NBP Narodowy Bank Polski

NBP Working Paper No. 264

Is Central and Eastern Europe converging towards the EU-15?

Marcin Grela, Aleksandra Majchrowska, Tomasz Michałek, Jakub Mućk, Agnieszka Stążka-Gawrysiak, Grzegorz Tchorek, Marcin Wagner

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Economic Research Department
Warsaw, 2017

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We would like to thank Ryszard Kokoszczyński and Andrzej Sławiński for their valuable feedback on earlier versions of this paper.

Published by:
Narodowy Bank Polski
Education & Publishing Department
ul. Świętokrzyska 11/21
00-919 Warszawa, Poland
www.nbp.pl

ISSN 2084-624X

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List of abbreviations

2SLS – two-stage least squares

CEE – Central and Eastern European; or the CEE-6 countries

CEE-6 – Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia

EC – European Communities

EME – emerging market economy

EU – European Union

EU-14 – EU-15 except Luxembourg

EU-15 – member states of the EU as of 2003 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, United Kingdom)

EU-26 – EU except Croatia and Luxembourg

EU-28 – member states of the EU as of 2016 (Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom)

EUR – euro

FDI – foreign direct investment

FE – fixed effects

G2SLS – generalised two-stage least squares

GDP – gross domestic product

GLS – generalised least squares

GMM – general method of moments

GVC – global value chain

MI – middle-income

NBP – Narodowy Bank Polski

NMS – new member states of the EU, i.e. those member states that joined the EU from 2004 onwards (i.e. Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia)

OECD – Organisation for Economic Co-operation and Development

OLS – ordinary least squares

PPS – purchasing power standard

R&D – research and development

TFP - total factor productivity

USD – United States dollar

Abstract

This paper is about the real convergence of six Central and Eastern European economies – Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia – towards the more advanced EU-15 economies. Our major goal is to analyse empirically which factors have driven growth and convergence in the region in the last two decades. The results of our analysis based on a panel of 26 EU countries in 1997–2014 suggest that the real convergence was driven by both traditional (core) and 'new growth theory' growth factors (among other things, by innovation activity and trade). We demonstrate that the post-transition growth model prevailing in the CEE region, based on a large inflow of foreign capital (mainly in the form of FDI) has reached its limits. The CEE countries' growth and convergence will now be driven mainly by factors affecting structural competitiveness, especially innovation activity, institutional environment and policies (or lack thereof) targeted at diminishing the influence of demographic developments on the labour market outcomes.

JEL classification: F43, O47, O43, O11

Keywords: real convergence, growth, Central and Eastern Europe, EU, panel data analysis

Non-technical summary

This paper is about the real convergence of six Central and Eastern European (CEE) countries towards the 'old' EU member states. Our major goal is to analyse empirically, by means of a panel data analysis, which factors have driven growth and convergence in the region in the last two decades. By the 'old' EU we mean the EU-15, i.e. the countries that became the EU members before 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

We understand 'CEE economies' as the CEE-6 economies, i.e. Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia. We focus on these countries due to their common past, including the path of economic transition and integration with the EU, not-so-small size (contrasting with the size of the Baltic States), geographic location in Central and Eastern Europe and the related strong economic ties to the core EU countries, common growth model and several other characteristics which, in our view, make them similar in terms of expected growth and convergence paths. In terms of economic jargon, we choose those six countries as our focus group because there are grounds to believe that their economies have a common long-term steady state to which they converge. The analysis generally covers the time period from 1997 on, with some exceptions. The cut-off date for statistical data and information presented in this paper is 30th June, 2016.

This paper is structured as follows. After a brief introduction (chapter 1), we present an overview of the relevant theoretical issues: the basic concepts related to growth and convergence, the models of economic growth prevailing in the theoretical literature and the factors which affect growth (chapter 2). In chapter 3, we look at the CEE economies from bird's eye view, underlining their common and individual features and analysing their growth model in the last two decades. Then we scrutinise the stylised facts on growth and convergence in the CEE region (chapter 4) and we review the relevant empirical literature (chapter 5). In chapter 6, we report the results of our empirical analysis based on data for 26 EU member states in 1997–2014. Below we summarise our results and conclusions.

Despite some differences, the CEE economies have shared a broadly similar growth model based on foreign capital inflows, mainly in the form of FDI. In the initial period of transition, foreign direct investment dominated the foreign capital inflows and had a very large scape. Favourable conditions offered by those countries to foreign investors, the geographical proximity of Western European economies as well as political and economic integration with the EU were the key factors behind these inflows. FDI positively affected domestic investment, contributing to closing the gap between the CEE countries' saving and investment rates. It also played a crucial role in shaping the structures of the CEE economies, strengthening the role of the manufacturing sector. Moreover, enhanced cooperation within the GVCs increased the CEE countries' trade openness and contributed to a more significant role of those economies in the EU trade.

Over time, a simultaneous large inflow of foreign capital via the expanding banking sector has made the CEE economies vulnerable to external shocks. The financial sector in the CEE region has been developing very fast in the last two decades, helping to spur domestic demand. At the same time, strong dependence on foreign capital and the accumulation of domestic and external imbalances made the CEE region more vulnerable to external shocks. The CEE countries (except for Poland) were among those economies which were the most severely hit by the global financial crisis. Persistently low activity in Western Europe since 2008 led to a sharp drop in FDI in-flows and translated into a significant slowdown in exports growth.

During the last two decades, GDP in the CEE region grew on average more than twice as fast as in the EU-15. Growth patterns seem to be mixed: though GDP growth rates of individual countries were generally high, their volatility differed substantially. Strong growth in economic activity translated into substantial increases of GDP per capita, leading the CEE region to rank among the best performing regions worldwide. The general pattern of convergence in the analysed period has been changing over time and has differed across countries. The process included a moderate catching up from 1997 to 1999, an expansion during which most of the convergence took place (from 2000 to 2008) and a slowdown in the convergence process

that has lasted until now. The general rule that countries starting from a lower level of development tend to con-verge faster seems to be confirmed for the CEE countries (except for Bulgaria), in line with neoclassical theory.

Despite different methods used and different time periods analysed, most of the abundant empirical literature confirms real (beta and sigma) convergence of the CEE countries towards Western Europe. The estimates of speed of convergence vary strongly across papers due to different periods analysed, methods applied and the set of control variables used in the conditional convergence equation. Moreover, research generally confirms that the speed of convergence in CEE was not constant in the analysed period, in line with the stylised facts described in the previous paragraph. From the supply-side perspective, the CEE countries have mostly benefitted from capital accumulation, but also from an increase in the technical efficiency of production. Since the outburst of the global financial crisis, the speed of real convergence has been hindered due to slower capital accumulation as well as lower TFP gains

Our empirical analysis showed that the real convergence within the EU-26 group of countries in 1997–2014 was driven by both traditional (core) and 'new growth theory' growth factors (among other things, by innovation activity and trade). We demonstrated that the relatively fast convergence of CEE countries observed in the initial years of our sample period was interrupted by the global crisis in 2008. Since then, convergence has been slower. Importantly, we could only confirm convergence among the new member states of the EU but not for the 'old' member states. In the latter case, we observed a certain degree of divergence of real per capita incomes in the recent years. As regards the growth factors other than the traditional ones, variables related to the human capital and the high technology sector not only proved to be significantly related with GDP per capita growth, but their importance was increasing over time. The strength of the positive relation between the scale of international trade and GDP per capita growth was also on the increase, whereas that of the relation between FDI and growth was decreasing.

Overall, we believe – and demonstrate – that the post-transition growth model has reached its limits and that further convergence of the CEE region to the more advanced EU economies cannot be achieved by simply replicating past efforts. As discussed in chapters 3 to 5 of this paper, before the financial crisis the convergence of the CEE economies was mainly driven by strong capital inflow facilitated by market reforms implemented at the beginning of the 1990s and accession of CEE countries to the European Union. The results of our empirical analysis presented in chapter 6 seem to confirm our intuition that this growth model has come to an end around the time of the global crisis. The CEE countries' growth and convergence will now be driven mainly by factors affecting structural competitiveness, especially innovation activity, institutional environment and policies (or lack thereof) targeted at diminishing the influence of demographic developments on the labour market outcomes.

The main thesis of this paper are confirmed by the existing analytical work on the Polish economy performed in the National Bank of Poland. Strong growth in the last two decades was based on the accumulation of capital, the inflow of new technologies from abroad and substantial progress in raising the level of education of Polish society. These factors contributed significantly to mitigate the effects of the global financial crisis on the Polish economy. However, the potential for further growth has gradually diminished since it will not be possible to maintain such a strong growth in physical and human capital. In case of Poland it is crucial to seek for sustainable growth in total factor productivity, which can be done by developing the innovative potential of the domestic economy and by making use of global diffusion of foreign technology. A policy in the direction of increasing savings in the Polish economy can be also the answer to dwindling resources of the domestic capital.

1. Introduction

The Central and Eastern European (CEE) region has made a remarkable progress in terms of economic development and convergence in the last 25 years. The convergence process of the CEE economies was mainly driven by strong capital inflow facilitated by market reforms implemented at the beginning of the 1990s and accession of the CEE countries to the European Union (EU). The goal of this paper is to analyse empirically which factors have driven the real convergence of the CEE economies towards the 'old' EU. By the 'old' EU we mean the EU-15, i.e. the countries that became the EU members before 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

We understand 'CEE economies' as the CEE-6 economies, i.e. Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia. Alternatively, we could (i) exclude Bulgaria and Romania as relative newcomers to the EU and the poorest EU member states or (ii) exclude the Czech Republic as the initially, by a wide margin, most developed country in the region or (iii) exclude Slovakia as the only euro area member state in the group, (iv) include the Baltic states and/or Croatia and Slovenia as other new EU member states and former centrally planned economies. Instead, we focus on the six aforementioned countries due to their common past, including the path of economic transition and integration with the EU, not-so-small size (contrasting with the size of the Baltic States), geographic location in Central and Eastern Europe and the related strong economic ties to the core EU countries, common growth model and several other characteristics which, in our view, make them similar in terms of expected growth and convergence paths. In terms of economic jargon, we choose those six countries as our focus group because there are grounds to believe that their economies have a common long-term steady state to which they converge.

