaction terms. The accession dummy, i.e. the dummy for the NMS during the period 2000-04, is interacted with three alternative variables for the full sample as well as the transition-country subsample.[11] For the full sample, the IV specification (5) of Table 2 is applied while, for the transition countries, the small number of observation restricts the method to OLS. Specification (1) tests the combined impact of initial per capita GDP and accession, finding a strongly significant and negative coefficient. The result is very similar when the post-1990 sample is applied, see specification (2). Hence, the catching-up effect is even stronger for the NMS during the accession period than otherwise. EU accession appears to have helped in speeding up the catching up process, possibly via technology transfer through increased trade and FDI inflows. Indeed, technological growth as reflected by total factor productivity has been shown to be a major driving force in the NMS (Cihák and Fonteyne (2009)). Increased labour mobility and migration may also have played a role in speeding up the convergence process, boosting capital-labour ratios and supporting aggregate demand through remittances (IMF (2008)).

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[11] Each of the three variables is standardised to mean zero and standard deviation of one before creating the interaction terms to facilitate the interpretation of coefficients.

[Table 3]

Specifications (3) and (4) interact the enlargment dummy with an institutional index, namely the quality of the legal system. Coefficinents for both samples indicate a significant negative impact of the interaction term, suggesting that a weaker legal system quality is associated with a larger growth gain of accession. A possible interpretation is that EU accession led to institutional catching up and then to increasing growth which is not captured by the Fraser indexes of institutional quality. The positive incentive effect of EU membership on institutional development has been demostrated empirically by Belke et al. (2009) and Di Tommaso et al. (2007).

Finally, the last two columns of Table 3 include the ratio of private credit to GDP as a measure of financial development and interact this variable with the accession dummy. The interaction coefficients turn out to be significant and negative in both samples, implying that a country with a low degree of financial development benefited more from EU accession in terms of economic growth.[12] In the NMS, financial sector development went hand in hand with overall economic transition and eventual EU accession. Initiated by extensive bank restructuring and privatisation as well as sizable FDI inflows, financial depth in the NMS increased markedly since the mid-1990s (European Commission (2009a)). Notably the Baltic countries as well as Bulgaria and Romania, having started with less advanced financial development and experienced boosting capital inflow and credit ratios thereafter, also exhibited the highest growth rates of real per-capita GDP during the EU accession period. Recent financial market turbulences have, however, revealed the substantial risks entailed in this development.

Financial development and advances in institutional quality have also been found to be intertwined. Kose et al. (2006) argue that the growth effects of financial development and integration are partly, if not mainly, influenced by institutional quality. In turn,

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[12]Employing the ratio of liquid liabilites (M3) to GDP as an alternative measure of financial development leads to very similar results. Rousseau and Wachtel (2009) examine the impact of financial development on growth in more depth.

financial liberalisation can impose discipline on macroeconomic policies and thereby lead to an improved institutional environment.

4 Conclusion

This paper investigates the growth performance of the NMS in the context of the EU accession boom. Based on a large cross-country dataset, panel regressions test for standard growth determinants as well as accession-related variables. The analysis finds that, on average, the accession period was characterised by an overall positive growth experience for the NMS, on top of the effects of other explanatory variables. Interestingly, this positive effect remains significant even after controlling for institutional factors that are possibly related to accession, such as freedom of trade and the quality of the legal and regulatory system. This suggests that TFP growth improvements associated with accession-related factors, like FDI and technology transfer, improved resource allocation and governance associated with financial integration, could have played a relevant role. Growth in the Baltic countries was particularly strong and exceeds model predictions for the early 2000s but falls short in the second half of the decade. The European Commission (2009b) as well as Lendvai and Roeger (2009) provide detailed analysis on the experience of the Baltics.

The regression results are robust to changes in the sample and estimation method. Restricting the sample to post-1990 observations delivers very simliar result. Comparing the NMS to the other transition countries in the sample indicates a positive, borderline-significant growth effect during the accession period for the NMS when the early 1990s are used as reference period.

To investigate potential channels of the growth impact of EU accession, various variables are interacted with the accession dummy. It is shown that countries with lower initial income levels, weaker institutional quality and less advanced financial development

benefited more strongly from EU accession in terms of economic growth. As expected, accession seems to have sped up the catching up process and improved the institutions in the laggards among the NMS. By triggering capital inflows, the prospect of EU accession is also likely to have improved economic growth for those NMS with lower degrees of finanical depth.