The analysis generally covers the time period from 1997 on, with some exceptions. We have chosen the year 1997 as our starting point for three main reasons. Firstly, by that point in time all the countries under study had already undergone the biggest structural changes related to the transition from centrally planned to market economies. Secondly, by 1997 the transition

recession and the subsequent recovery were over in all the CEE countries under study and so the real convergence process had been set in motion. Thirdly, many relevant data are unavailable and/or unreliable for the previous years. Indeed, in some cases data availability limits our analysis to a time frame starting only after 1997. The cut-off date for statistical data and information presented in this paper is 30th June, 2016.

It is worth underlining that this paper focuses on selected issues related to its subject while missing out on others. The issues *not* covered by the paper include: cyclical convergence, nominal convergence, or the ability of the CEE economies to function smoothly within the euro area. Moreover, we abstain from formulating policy recommendations on a country level. Cyclical and nominal convergence constitute possible avenues of our future research. The question of whether a given country is ready to adopt the euro was, in many cases, analysed by detailed reports prepared by teams of central bank analysts.[1]

This paper is structured as follows. We start with an overview of the relevant theoretical issues: the basic concepts related to growth and convergence, the models of economic growth prevailing in the theoretical literature and the factors which affect growth (chapter 2). In chapter 3, we look at the CEE economies from bird's eye view, underlining their common and individual features and analysing their growth model in the last two decades. Then we scrutinise the stylised facts on growth and convergence in the CEE region (chapter 4) and we review the relevant empirical literature (chapter 5). In chapter 6, we report the results of our empirical analysis based on data for 26 EU member states in 1997–2014. Finally, in chapter 7 we summarise our results and draw conclusions.

[1] See Czech MF and CNB (2014) and CNB (2014) for the case of the Czech Republic, MNB (2011) for the case of Hungary, NBP (2014) for the case of Poland, or NBS (2006) for the case of Slovakia (which, as the only country in the analysed group, adopted the euro in 2009).

2. Growth and convergence: theoretical underpinnings

2.1. Concepts and definitions

The concept of real convergence is related to differences in economic growth across countries. Islam (2003) refers to seven different classifications of convergence types: (i) convergence within vs. between countries, (ii) convergence in terms of income growth rates vs. levels, (iii) beta vs. sigma convergence, (iv) absolute vs. conditional convergence, (v) income vs. total factor productivity convergence, (vi) global vs. club convergence, and (vii) deterministic vs. stochastic convergence. In this paper, we focus on concepts (iii) and (iv).

The distinction between beta vs. sigma convergence across countries has to do with catching up vs. reduction in disparity. Beta convergence implies that economies with a lower level of development tend to grow faster than those with a higher development level so that the former show a tendency to catch up with the latter. Sigma convergence means a reduction in disparity in terms of development level across economies. In general, beta convergence generates sigma convergence, though disturbances pushing countries away from their growth paths may stop sigma convergence from manifesting itself even in the presence of beta convergence (Barro and Sala-i-Martin, 2004, p. 462). Beta convergence is the necessary condition of sigma convergence: it is not possible for two economies to become more similar in terms of per capita GDP without the poorer one growing faster than the richer one. However, beta convergence is not a sufficient condition of sigma convergence. Two economies can become less similar in terms of per capita income (sigma divergence) while the initially poorer economy grows faster than the richer one (beta convergence). This happens when the initially poorer economy overtakes the richer one in terms of per capita income and continues to grow faster (Sala-i-Martin, 1996).

The distinction between absolute and conditional (beta) convergence has to do with the steady state, i.e. the economy-specific state of equilibrium. Absolute beta convergence applies when countries with a lower level of economic development tend to grow faster than more developed economies. Conditional beta convergence, in turn, applies when the growth rate of an economy is positively related to the distance of that economy's current development level from its own steady state. Two economies may show conditional convergence (i.e. they

grow at a slower rate as they approach their own steady states) but no absolute convergence (i.e. the richer economy grows faster) when the richer economy is further below its steady state level of development than the poorer one. Both concepts of convergence are identical when the economies have identical steady states (Barro and Sala-i-Martin, 2004, p. 461).

Beta convergence can be verified empirically by estimating a panel (or cross-sectional) regression which explains the average growth rate of income per capita with its one-period-lagged (or initial) level. The panel approach, which we employ in our empirical analysis in chapter 6, boils down to estimating the following equation:

$$\frac{1}{T}\ln\frac{y_{i,t}}{y_{i,t-1}} = \alpha_0 + \alpha_1 \ln y_{i,t-1} + \sum_{j=2}^{k} \alpha_{ij} x_{ij-1,t} + \varepsilon_{it}, \tag{2.1}$$

where $t = 1, \dots, T$ is the time index, i is the index referring to individual countries (cross-sectional dimension), y_{it} is income per capita of the i-th economy (with $i = 2, \dots, n$) in period t, $x_{ij,t}$ stands for the values of explanatory variables other than the initial income level (with $j = 2, \dots, k$) in period t, ε_{it} is a random noise disturbance, and $\alpha_0, \alpha_1, \dots, \alpha_k$ are regression parameters. Alternatively, one can estimate the following cross-sectional equation in which the time dimension of the variables is missing and the lagged income per capita has been replaced by the initial income level, y_{i0}:

$$\frac{1}{T}\ln\frac{y_{iT}}{y_{i0}} = \alpha_0 + \alpha_1 \ln y_{i0} + \sum_{j=2}^{k} \alpha_{ij} x_{ij-1} + \varepsilon_i. \tag{2.2}$$

Equations 2.1 and 2.2. in their general form can be employed to verify conditional convergence. When the variables $x_{ij,t}$ are dropped, the equations serve to verify absolute convergence. Convergence is confirmed if the parameter α_1 is statistically significant and negative.

The speed of beta convergence, β, indicating how rapidly an economy's output per capita approaches its steady-state value, can be calculated as:

$$\beta = -\frac{1}{T}\ln(1 - \alpha_1 T). \tag{2.3}$$

E.g. if $\beta = 0.02$, it means that 2% of the gap between the actual GDP per capita and its steady-state value vanishes in one year. The half-life of convergence, i.e. the time that it takes for half of the initial gap to be eliminated, is thus ca. 35 years (Barro and Sala-i-Martin, 1994).

Sigma convergence, in turn, can be tested empirically based on various measures of income dispersion. Those measures include the variance, the standard deviation and the variation coefficient of income per capita. Convergence is confirmed when the dispersion of income per capita across countries declines over time as shown, e.g., by a declining trend of the time-varying variation coefficient or a declining rolling window standard deviation.

Among the various indicators which can proxy the level of economic development, GDP per capita is the preferred measure in this paper. We choose this indicator because, firstly, GDP is the most commonly used measure of an economy's output or income. Secondly, using the population number in the denominator ('per capita' is synonymous to 'per head') is justified by our focus on convergence in terms of living standards rather than labour productivity. Otherwise we would have chosen a measure of income per worker, income per hour worked or perhaps income per working age population (though this last measure is seldom used; see e.g. Pop Silaghi et al., 2014).

2.2. Theoretical models of economic growth

This section briefly reviews selected theoretical models of economic growth, placing them in the context of convergence. The theory of economic growth is a vast subject and we have no ambition of providing an exhaustive overview of the various models put forward by the literature.[2] Rather, our goal is to explain how the convergence process fits in the models.

Chronologically, Ramsey's (1928) paper was the starting point for modern theory of economic growth. In his article, which was widely recognised by the economic profession only over three decades later, Ramsey analysed household optimisation decisions in an inter-temporal setting. His optimality conditions laid the foundations not only for growth theory but also for consumption theory or asset pricing. Harrod (1939) and Domar (1946) are two other early contributions which tried to fit elements of economic growth into the Keynesian framework. By contrast to the Ramsey model, their thinking enjoyed a positive reception among the contemporaries but plays hardly any role in today's economic theory.

[2] For an in-depth presentation of economic growth theory see e.g. Barro and Sala-i-Martin (2004). This section heavily draws on section 1.4 of their book. For a clear and simple exposition, see e.g. Próchniak (2010).

The next important contributions were those of Solow (1956) and Swan (1956), putting forward very simple general-equilibrium models of the economy. The models are characterised by a neoclassical production function of the Cobb-Douglas form, with constant returns to scale, diminishing returns to both production inputs – labour and capital – as well as a positive elasticity of substitution between those inputs. The model implies that changes in output (income) per capita or per worker[3] depend on changes in capital stock (resulting both from investment and capital depreciation), changes in population, and the income share of capital:

$$\ln y = \ln y^* + [\ln y(0) - \ln y^*]e^{-(1-\alpha)(n+\delta)t}. \quad (2.4)$$

In the above equation, written for the continuous time version of the model, y is the current level of income, y^* is the steady-state income, $y(0)$ is the initial level of income, α is the capital share, n is the growth rate of population, δ is the rate of capital depreciation, and t is the time index. It is worth noting that all the sources of income growth in the Solow-Swan model are exogenously given (see below).[4]

The Solow-Swan model predicts conditional convergence but not necessarily absolute convergence. Conditional convergence, i.e. the fact that a low (compared to the steady state) initial output per capita corresponds to a high growth rate, is a property of the model resulting from diminishing returns to capital. Economies with low output per capita are those with a low level of capital per capita and, all else equal, the marginal return to capital is high when the capital stock is low, in line with the law of diminishing returns. Absolute convergence does not necessarily follow from the model's assumptions because different economies may have different long-term equilibrium positions. Those positions depend on the economies' characteristics determining the steady state level of output per worker, i.e. the saving rate, the population growth rate, and the elasticity of substitution between labour and capital (and thus the

[3] In the Solow-Swan model, due to its simplicity, output and income on the one hand and population and labour force on the other hand are synonymous.

[4] Mankiw et al. (1992) extended the Solow-Swan model to include human capital apart from physical capital so that the growth rate of human capital, *h*, also determines the current level of income. In equation 2.4, *h* is then added to the growth rate of population and the depreciation rate of human capital in the last pair of brackets on the right.

shape of the production function). In terms of equation 2.4 above, differentiating both sides with respect to time yields:

$$\frac{\dot{y}}{y} = \beta(\ln y^* - \ln y), \tag{2.5}$$

where a dot over a variable denotes the first derivative of that variable with respect to time and β is a parameter reflecting the speed of convergence, defined as[5]:

$$\beta \equiv (1-\alpha)(n+\delta) > 0. \tag{2.6}$$

Even though the neoclassical Solow-Swan model offers a simple explanation for convergence, it fails to account for long-term equilibrium growth. In line with the model, as the economy reaches the steady state, it ceases to grow. This prediction contradicts with the empirical observation that most countries continue to grow for many decades, i.e. never seem to reach the steady state. Moreover, the model fails to explain the empirically observed large disparities of per capita income across countries.

This failure of the Solow-Swan framework led economists in the late 1950s and the 1960s to complement it with technological progress and/or endogenously determined saving rate, yielding models accounting for non-zero growth in the steady state. The endogenously determined saving rate was proposed by Cass (1965) and Koopmans (1965) who drew on the consumer optimisation approach put forward by Ramsey (1928). Their work completed the basic neoclassical growth model. A common shortcoming of all the aforementioned models is the fact that the rate of technological progress is exogenously given. As a result, they fail to explain a major driving force of long-term growth. A problem with incorporating endogenous technological progress into the neoclassical framework was that it is incompatible with that framework's assumptions of perfect competition and constant returns to scale. Specifically, new ideas contributing to technological progress should have increasing rather than constant returns to scale and result in a competitive advantage of some firms over others.

[5] For the Mankiw et al. (1992) version of the model (see footnote 4), the growth rate of human capital, a, is included with a positive sign in the second pair of brackets on the right.

After the mid-1980s, the mainstream research turned away from the neoclassical Solow-Swan framework towards endogenous growth models. Between late 1960s and the mid-1980s, due to the global macroeconomic turbulences of the 1970s, economists were more interested in analysing business cycle fluctuations than long-term growth. The seminal works of Romer (1986), Lucas (1988) and Rebelo (1991) put the determinants of long-term growth, which are exogenously given in the neoclassical setting, in the centre, making them determined within the model, i.e. endogenously.

Endogenous growth models abstract from the assumption of diminishing returns to capital and allow for scenarios where divergence persists. Growth in these models can be sustained almost indefinitely through accumulation of human capital and knowledge generation following investments in research and development (R&D) or learning by doing (Romer, 1987, 1990; Aghion and Howitt, 1992; Grossman and Helpman, 1991). This is because the returns to human capital (and possibly some other forms of capital) do not necessarily diminish as the capital stock increases. Thus, a prediction from those models is that poor countries with a low and slowly expanding stock of human capital may actually diverge, not converge towards more advanced, knowledge-based economies. Endogenous models proved to be inconsistent with empirical evidence. Jones (1995) showed that the increase in employment in R&D in the United States was not accompanied by increase in long-term growth rate. Second-generation endogenous growth models, such as semi-endogenous growth theories, which relax the assumption of constant returns to knowledge, have been used to try to resolve the empirical problems. However, the results show that Schumpeterian growth models are more consistent with the time-series evidence than the semi-endogenous growth theories (Madsen, 2008; Ha and Howitt, 2007).

Relaxing the neoclassical assumption of perfect competition makes the government sector in the endogenous growth models play a role in sustaining long-term growth. Imperfect competition leads to market distortions as well as non-Pareto optimal growth rates and the amount of inventive activity. In such an environment, there is a role for government activity, including taxation, provision of infrastructure, intellectual rights protection, regulations concerning foreign trade, etc.

2.3. Factors affecting economic growth

Economic sciences lack a uniform theory which identifies growth factors within a coherent framework. When trying to pin down the determinants of economic growth, one has to refer to various growth models or theories as well as different complementary economic and non-economic approaches. Neoclassical models stress the crucial role of labour supply and investment in physical capital (Solow, 1956). Endogenous growth models, in turn, pay more attention to investment in human capital, knowledge accumulation and innovations as self-reinforcing factors of growth. It is worth noting that skills – by contrast to the basic production factors, i.e. labour and capital – are not subdued to the law of diminishing returns (Romer, 1986).

Economic growth factors can be identified not only based on explicit growth theories, but also using different partial economic and non-economic theories describing various social and economic processes. Thus, economic growth factors are not only of strictly economic nature. Below we shortly characterise the main economic growth factors which are rooted in growth theories as well as those reflecting many theoretical approaches which are not formally included in models of economic growth but contribute to explaining this phenomenon.

Population growth, its age structure and migrations play a major role in economic growth because they influence both the supply of labour force and human capital quality (Barro and Sala-i-Martin, 2004). Labour supply is the basic production factor in the neoclassical framework, whereas human capital quality is an important production factor in endogenous growth models. Moreover, demography also affects other economic and non-economic determinants of growth, including the saving and investment behaviour, socio-cultural dimension, institutional framework, etc.

Investment, which leads to the expansion of capital stock, is another basic growth engine in both neoclassical and endogenous growth models. In the neoclassical framework, investment simply adds to the existing physical capital stock, while in endogenous growth models,

it additionally enables knowledge and technology accumulation. Investment behaviour is explained by a separate part of economic theory which stresses the role of saving behaviour, productivity of capital, cost of capital, capacity utilisation, public policy, etc.

Savings, both domestic and foreign, are an important driver of investment and economic growth. Domestic savings generated by an economy are driven by its level of development, productivity, demographic trends, efficiency of the financial system, etc. From the theoretical point of view, explanation of savings determinants began with the household life-cycle hypothesis (Modigliani, 1986) and the permanent income hypothesis (Friedman, 1957). Insufficient domestic savings can be complemented by capital imported from abroad. Capital inflows are the subject of interest of the balance of payments theory (Blanchard and Giavazzi, 2002) and the international portfolio theory (Grubel, 1968).

The significance of FDI as a growth factor is justified by the neoclassical as well as endogenous growth theories. In the former type of models, FDI provides a higher capital stock per worker, leading to higher per capita output. In the latter type of models, depending on absorptive capacity of the domestic economy, FDI should additionally ensure knowledge and technology transfer, which is emphasised by new growth theories (Gammeltoft and Kokko, 2013).

Technological progress constitutes another important long-term growth determinant, conditioned by knowledge accumulation and the quality of human capital. Sustainable effects of technological progress for the economic growth follow from unlimited non-rivalrous knowledge accumulation embodied in human and physical capital (Casey and Sala-i-Martin, 1995). Human capital is a separate production factor and, according to endogenous growth models, the main source of economic development. It is measured by the level of know-how, skills, education and training. The main attribute of human capital is that it influences the productivity of physical capital and accumulates knowledge and skills (Barro and Sala-i-Martin, 2004). Another growth factor and carrier of knowledge is R&D activity, which increases the use of technology, thus enabling quality and productivity growth as well as the introduc-

tion of new products and processes. R&D activity both spurs innovation processes and is reinforced by them, and it also contributes to structural international competitiveness of an economy (see below), thus fuelling sustainable productivity growth.

Financial markets and the financial system in general play an important role in the process of savings accumulation, transformation into capital, allocation in investment, risk management and corporate governance. A more developed and deeper financial system should fulfil its functions better thanks to more efficient information and higher liquidity (Levine, 1997). Literature concerning the relationship between financial markets and economic growth underlines the importance of other factors modulating the influence of financial development: financing structure (i.e. the role of banking credit versus market financing), human capital, institutional environment, etc. The latest analyses point to a non-linear influence of financial market development on economic growth: at low levels of development, financial deepening contributes positively to economic growth, though at a decreasing pace, and at a certain level further development of the financial system weakens economic growth (Sahay et al., 2015).

Institutional framework is recognised as an important structural prerequisite of economic development which also influences many other growth factors. Institutional economics understands institutions as rules of the game that set limits to human behaviour (North, 1990). The key institutional regulations relate to property rights, corruption, principles of macroeconomic stabilisation policies, or conflict management. They may have an impact on economic growth through their effects on the level of competition, a country's attractiveness for foreign capital, investment, human capital, financial markets sophistication, etc. Inefficient institutions and regulations may lead to inadequate allocation of factors of production, the lack of competition, low productivity and low level of human and social capital (Wölfl et al., 2010). Easterly (2001) argues that the traditional growth factors would hardly have any influence on economic growth if there was no stable institutional environment developed in the first place.

International competitiveness also contributes to expanding the real income as some of its determinants are also important drivers of economic growth (Hämäläinen, 2003). This is be-

cause these determinants – including technological advancement, human capital, or the institutional environment – generally raise productivity, whether in tradable or non-tradable sectors. Exchange rate movements and cost and price trends also affect the international competitiveness of an economy, though their contribution to economic growth is rather indirect, through increased export performance.

In a similar vein, the economy's external openness is seen as another determinant of growth performance. Generally, an increase in openness, i.e. in the degree of outward mobility of production factors and in the role of trade in GDP, should lead to a better allocation of resources. Trade openness contributes to economic performance through rising specialisation and comparative advantage, technology transfer and diffusion of knowledge, increasing the economies of scale and the exposure of domestic enterprises to competition (di Giovanni and Levchenko, 2009).

Apart from the economic approach based on neoclassical and endogenous growth theories, important contributions to the economic growth theory stem from the new economic geography rooted in the location theory and regional growth theories (Capello, 2011). Together with institutional economics, these theories emphasise the role of non-economic factors such as institutions, legal and political systems, the socio-cultural dimension (see below), demography and geography. Geography may affect growth as it determines natural resource endowment, location attractiveness and ability to trade internationally. The geographical location of a country not only determines an economy's access to natural resources, but also its climate, topography and 'landlockedness' understood as access to transit corridors (Raballand, 2003).