The present analysis is a first step to understand the mechanisms underlying the positive factors of economic growthe effects during the EU accession process. For future research it would be useful employing also micro-level evidence to further investigate the driving forces of accession-related growth effects in the NMS.

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Per-capita growth rates, 1996 - 2008

Graph 1: Baltics, Bulgaria, Romania
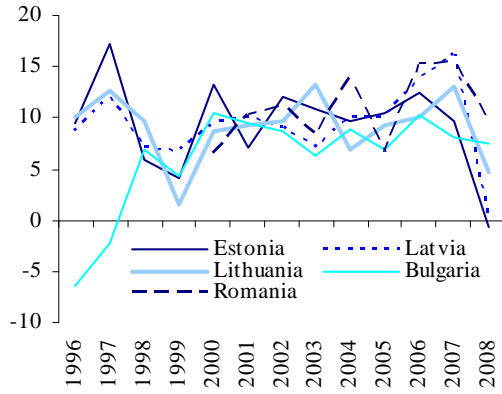
Graph 2: NMS-5
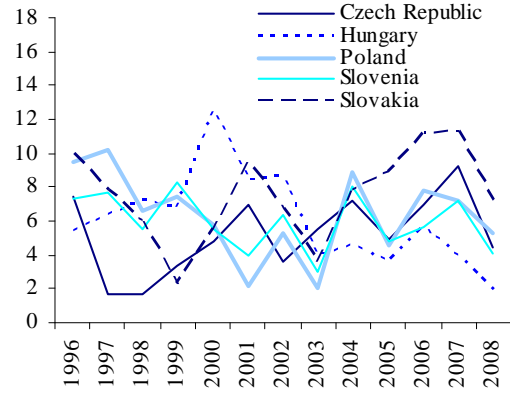
Note: Annual growth rates of per-capita GDP (PPP). Source: AMECO database.

Graph 3: Beta convergence
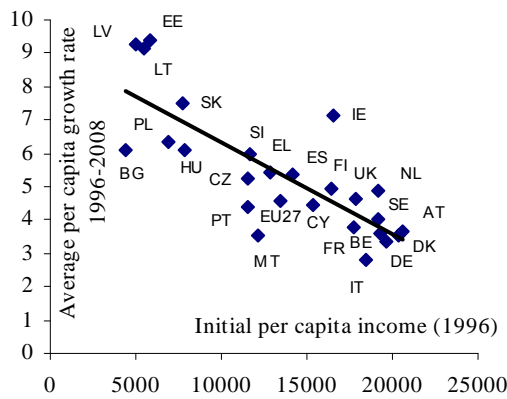
Graph 4: Sigma convergence
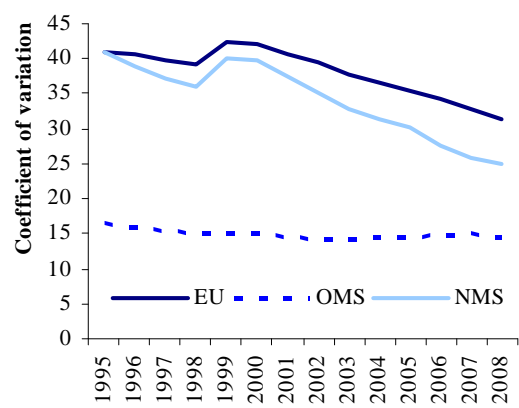
Note: Income levels and growth rates are based on real per-capita GDP in PPP terms. Source: Elaborations on the AMECO database.

Graph 5: Quality of the legal system
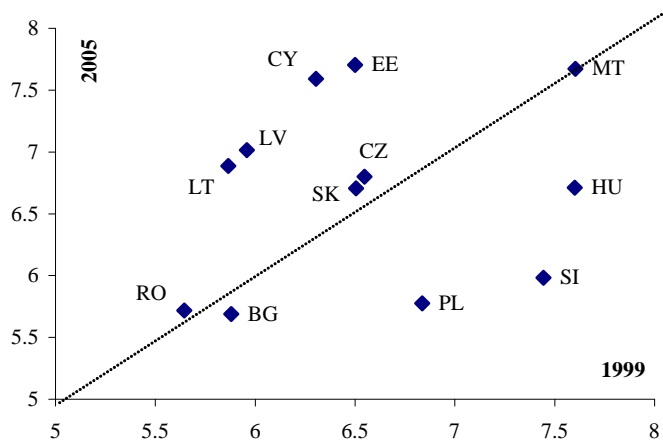
Note: Larger indices indicate higher quality of the legal system. Source: Fraser Institute.