Moreover, international business and FDI theories underline the role of a firm's assets quality, the organisational and strategic skills of workers leading to the firm's expansion and its international competitiveness. Competitiveness factors at the companies' level and the local business environment offer complementary explanations for traditional trade theories. Both international business and trade theories examine individual motives of multinational corpo-

rations' internationalisation within GVCs as well as the role of networks and accumulated intangible assets (Baldwin, 2012). In this context, theories and models related to FDI seek to explain the accumulation of knowledge and its spillover effects to the local environment.

Finally, socio-cultural factors may also affect growth through their impact on consumption, savings, investment, expectations, and short- or long-term economic decisions. The main factor in this context is the cultural dimension which is defined as the sum of symbols, meanings, habits, values, institutions, behaviours and social artefacts characterising specific population groups (Sala-i-Martin, 1996). Socio-cultural factors are related to religion, tradition, socio-political dependencies or social/ethnic conflicts and shape the social capital of a given country. Social factors also affect the political regime, the degree of democracy and political (in)stability which, in turn, can influence uncertainty, investment and economic growth. One of the main features of a high social capital is trust. Trusting societies are expected to have higher human capital, stronger incentives to accumulate physical capital and innovate, they are usually more open and show more tendencies to cooperate. In turn, diversities and inequalities within societies may have a negative impact on growth by reducing trust and they may lead to the emergence of social uncertainty or even of social conflicts and increasing polarisation (Easterly and Levine, 1997).

3. The CEE growth model

3.1. The CEE facts and figures

The CEE countries share common experience of the last 25 years of economic development. They managed to transform from centrally planned to fully market-based economies integrated with the global economy. The CEE countries went along similar paths in introducing market mechanisms, restructuring public institutions and pursuing the very similar growth model based on foreign capital inflows. Integration with the European Union, accompanied by a closer cooperation of CEE corporations within the European value chains, led to a higher degree of trade openness and made the CEE countries become increasingly noticeable players in the global economy. However, despite above mentioned similarities, the CEE countries cannot be perceived as a fully homogenous group. They differ in terms of their size, level of economic development and living standards (Table 3.1 and Table 3.2). The characteristic features and challenges faced by the individual economies are discussed below.

Bulgaria is the poorest economy not only among the CEE countries but also among all the EU member states. Its GDP per capita in 2015 amounted to 46% of the EU average, i.e. it was merely half of the Czech level. Bulgaria is the only country in the CEE group that still has a fixed exchange rate regime, namely a currency board, introduced in 1997, initially with the German mark and from 1999 the euro as anchor currency. This regime is considered to be one of the main causes of large external imbalances which were accumulated in the pre-crisis period and resulted in a sizeable consumption and investment boom. However, sound fiscal policy has cushioned the effects of the global crisis and the resulting domestic bust. Bulgaria is still facing some serious structural problems with persistently high unemployment rate and underperforming domestic energy sector being the major ones.

The Czech Republic is the most developed economy in the CEE region, which largely reflects the fact that it entered the transition in the early 1990s with the highest GDP per capita. The pace of convergence has been relatively slow compared to the other CEE countries, which resulted in the diminishing gap between the Czech Republic and its regional peers. At the beginning of transition, it was the most heavily industrialised economy among all the CEE

countries. Industrialisation continued in the following years and the current share of industry in the Czech GDP (almost 30%) is the highest in the EU. Strong industrial sector is an effect of both historical heritage and close connections with German enterprises. These factors also explain the large trade openness and high dependence on foreign demand. The global economic crisis demonstrated that the country has earned the status of regional financial 'safe haven' due to sound economic fundamentals, low inflation and interest rates and a stable and reliable business environment.

Hungary is a relatively well developed among CEE economies. Alongside Slovakia it is also the most open one, with exports exceeding 90% of GDP in recent years. Hungary managed to attract a large inflow of foreign investments, mostly into manufacturing. This shaped the structure of the economy, with industry playing an increasingly important role. During the transition period, convergence in Hungary was hampered by internal instability. General government finance was destabilised by far too loose fiscal stance at the beginning of the 21st century and the consequences of the global financial crisis. The financial system also proved to be unstable, which was an effect of, among other things, a high share of foreign currency loans. However, the scale of external and internal imbalances has recently decreased significantly. Fiscal consolidation of recent years has borne fruit, deficit has been taken down to a tolerable level and public debt started to shrink. Moreover, the problem of foreign currency loans has been solved. Notwithstanding this, in recent years business environment in Hungary has become less predictable, especially for companies operating in the services sectors, due to frequent changes in state regulations, which may influence the country attractiveness for foreign investors.

Poland is by far the largest CEE economy, with GDP amounting to almost half of the region's total GDP. Large domestic market and relatively small trade openness make the Polish economy less vulnerable to external shocks than the economies of its peers. Poland was the only EU economy which did not fall into the recession during the recent global crisis owing to, among other things, freely floating exchange rate which helped to maintain the cost competitiveness of exports during that period. Poland's relatively small dependence on foreign capital inflows into the banking sector, along with rather strict financial sector supervision,

resulted in a comparably smaller credit boom during the pre-crisis period and thus the Polish financial system has remained in a stable condition.

Romania is a relatively large but also second poorest CEE economy. It is still very dependent on agriculture: the share of that sector in Romanian GDP and, especially, in employment is the highest in the EU. However, similarly to the other CEE countries, industry (and manufacturing in particular) plays a crucial role in the economy. The floating exchange rate regime did not prevent the Romanian economy from growing imbalances before the global financial crisis. A sudden stop in capital inflow forced Romanian authorities to apply for international assistance, and three consecutive EU/IMF/World Bank programmes (of 2009, 2011, and 2013) helped to restore external sustainability. However, the banking sector in Romania is still bearing the consequences of the previous credit boom: the still high share of non-performing loans keeps on hampering economic growth.

Slovakia is one of the fastest converging economies in the CEE region, quickly catching up with the neighbouring Czech Republic. Its ability to attract foreign investors, especially in the automotive sector, made this small country one of the most significant car manufacturers in Europe (car production per capita is by far the largest among all European countries). However, such high concentration of large companies operating in the same sector makes Slovakia vulnerable to shifts in global demand for cars. Slovakia is the only analysed CEE economy that joined the euro area (in 2009). The relatively strong irrevocable euro conversion rate of the Slovak koruna contributed to a slowdown in this export oriented economy. Mismatches in the labour market, translating into the highest unemployment rate among the CEE countries, constitute the most important structural obstacle for the Slovak economy.

Table 3.1 General information about the CEE countries (data for 2015)

	Area (sq. km)	Population (thousands)	Population density (inhabitants per sq. km)	GDP (EUR bn)
Bulgaria	110,898	7,202	65	44
Czech Republic	78,865	10,538	134	167
Hungary	93,023	9,856	106	109
Poland	312,679	38,006	122	428
Romania	238,394	19,871	83	160
Slovakia	49,037	5,421	111	78

Source: Eurostat.

Table 3.2 Main macroeconomic indicators

	GDP per capita (EUR thousand, PPS)					GDP growth rate, average (%, y/y)			
	1997	2000	2004	2009	2015	1997–2000	2001–2004	2005–2009	2010-2015
Bulgaria	4.6	5.6	7.7	10.6	13.3	0.7	5.1	4.0	1.3
Czech Republic	12.7	14.1	17.6	20.2	25.0	1.2	3.3	3.3	1.7
Hungary	8.6	10.5	13.8	15.6	19.5	3.8	4.2	0.6	1.6
Poland	7.7	9.2	11.0	14.4	19.7	5.1	3.0	4.7	3.1
Romania	4.8	5.0	7.5	11.9	16.3	-1.2	6.2	4.1	1.9
Slovakia	8.5	9.7	12.6	17.3	22.0	1.7	4.7	5.1	2.8
	Unemployment rate (%)					Inflation, average (%, y/y)			
	1997	2000	2004	2009	2015	1997–2000	2001–2004	2005–2009	2010-2015
Bulgaria	–	16.4	12.1	6.8	7.7	10.5	5.4	7.4	1.1
Czech Republic	4.8	8.8	8.3	6.7	4.4	5.9	2.1	3.0	1.5
Hungary	9.1	6.3	6.1	10.0	6.1	13.2	6.5	5.5	2.7
Poland	10.9	16.1	19.1	8.1	6.9	11.0	2.9	3.0	1.7
Romania	6.1	7.6	8.0	6.5	6.7	76.4	21.1	6.3	3.3
Slovakia	12.7	18.9	18.4	12.1	10.7	8.8	6.7	2.8	1.6
	Public debt (% of GDP)					General government balance, average (% of GDP)			
	1997	2000	2004	2009	2015	1997–2000	2001–2004	2005–2009	2010–2015
Bulgaria	97.3	70.1	36.1	14.2	26.7	0.4	0.3	0.3	-2.2
Czech Republic	12.1	17.0	28.5	34.1	41.1	-3.8	-5.2	-2.7	-2.4
Hungary	62.2	55.2	58.8	78.2	75.3	-5.3	-6.7	-6.1	-3.2
Poland	42.3	36.5	45.3	49.8	51.3	-3.5	-5.2	-4.1	-4.3
Romania	14.9	22.4	18.6	23.2	38.4	-4.2	-2.1	-4.2	-3.3
Slovakia	33.0	49.6	40.6	36.0	52.9	-7.7	-4.9	-3.7	-4.1
	Net international investment position (% of GDP)					Current account balance, average (% of GDP)			
	1997	2000	2004	2009	2015	1997–2000	2001–2004	2005–2009	2010–2015
Bulgaria	–	–	–	-98.1	-60.7	-1.3	-4.8	-16.8	0.2
Czech Republic	-4.7	-8.2	-28.2	-44.2	-30.9	-3.6	-5.1	-2.3	-1.1
Hungary	-58.5	-69.5	-85.7	-118.8	-66.1	-5.7	-7.3	-5.8	2.2
Poland	–	–	-45.9	-60.6	-60.9	-5.2	-3.4	-4.6	-3.0
Romania	–	–	–	-62.3	-50.2	-5.1	-5.7	-9.6	-2.9
Slovakia	–	–	-38.9	-66.7	-69.6	-6.8	-7.4	-6.0	-1.3

Source: Eurostat.

3.2. The CEE economies' growth model

3.2.1. Growth model based on foreign capital inflows

Despite some differences, the CEE economies have shared a broadly similar growth model. Their economic development in the past two decades has been based on foreign capital inflows. Those inflows, mainly originating from EU-15 countries, have been supported by the ongoing shift of the CEE economies towards the market economy, liberalisation of capital flows and integration with(in) the EU.

The CEE countries provide a very good example of economies whose growth has been boosted by downhill capital flows. This growth model, although consistent with economic theory, is markedly different from that observed in other developing countries during the last twenty years, described by the Lucas paradox[6]. Economies of Latin America and, most of all, of developing Asia have not benefitted from foreign investment inflows to such an extent. Structural changes in these economies that took place after the South American or Asian crises of the 1980s and the 1990s, in some cases, even turned those economies into net capital exporters (Figure 3.1).

The transition to market economy acted as an initial trigger for the inflow of foreign capital. Gradual liberalisation of capital flows as well as unification of laws and regulations enabled international corporations to enter the CEE markets. Another important aspect attracting foreign companies was large-scale privatisation. Governments in the CEE countries clearly supported foreign investors and used many incentives (e.g. tax incentives, including full exemption in some cases, subsidies to investment projects) in order to attract new investments.

In the initial period of transition, foreign direct investment (FDI) dominated the foreign capital inflows. Until 2006 FDI amounted to over 80% of total foreign capital inflows. Other forms of capital flows gained importance in the subsequent years, especially after the CEE countries' accession to the EU and the related liberalisation of capital markets and financial flows. This, along with the globally observed search for yield, encouraged huge financial inflows, predominantly through the banking sector, culminating in 2007/2008. Since 2009 portfolio investment started to play a significant role as foreign investors have decided to focus on less risky treasury debt markets (Figure 3.2).

The CEE countries have offered favourable conditions to foreign investors. The main pull factor for FDI in the CEE countries was the intention to reduce production costs by foreign enterprises (*efficiency seeking FDI*[7]) as labour costs in those countries were significantly lower

[6] The paradox associated with capital flows from less developed to more developed countries was first signalled in 1990 (Lucas, 1990).
[7] The most popular classification of factors driving foreign investors was introduced by Dunning (1992) who made a distinction between resource, efficiency, market and strategic asset-seeking investment.

than in EU-15. Additionally, the region offered relatively skilled labour force, favourable geographical location and generally well-developed transportation and energy infrastructure. Among other factors which helped to attract investors into this part of Europe, a McKinsey report (see Labaye et al., 2013) lists more intense usage of mobile and fixed telecommunications and better health indicators than, for instance, among the BRIC economies.

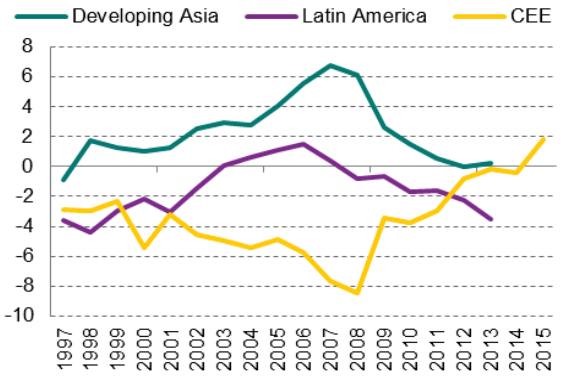
The geographical proximity of Western European economies played a vital role in attracting FDI into the region. Popescu (2014) finds that FDI levels in the CEE countries were positively associated with GDP in the host and source countries and negatively connected with distance and unit labour expenditures. Murgasova et al. (2015), analysing the convergence of Western Balkan countries, underline the weakness of that process comparing to the CEE countries. They find a part of the explanation in the closer physical distance of the CEE countries to Europe's core, allowing some of them to become better integrated into the German supply chain. In this context, it is worth noting that a significant share of investors mainly aimed to enter the local markets (*market seeking FDI).* This is confirmed by the relatively high percentage (ca. 60%) of direct investment located in the economic sectors clearly focusing on domestic markets, i.e. market services (financial services, telecommunication services, retail trade) or construction.

All of the above notwithstanding, political and economic integration with the EU appears to be the key factor behind this extraordinary scale of foreign capital inflows to the CEE economies. Rosati (2011) stresses that liberalisation, including the free movement of capital, started already during the pre-accession period, and a gradual liberalisation of labour flows followed the accession. In parallel, the CEE countries have harmonised their legal and institutional systems with the EU norms and standards. After the EU accession most of the remaining barriers to trade, investment and finance were removed.

Foreign capital inflows, especially FDI, positively affected domestic investment, contributing to closing the gap between the CEE countries' saving and investment rates. Foreign capital inflows increased productivity and spurred growth in the region (Fidrmuc and Martin, 2011; Damijan et al, 2013) mainly by increasing gross fixed capital formation (Aizenman and Sushko, 2011). At the outset of transition, the CEE countries were characterised by relatively

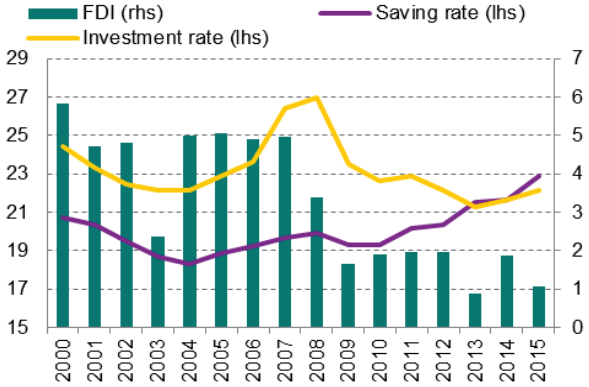
low saving rates and large investment needs. Until the outbreak of the global financial crisis in 2008, the gap between domestic investment and savings was financed through the inflow of foreign capital (Figure 3.3). Later on, as FDI inflows decreased significantly, investment rates in the CEE countries also fell despite the concomitant hike in domestic savings. Still, as of end-2015, FDI constituted more than 50% of the net foreign capital position in most of the CEE countries (Figure 3.4).

Figure 3.1. Financial account balance in major emerging market regions (% of GDP)



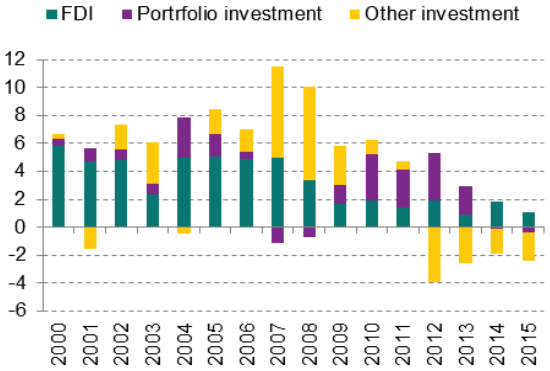
Source: Eurostat, IMF WEO.

Figure 3.2. Saving and investment rate vs. net FDI in the CEE countries (% of GDP)



Source: Eurostat.

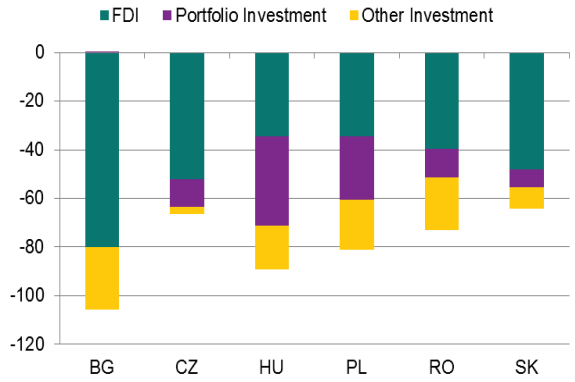
Figure 3.3. Net foreign capital inflow by type in the CEE countries (% of GDP)



* Other investment is a residual category that includes positions and transactions other than those included in direct investment, portfolio investment, financial derivatives and employee stock options, and reserve assets.

Source: Eurostat.

Figure 3.4. Net foreign capital position by type as of end-2015 in the CEE countries (% of GDP)



* See Figure 3.3 for notes.

Source: Eurostat.

3.2.2. Foreign direct investment shaping the CEE economies structures

FDI inflows have played a crucial role in shaping the structures of the CEE economies. This outcome reflected the strategy of multinationals that focused on incorporating the CEE economies into the global value chains (GVCs).

Over the last two decades, about one third of FDI inflow into the CEE economies was directed into manufacturing, strengthening the role of this sector (Figure 3.5)**.** Multinationals focused on moving production from Western European to the CEE countries, acquiring existing or building new production plants. As a result, the share of manufacturing in value added in the CEE economies has seen a continuous increase over the last two decades[8], which led to those economies becoming the most industrialised ones in the EU (Figure 3.6). This growth was exceptionally high in Slovakia, the Czech Republic and Poland, where the share of manufacturing increased by over a half, whereas in Hungary the increase was smaller. Only Romania saw a slight decline in the role of manufacturing; nevertheless, this country has remained among the most industrialised ones in the EU. An opposite trend was observed in the EU-15 countries, which generally saw a de-industrialisation process between 1995 and 2015. Whereas the position of manufacturing has remained stable in the most heavily industrialised countries (i.e. Germany, Austria, and Sweden), in some other countries (notably France, Italy, the United Kingdom, and Spain) the decline in the share of manufacturing in value added was very pronounced.