Graph 6: Actual and predicted growth rates
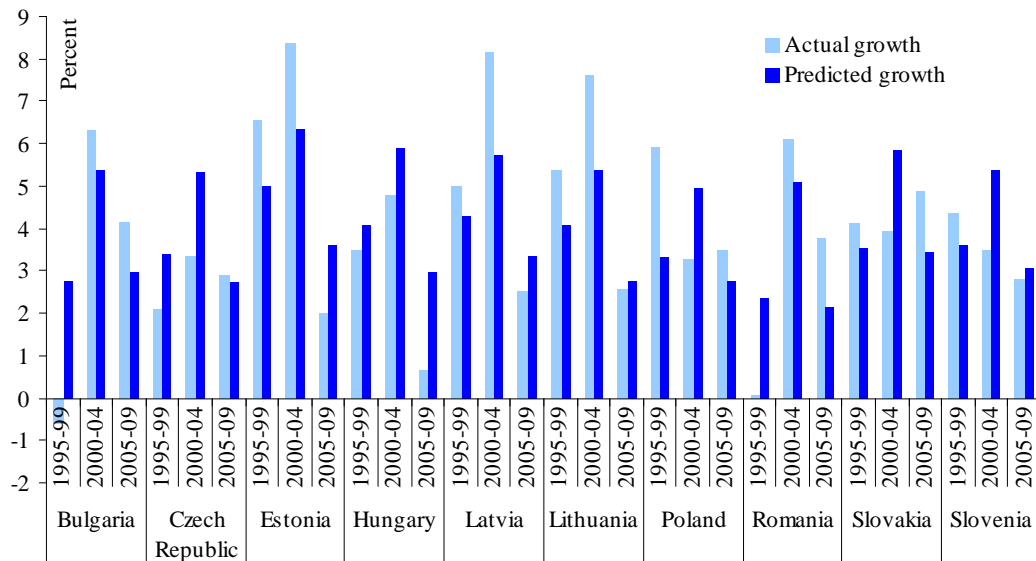
Notes: Actual average annual growth rates are compared to model predictions, based on the baseline regression specification (4) in table 1. Source: AMECO database. Figures for 2009 are based on forecasts.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full	Full	Full	Full	Post-1990	Transition	Transition
Log initial GDP per capita	-1.87***	-1.62***	-1.62***	-2.03***	-1.96***	-3.54***	-3.54***
	(-7.03)	(-8.43)	(-6.24)	(-6.92)	(-4.61)	(-3.13)	(-3.13)
Population growth	-0.22	-0.25*	0.029	-0.38*	-0.43	0.074	0.074
	(-1.44)	(-1.66)	(0.12)	(-1.65)	(-1.44)	(0.082)	(0.082)
Investment (in % of GDP)	0.15***	0.14***	0.13***	0.13***	0.10***	0.034	0.034
	(9.26)	(9.14)	(5.67)	(5.63)	(3.39)	(0.43)	(0.43)
Openness (in % of GDP)	0.0041**	0.0038*	0.010***	0.0073***	0.0056*	-0.025	-0.025
	(2.09)	(1.90)	(4.08)	(2.83)	(1.84)	(-1.08)	(-1.08)
Years of schooling	0.099*						
	(1.66)						
Terms of trade growth			5.26	6.41*	9.13	22.4	22.4
			(1.16)	(1.92)	(1.62)	(1.29)	(1.29)
Output loss				0.68	0.97	0.037	0.037
				(0.85)	(1.24)	(0.017)	(0.017)
Legal system quality index				0.12	0.26	1.21*	1.21*
				(1.07)	(1.44)	(1.88)	(1.88)
Freedom of trade index				0.23**	0.45**	1.77**	1.77**
				(2.19)	(2.41)	(2.32)	(2.32)
Regulation quality index				0.11	-0.13	0.16	0.16
				(0.56)	(-0.49)	(0.22)	(0.22)
NMS (dummy)			-0.54	-0.59	-0.65	-0.50	-5.41**
			(-0.63)	(-0.73)	(-0.72)	(-0.23)	(-2.40)
NMS during 1990-1994 (dummy)			-2.97**	-1.13	-0.88	-4.90**	
			(-2.27)	(-0.70)	(-0.50)	(-2.23)	
NMS during 1995-1999 (dummy)							4.90**
							(2.23)
NMS during 2000-2004 (dummy)			2.82***	2.65***	2.95***	-0.72	4.19
			(2.72)	(2.71)	(2.90)	(-0.34)	(1.60)
NMS after 2005 (dummy)			2.15**	1.78**	2.01**	-0.69	4.21
			(2.44)	(2.07)	(2.23)	(-0.34)	(1.50)
Observations	406	406	455	351	208	51	51
Adjusted R-squared	0.557	0.555	0.457	0.493	0.464	0.595	0.595