Enhanced cooperation within the GVCs increased the CEE countries' trade openness and contributed to a more significant role of those economies in the EU trade. FDI inflows resulted in expansion of the production base, which created additional stimuli (besides growing global demand) for increases in both exports and – as an effect of growing imports intensity of exports – imports. Trade openness of the CEE countries, calculated as the sum of exports and imports relative to GDP, doubled in the last 20 years from 60% to 120% on average (ranging in 2015 from 80–95% in Poland and Romania to 175–185% in Slovakia and Hungary) and

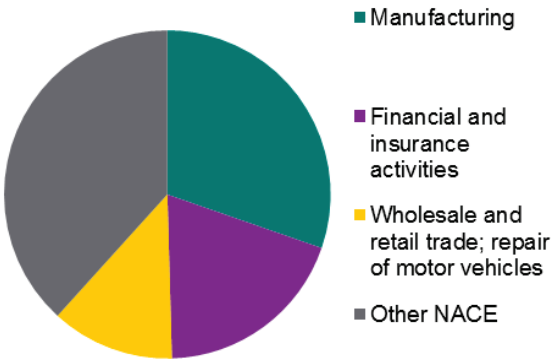
[8] In 2000, the share of manufacturing in value added in the CEE countries (except for Bulgaria, for which no data are available) amounted to 18% and by 2014 it had increased to over 25%.

thus visibly exceeding the EU-15 average. Fast growth of foreign trade turnover led to an increase in the share of the CEE countries in EU exports, which amounted to less than 4% in 1995 and grew to almost 10% in 2015 (Figure 3.7). Incorporation of the CEE countries into GVCs not only increased the trade between 'old' and 'new' member states but also amplified cooperation among the CEE economies, which is demonstrated by a significant growth in the volume of trade within the CEE region.

Considerable changes also occurred in the structure of value added within the manufacturing sector. The role of food and textile industries as well as manufacture of coke and refined petroleum products has been gradually decreasing. In mid-1990s, those sectors were the most important ones in the CEE manufacturing, with a share of over 40% of total value added generated in manufacturing. However, their role has been gradually taken over by the industries strongly integrated within the GVCs, i.e. production of machinery, electrical and electronic devices, computers and transport vehicles. Value added in the automotive industry and production of electrical devices increased five-fold and in the case of computers and electronic devices even nine-fold. At the same time, the EU-15 countries saw a diminishing role of GVC-integrated industrial sectors, which was conducive to a continued decrease in the share of value added of manufacturing in total value added in the economy, most notable in France, Italy, Spain, and the United Kingdom.

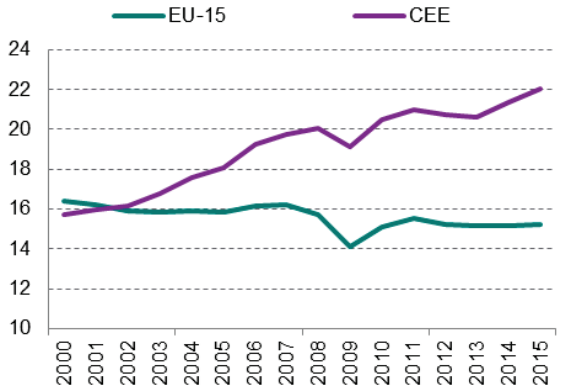
Increased participation of the CEE economies in GVC production and trade did not apply to services. Multinationals' expansion on the CEE markets was limited almost solely to relocation of manufacturing. At the same time, most of the manufacturing related services, especially those with the highest value added (pre-production and post-sales) remained in their home countries. Thus, manufacturing multinationals clearly set the role of the CEE countries as their European production bases.

Figure 3.5. Inflow of FDI into economic sectors in 2012 in the CEE countries (%)



Source: Eurostat.

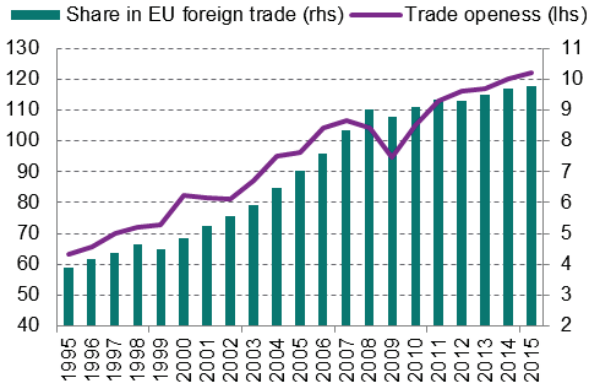
Figure 3.6. Value added in manufacturing in the CEE and EU-15 countries (% of total value added)



* Data for the CEE region excluding Bulgaria.

Source: Eurostat.

Figure 3.7. Trade openness (% of GDP) and share in EU trade (%) in the CEE countries



Source: Eurostat.

3.2.3. Capital flows via the financial sector as a source of volatility

The financial sector in the CEE region has been developing very fast in the last two decades. The development was spurred by privatisation of banks and other financial institutions. Integration within the global financial system and the EU accession resulted in credibility gains of the NMS. It also led to financial market liberalisation and deregulation which enabled foreign, mainly Western European, banks to expand into the underdeveloped CEE markets.

Both pull and push factors attracted foreign financial groups into the CEE markets. The beginning of the 21st century was marked by Great Moderation. In search for yield, global

financial institutions moved towards new, more profitable markets, among them the NMS (Vogel and Winkler, 2010), which appeared as the optimal choice due to their macroeconomic stability and large expansion potential. The latter was reflected in relatively low indebtedness of both households and enterprises: before the EU accession domestic credit to private sector ranged from 10% of GDP in Romania to 35% of GDP in Hungary, as compared to close to or above 100% of GDP in the EU-15 countries.

Large inflow of foreign capital via the expanding banking sector helped to spur domestic demand. In 2004–2008, growth in the CEE economies was the fastest within the EU. One of the key growth factors was massive inflow of foreign capital which translated into exceptionally rapid growth in domestic credit, especially in Bulgaria and Romania (up to 70% y/y at the beginning of 2008).

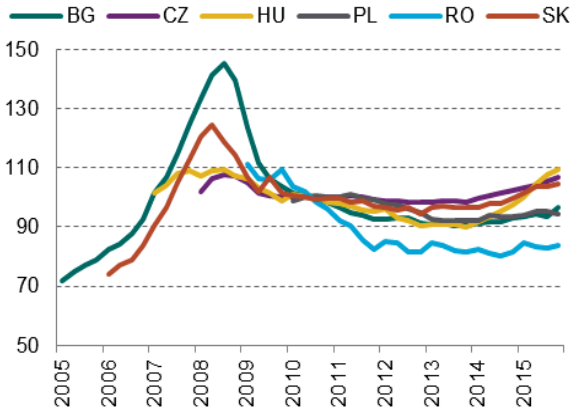
On the other hand, foreign capital inflows led to the accumulation of domestic and external imbalances and made the CEE region more vulnerable to external shocks. The CEE countries experienced credit booms (Figure 3.8) which quickly translated into consumption booms and bubbles on real estate markets (Figure 3.9). Its' effects were especially pronounced in Bulgaria and Romania, where residential property prices almost doubled between 2005 and 2008. This resulted in accumulation of capital in sectors (e. g. construction) that have productivity growth rates lower than other sectors. [Details about the house prices booms in the CEE countries are presented in Box 3.1]. Strong growth in consumption induced increased imports. At the same time increasing labour costs and appreciating real exchange rates (Figure 3.10) reduced the cost competitiveness of exports. As a result, growth in imports far exceeded that in exports and thus external imbalances started to pile up. Large foreign trade deficits led to current account deficits which reached double digits as a percentage of GDP in Bulgaria and Romania (Figure 3.11). Net international investment position also deteriorated seriously, especially in Bulgaria and Hungary, where it exceeded (in absolute terms) -100% of GDP.

Figure 3.8. Credit to non-financial private sector in the CEE countries (%, y/y, excl. Romania*)

* No data are available for the whole analysed period.

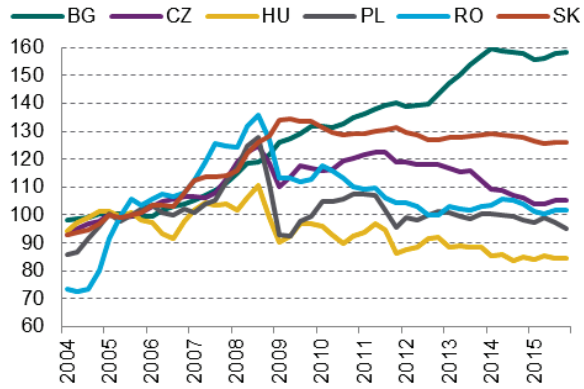
Source: National central banks.

Figure 3.9. Dwelling prices in the CEE countries (2005=100)



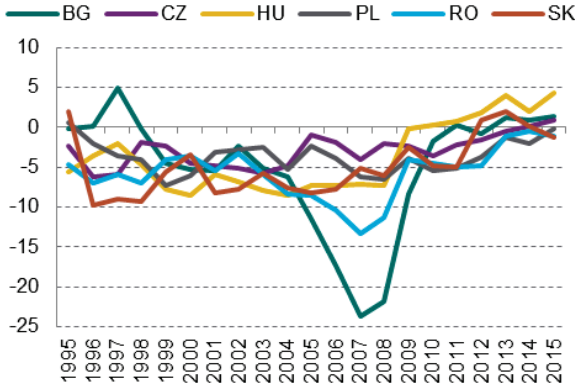
Source: Eurostat.

Figure 3.10. Real effective exchange rates in the CEE countries (deflated by unit labour cost, 2004q1=100)



Source: Eurostat.

Figure 3.11. Current account balance in the CEE countries (% of GDP)



Source: Eurostat.

Box 3.1. Housing booms in the CEE countries

At the beginning of the transition period the housing sector in the CEE countries lacked functioning market mechanisms, which was reflected in strong house price distortions and supply shortages. Institutions and the main participants involved in real estate activities were being established only gradually. The fact that it took considerable time to build real estate markets driven by supply and demand was mainly due to complex interactions between a large number of participants from sectors including construction, banking, legal services, insurance and government (Palacin and Shelburne, 2005).

Efficient mechanisms of housing funding were also missing at the beginning of the transition. Banks had only started to adopt their activity to a new business environment, so housing loans to households and credit financing of residential investments by construction companies hardly existed. Further problems included low level of professionalization of the real estate brokers, often unclear ownership titles of real estate and relatively slow pace of liberalisation of zoning regulations.

In the initial phase, the transition of the housing sector in the CEE region was associated with the privatisation and restitution of the housing stock. Properties were sold for low, non-market prices (Ivanicka, 2012). This, along with the initial undershooting of prices due to the transition process, contributed to continuing house price distortion. The economic turbulence during the transition period and the sluggish process of establishing market-based mechanisms, which resulted in a low property market turnover, both led to a drop in housing starts in the early 1990s. This deepened the problem of quantitative and qualitative shortages in the residential markets.

A major factor that boosted the residential market was the privatisation of the CEE countries' banking sectors. The acquisition of local banks by strategic foreign investors contributed to the development of housing finance. Foreign direct investment in the banking sector and cross-border loans from parent banks allowed banks operating in the region to expand

their lending to households while also reducing the perception of risk (Ivanicka, 2012). Furthermore, the finance flow from abroad provided the banking sector with liquidity and increased competition among banks, which created an environment for a rapid credit growth.

In the early 2000s, the CEE countries experienced credit and housing booms which led to rapid growth of residential property prices (Figure B.3.1)**.** It was mainly driven by developments of such fundamentals as disposable incomes, credit volumes and interest rates as well as by demographic factors and housing policies (Égert and Mihaljek, 2007). On the demand side, vigorous growth of disposable incomes (Figure B.3.2) was conducive to higher demand for housing. In some CEE countries these tendencies were supported by demographic factors, namely a rise in prime-age population being the result of baby booms in the 1970s and 1980s[1)] (Figure B.3.3).

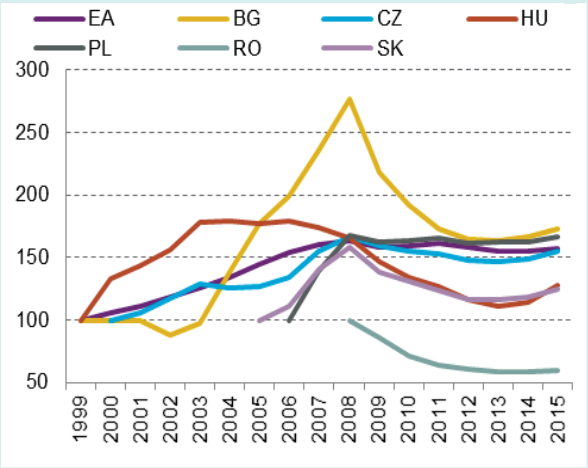
Housing demand in the region was spurred by credit expansion, driven by financial liberalisation and capital inflows into the banking systems. On the part of households, credit demand increased owing to significantly easier access to credit and lower cost of financing. On the part of banks, the inflow of funding from abroad resulted in a substantial expansion of housing loans (Figure B.3.4; OECD, 2011). Credit conditions and standards were eased, as reflected by the reduction in down-payment requirements and a decrease in mortgage rates. An important factor contributing to a rapid credit growth were foreign exchange denominated mortgage loans whose popularity was driven by markedly lower interest payments than those for loans denominated in domestic currencies. Such loans played the most significant role in Hungary and Romania, where their share in total loans to households exceeded 60% at the end of 2009 (ECB, 2010).

The strong increases in house prices resulted from the combination of significant increase in housing demand and low responsiveness of housing supply. The low responsiveness of supply, which generally leads to strong reaction of prices rather than adjustment of quantities in the face of demand increases (Caldera Sánchez and Johansson, 2011), was mainly due to the above-mentioned slow implementation of reforms concerning the housing sector after 1990. During the build-up phase of the housing boom in the CEE countries, the growth

of dwellings investment was relatively sluggish (Figure B.3.5) and the residential market suffered from quantitative and qualitative shortages in housing stocks.

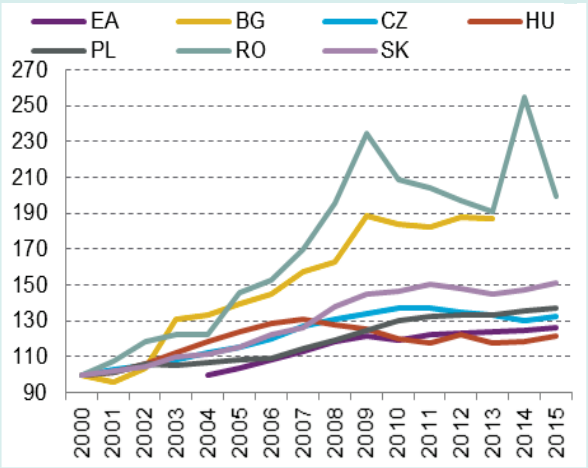
The upward pressure on house prices also came from the low degree of development of rental markets in the CEE countries. Under such conditions, households decided to buy dwellings rather than rent (Figure B.3.6). The empirical literature suggests that an effective rental market would have reduced the impact of a housing demand shock on house prices (Cuerpo et al., 2014).

Figure B.3.1. Real house prices in domestic currency (1999=100)



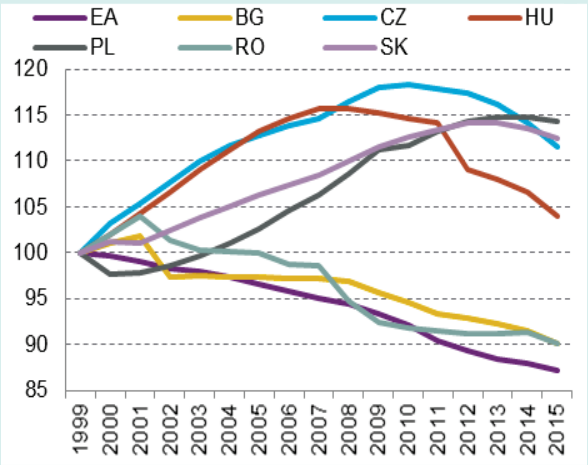
Source: ECB, BIS.

Figure B.3.2. Real disposable income in domestic currency (1999=100)



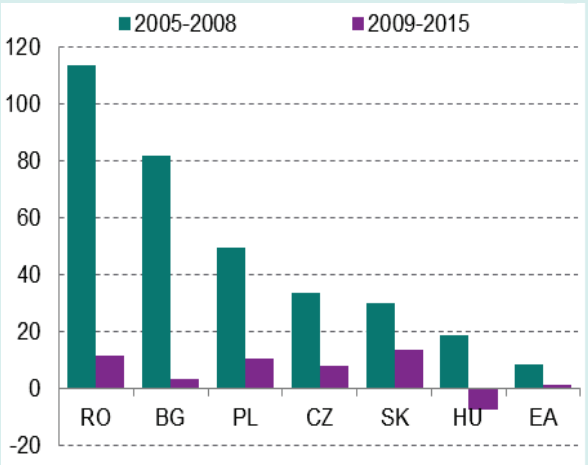
Source: Ameco.

Figure B.3.3. Population at the age of 25–40 (1999=100)



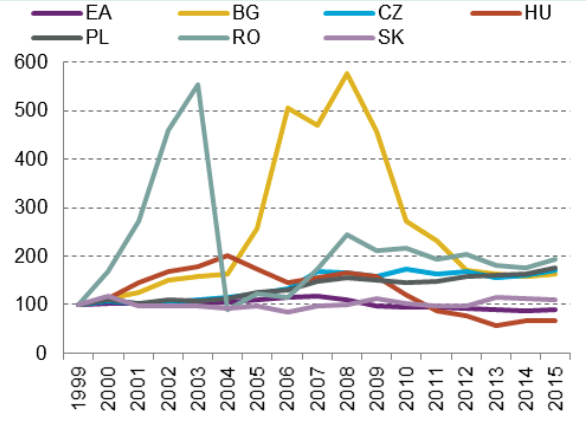
Source: Eurostat.

Figure B.3.4. Average annual growth of housing loans (%)



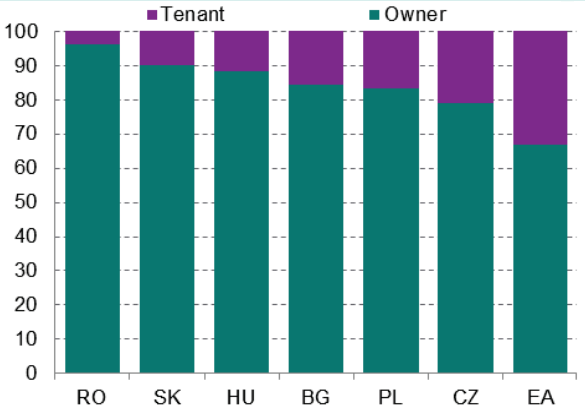
Source: ECB.

Figure B.3.5. Dwellings investment (1999=100)



Source: Eurostat.

Figure B.3.6. Distribution of population by tenure status (2014)



Source: Eurostat.

[1)] In Bulgaria and Romania, population aged 25–40 has been on the decline to a large extent because of emigration (Figure B.3.3).

3.3. The aftermath of the global financial crisis: has the growth model changed?

Strong dependence on foreign capital and accumulation of large external imbalances were the most important factors that made the CEE region vulnerable to the effects of the global financial crisis. The CEE countries (except for Poland) were among those economies which were the most severely hit by the crisis. Strong drop in external demand and exports was an important trigger for the economic crisis in the region. However, a sharp decline in foreign capital inflows, especially via the financial sector, seemed to play an even more important role. It led to a sudden stop in lending and thus contributed to a burst of bubbles in real estate and financial markets and, consequently, to a plunge in domestic demand.