*Notes: Estimation method: OLS. t statistics are reported in parentheses. The panel structure employs non-overlapping five-year periods. *, **, *** denote statistical significance at 10, 5, and 1 per cent level, using robust standard errors. Column (1) displays standard textbook specification, column (2) repeats the same regression excluding the schooling variable but using the same sample as (1). All specifications include world region dummies, time period dummies (1995-1999 period omitted), and the interaction between the two set of dummies. World regions are defined as follows: OMS (omitted), NMS, non-EU OECD, non-EU non-OECD; in column (6), the reference group to the NMS dummy are the remaining transition economies. In column (7), the 1990-1994 period is omitted.*

Table 2: Addressing the possible endogeneity of the investment variable

	(1)	(2)	(3)	(4)	(5)	(6)
Maximum time period	Full	Post-1990	Full	Post-1990	Full	Post-1990
Estimation method	OLS	OLS	OLS	OLS	IV	IV
Log initial GDP per capita	-2.11***	-1.94***	-2.27***	-2.17***	-2.05***	-1.94***
	(-7.02)	(-4.51)	(-7.32)	(-4.80)	(-7.53)	(-4.88)
Population growth	-0.54**	-0.65**	-0.58**	-0.63**	-0.53**	-0.64**
	(-2.25)	(-2.11)	(-2.44)	(-2.11)	(-2.41)	(-2.23)
Initial investment (in % of GDP)	0.072***	0.044*				
	(3.66)	(1.74)				
Relative price of investment			-0.013***	-0.012**		
			(-3.27)	(-2.29)		
Investment (instrumented)					0.084***	0.051*
					(4.04)	(1.93)
Openness (in % of GDP)	0.0088***	0.0069**	0.011***	0.0090***	0.0085***	0.0069**
	(3.23)	(2.17)	(4.12)	(2.92)	(3.40)	(2.33)
Terms of trade growth	5.97*	7.53	5.27	9.47	5.53*	7.25
	(1.75)	(1.39)	(1.38)	(1.63)	(1.78)	(1.45)
Output loss	1.42*	1.80**	1.90**	1.95***	1.31*	1.72**
	(1.80)	(2.36)	(2.41)	(2.61)	(1.80)	(2.45)
Legal system quality index	0.18	0.33*	0.18	0.30	0.17	0.32*
	(1.44)	(1.80)	(1.35)	(1.55)	(1.49)	(1.90)
Freedom of trade index	0.22**	0.40**	0.13	0.31	0.20**	0.40**
	(1.99)	(2.19)	(1.15)	(1.65)	(2.02)	(2.37)
Regulation quality index	0.086	-0.18	0.072	-0.17	0.083	-0.17
	(0.43)	(-0.65)	(0.37)	(-0.67)	(0.45)	(-0.67)
NMS (dummy)	-0.93	-0.98	-0.87	-0.89	-0.93	-1.00
	(-1.06)	(-1.03)	(-1.05)	(-0.99)	(-1.18)	(-1.15)
NMS during 1990-1994 (dummy)	-0.59	-0.25	-1.27	-1.00	-0.51	-0.19
	(-0.31)	(-0.12)	(-0.75)	(-0.54)	(-0.29)	(-0.10)
NMS during 2000-2004 (dummy)	2.71***	3.04***	2.65***	2.94***	2.71***	3.03***
	(2.68)	(2.92)	(2.77)	(2.94)	(2.98)	(3.20)
NMS after 2005 (dummy)	1.72*	2.00**	1.85**	2.12**	1.92**	2.15**
	(1.87)	(2.09)	(2.09)	(2.31)	(2.29)	(2.44)
Observations	350	207	350	207	349	206
Adjusted R-squared	0.437	0.425	0.433	0.436	0.480	0.450
First-stage IV estimation						
Relative price of investment					-0.016***	-0.013***
					(-4.40)	(-2.68)
Initial investment (in % of GDP)					0.82***	0.84***
					(27.50)	(19.71)
Kleinbergen-Paap F statistic					661.38	357.62
Stock-Yogo 10% critical value					19.93	19.93

Notes: OLS (columns 1-4), IV (columns 5-6). See also notes to Table 1.

Table 3: IV regressions with interaction terms

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Full	Transition	Full	Transition	Full	Transition
Estimation method	IV	OLS	IV	OLS	IV	OLS
Log initial GDP per capita	-1.67***	-2.34**	-2.02***	-3.28***	-1.81***	-1.88
	(-7.18)	(-2.43)	(-7.38)	(-2.86)	(-6.57)	(-1.22)
Population growth	-0.47**	0.36	-0.51**	0.31	-0.37*	0.068
	(-2.12)	(0.40)	(-2.27)	(0.36)	(-1.85)	(0.052)
Investment (in % of GDP,	0.089***	0.076	0.086***	0.057	0.085***	0.094
instrumented in case of IV)	(4.23)	(0.95)	(4.09)	(0.70)	(4.15)	(0.93)
Openness (in % of GDP)	0.0083***	-0.023	0.0084***	-0.024	0.0090***	-0.0068
	(3.31)	(-1.11)	(3.36)	(-1.05)	(4.24)	(-0.27)
Terms of trade growth	5.43*	19.6	5.45*	19.8	8.80**	40.4**
	(1.75)	(1.14)	(1.76)	(1.12)	(2.37)	(2.41)
Output loss	1.30*	-0.63	1.31*	-0.50	0.46	0.48
	(1.80)	(-0.29)	(1.81)	(-0.22)	(0.47)	(0.12)
Private credit (in % of GDP)					-0.19*	1.02
					(-1.91)	(0.63)
Legal system quality index	0.18	1.51**	0.30	2.59**	0.18	0.61
	(1.56)	(2.46)	(1.54)	(2.32)	(1.58)	(0.91)
Freedom of trade index	0.22**	2.03***	0.21**	2.02**	0.17	1.46
	(2.15)	(2.78)	(2.08)	(2.68)	(1.57)	(1.53)
Regulation quality index	0.045	-0.28	0.073	-0.0084	0.025	-0.25
	(0.25)	(-0.38)	(0.39)	(-0.012)	(0.15)	(-0.46)
NMS (dummy)	-0.80	-1.27	-0.87	-1.19	-0.59	-0.94
	(-1.01)	(-0.59)	(-1.10)	(-0.55)	(-0.76)	(-0.48)
NMS during 1990-1994 (dummy)	-0.56	-4.65**	-0.53	-4.26**	0.14	
	(-0.33)	(-2.26)	(-0.31)	(-2.08)	(0.083)	
NMS during 2000-2004 (dummy)	2.78***	-0.72	2.16**	-1.75	-1.44	-4.04*
	(3.32)	(-0.35)	(2.18)	(-0.77)	(-1.63)	(-2.08)
NMS after 2005 (dummy)	1.94**	-0.45	1.92**	-0.57	1.31	1.08
	(2.31)	(-0.22)	(2.29)	(-0.28)	(1.50)	(0.67)
(NMS 2000-04)*(log initial GDP per capita)	-2.89***	-4.28**				
	(-4.00)	(-2.44)				
(NMS 2000-04)*(legal system quality)			-1.74*	-3.24*		
			(-1.71)	(-1.85)		
(NMS 2000-04)*(private credit ratio)					-5.72***	-7.76**
					(-6.14)	(-2.76)
Observations	349	51	349	51	320	37
Adjusted R-squared	0.488	0.632	0.481	0.608	0.478	0.614
First-stage IV estimation						
Relative price of investment	-0.02***		-0.02***		-0.02***	
	(-4.40)		(-4.39)		(-3.99)	
Initial investment (in % of GDP)	0.82***		0.82***		0.82***	
	(27.05)		(27.08)		(23.11)	
Kleinbergen-Paap F statistic	642.47		647.44		552.36	
Stock-Yogo 10% critical value	19.93		19.93		19.93	

Notes: OLS (columns 1, 3 and 5), IV (columns 2, 4 and 6). See also notes to tables 1 and 2.

Annex

Details on data sources and variable definitions

- Growth in real GDP per capita (%). Source: World Development Indicators.
- Initial real GDP per capita (PPP): value recorded in the first year of each five-year periods Source: Penn World Tables.
- Population growth (%). Source: Would Development Indicators
- Openness: sum of imports and exports on GDP (%). Source: Penn World Tables.
- Years of schooling: average years of schooling across whole population. Source: Barro and Lee.
- Terms of trade growth (%). Source: World Development Indicators.
- Quality of legal system: index computed by Fraser Institute summarising elements of legal system and property rights protection.
- Freedom of trade: index computed by Fraser Institute summarising information on tariff and non tariff barriers and capital movement controls.
- Quality of regulation: index computed by Fraser Institute summarising elements (including the extent of public versus private ownership) of regulations affecting labour, product, and financial markets.

Table A.1: Further robustness checks

	(1)	(2)	(3)	(4)
Estimation method	OLS	OLS	IV	IV
Log initial GDP per capita	-2.20***	-2.15***	-2.15***	-2.21***
	(-6.91)	(-4.78)	(-7.64)	(-5.64)
Population growth (initial values)	-0.38*	-0.46*		
	(-1.93)	(-1.82)		
Investment ratio (initial values)	0.087***	0.066**		
	(4.29)	(2.49)		
Openness ratio (initial values)	0.0083***	0.0065*		
	(2.98)	(1.96)		
Terms of trade growth (initial values)	3.96**	7.74***		
	(2.21)	(2.90)		
Output loss (initial values)	0.41	0.83		
	(0.44)	(0.98)		
Population growth			-0.42*	-0.52*
			(-1.79)	(-1.67)
Investment ratio			0.100***	0.073**
			(4.50)	(2.54)
Openness ratio			0.0087***	0.0073**
			(3.29)	(2.28)
Terms of trade growth			14.8**	22.1***
			(2.22)	(2.72)
Output loss			0.30	0.58
			(0.34)	(0.70)
Legal system quality index	0.19	0.39**	0.20*	0.37**
	(1.47)	(2.22)	(1.83)	(2.41)
Freedom of trade index	0.25**	0.45**	0.18*	0.46**
	(2.13)	(2.33)	(1.66)	(2.51)
Regulation quality index	0.034	-0.29	0.071	-0.26
	(0.16)	(-1.01)	(0.36)	(-0.97)
NMS (dummy)	-1.08	-1.16	-1.12	-1.33
	(-1.20)	(-1.21)	(-1.34)	(-1.44)
NMS during 1990-1994 (dummy)	1.07	1.66	1.08	1.86
	(0.49)	(0.69)	(0.51)	(0.79)
NMS during 2000-2004 (dummy)	3.02***	3.34***	2.88***	3.20***
	(2.87)	(3.10)	(3.03)	(3.23)
NMS after 2005 (dummy)	2.15**	2.53**	2.24**	2.54***
	(2.27)	(2.58)	(2.56)	(2.75)
Maximum time period	1960-2009	1990-2009	1960-2009	1990-2009
Observations	340	200	341	201
Adjusted R-squared	0.446	0.448	0.474	0.436
First-stage IV estimation				
Relative price of investment			-0.02***	-0.01**
			(-4.32)	(-2.33)
Investment ratio (initial values)			0.83***	0.86***
			(28.47)	(21.07)
Openness ratio (initial values)			0.99***	0.99***
			(78.55)	(65.79)
Terms of trade growth (initial values)			0.27***	0.34***
			(6.93)	(6.90)
Output loss (initial values)			1.07***	1.06***
			(25.10)	(24.29)
Kleinbergen-Paap F statistic			9.94	9.93

Notes: OLS (columns 1-2), IV (columns 3-4). See also notes to table 2.