Persistently low activity in Western Europe since 2008 led to a sharp drop in FDI inflows and translated into a significant slowdown in exports growth. An exceptionally pronounced slowdown in FDI inflows accompanied by deceleration in foreign trade turnover in the CEE countries was the result of global conditions: secular stagnation in advanced economies, growing protectionism, public expenditure replacing private spending, lower income elasticity of trade, limited access to trade credit (see Constatinescu et al., 2015). These developments were

aggravated by the tight connection with the euro area where the sovereign debt crisis made the consequences of the global financial and economic crisis more severe. These conditions, coupled with high uncertainty about the euro area recovery, hampered the activity of European multinationals, which most evidently contributed to the observed slowdown.

The CEE countries have reported a substantial improvement in the current account balance. Due to the loss of external financing, domestic demand in the CEE region decelerated significantly after 2008. This clearly translated into a slowdown in imports growth of a scale exceeding the slowdown in exports. As a result, foreign trade deficit started to wind down, leading to current account improvement. Additionally, since 2014 the terms of trade for the CEE countries, mostly oil and energy importers, improved as global oil and other energy commodities' prices fell, pulling import prices down. It seems that the improvement in the current account balance may prove to be long-lasting as excessive growth in CEE imports is not expected in the forthcoming years. However, the balance may slightly deteriorate in comparison to the last couple of years due to less favourable terms of trade.

Current developments suggest that the post-transition growth model has reached its limits. The slowdown in capital inflows and exports leading to lower GDP growth in the past few years resulted mainly from cyclical factors and should probably not be treated as a permanent change. However, the recent experience has demonstrated that the role of a manufacturing base for EU-15 and dependence on foreign capital inflows has made the region rather vulnerable to exogenous shocks. Moreover, growth and convergence towards EU-15 (see the next chapter) has made the CEE economies less cost competitive, and this comparative advantage will likely tend to further diminish over time. These developments reveal a need for a gradual change in the CEE economies post-transition growth model towards a knowledge economy, based on innovation activity of domestic corporations and not only the import of technology from abroad through FDI. Such a change would enable the CEE countries to move up in the production chains and it seems to be necessary for those countries to remain on (or return to) a fast economic growth pace.

4. Stylised facts on growth and convergence in the CEE region

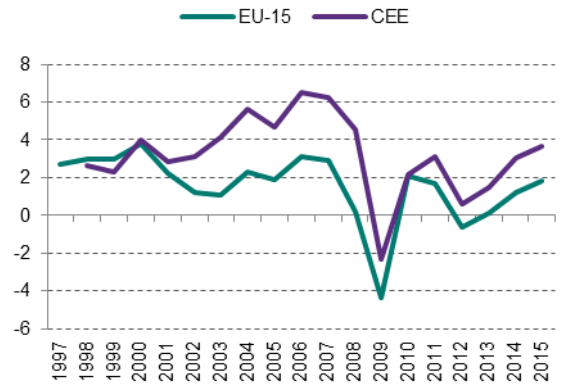
4.1. Economic growth

In the period under review, GDP in the CEE region grew on average more than twice as fast as in the EU-15 (Figure 4.1). The region's growth was mainly fuelled by economic activity in the biggest economies, i.e. Poland or the Czech Republic, and in those CEE economies which expanded at the fastest pace, i.e. Slovakia and Romania (Figure 4.2).

Growth patterns seem to be mixed: though GDP growth rates of individual countries were generally high, their volatility differed substantially. The Polish economy not only grew at the fastest average rate in the 1997–2015 period, but its GDP growth was the least volatile in the region. With its large weight, Poland was the main contributor to the region's economic expansion. The Slovak GDP expanded on average at a slower (though higher than the CEE average) pace. Even though economic activity in that country recorded the highest increase across the region in the 2000–2007 expansion phase, GDP growth was much more volatile than in Poland, affecting the overall performance of the Slovak economy in the entire 1998–2015 time frame.[9] The economies of Bulgaria and Romania performed very well during the 2000–2007 expansion. Nevertheless, similarly to Slovakia, both countries suffered from a severe contraction of economic activity before 2000 and after the 2008 crisis, which translated into higher volatility and relatively lower average GDP growth throughout the analysed period. The performance of both Hungary and the Czech Republic was relatively weaker. The former expanded at an above-average rate at the beginning of the analysed period, yet growth slowed down with the eruption of the Hungarian crisis in 2005 and remained sluggish as the global crisis prevented a full recovery. As for the Czech Republic, GDP growth remained below the CEE average throughout most of the analysed period. Even though the country avoided a prolonged period of recession following the 2008 meltdown, economic activity has remained sluggish since.

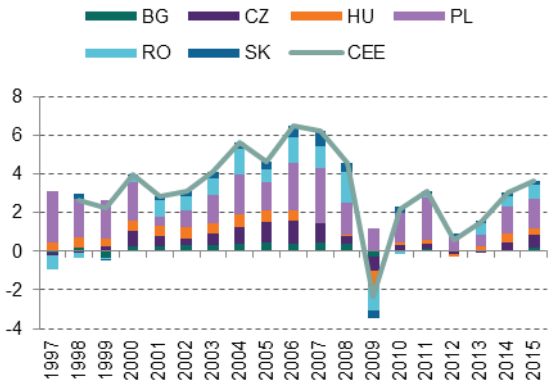
[9] We analyse data from 1997 onwards but in specific cases the time frame may differ due to data limitations.

Figure 4.1. GDP growth in the CEE region and the EU-15 (%)



Source: Eurostat.

Figure 4.2. Individual countries' contribution to the CEE region's growth (percentage points)



Source: Eurostat.

4.2. Real convergence

Strong growth in economic activity translated into substantial increases of GDP per capita, leading the CEE region to rank among the best performing regions worldwide. In 1997 the level of development as measured by GDP per capita in CEE-6 was much higher than the levels of other emerging market economies (EMEs). Given these initial conditions, the average GDP per capita growth from 1997 to 2015 was relatively strong, next to only that of the EMEs of East Asia and Pacific. Bulgaria, Poland and Romania have noted the highest per capita growth rates (Figure 4.3 and Figure 4.4).

Changes in population were among the factors significantly driving the increases in GDP per capita in some CEE countries. It is worth noting that very high GDP per capita growth in 1997–2015 has been, in some cases, partly due to emigration (Figure 4.5). In particular, the populations of Bulgaria and Romania have decreased respectively by 14% and 12% over that period. This contrasts with the concurrent considerable increase in the populations of some African, Asian or Latin American developing economies and EMEs (Figure 4.6).

During the last 20 years GDP per capita of the CEE countries has been converging towards the level observed in the EU-15, in line with the neoclassical growth theory. The region has reached over 60% of the EU-15 level, i.e. GDP per capita in PPS has converged by 20 percentage points since 1997 (Figure 4.7, Figure 4.8). Relative GDP is currently the highest in the Czech

Republic (80% of the EU-15 level), followed by Slovakia (71%), Hungary (63%) and Poland (63%). Romania and Bulgaria have reached levels below the CEE average (respectively 52% and 43% relative to the EU-15).

The general pattern of convergence in the analysed period has been changing over time and has differed across countries. The process included a moderate catching up from 1997 to 1999, an expansion during which most of the convergence took place (from 2000 to 2008) and a slowdown in the convergence process that has lasted until now. The different importance of these phases across the CEE countries determined their overall convergence performance.

Slovakia has performed remarkably well in reducing the distance from the EU-15. Its relative GDP per capita amounted to only 44% of the EU level in 1997 and reached 71% in 2015. This pace of catching up has also reduced the development gap between Slovakia and the Czech Republic, where the process virtually stagnated after the global crisis. The pace of convergence in Slovakia was affected by the crisis to a relatively smaller extent.

The process of convergence has been nearly as effective in Poland. Owing to a stable pace of growth in economic activity, Poland significantly reduced the distance separating it from the EU-15: between 1997 and 2015, its relative GDP rose by 23 percentage points to 63%. Poland underperformed its CEE peers during the 2000–2008 expansion phase, yet growth remained stable after the crisis, thus accelerating convergence compared to other CEE countries.

Romania and Bulgaria, the poorest countries in the group, have followed different convergence paths. In 1997, Romania and Bulgaria were characterised by the lowest levels of economic development, reaching respectively 25% and 24% of the EU-15 GDP per capita. Both countries were converging to the EU-15 at a broadly similar pace until the global crisis of 2008. Thereafter, the Bulgarian GDP per capita virtually stopped converging, its relative GDP per capita barely exceeding 40% since 2012. By contrast, Romania continued to catch up, decoupling from the Bulgarian economy and reducing the development gap with the EU-15 by 27 percentage points during the entire 1997–2015 period.

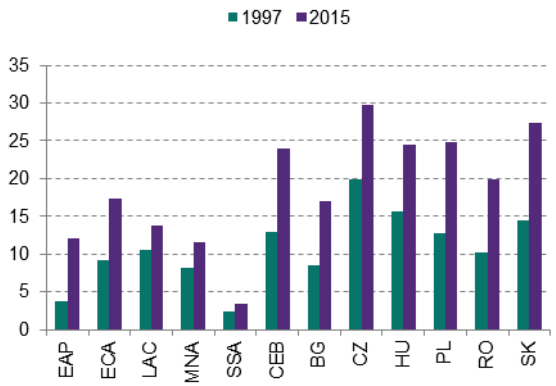
Convergence of Hungary has been subdued due to domestic factors. After catching up at a comparatively fast pace at the outset, the Hungarian economy slowed down in 2005 due to a

local crisis. Further acceleration of the convergence process was inhibited by the global crisis. Overall, during the analysed period the economy has caught up with the EU-15 by 19 percentage points, which is slightly below the CEE average. Still, due to a relatively high initial value, the Hungarian relative GDP per capita reached a comparatively high level of 63% in 2015.

The worst performance in terms of speed of convergence has been noted in the Czech Republic. The Czech relative GDP per capita first dropped in 1997–1999, then increased during the expansion phase but virtually stagnated after 2008. This poor performance may be explained, at least partially, by the initial high (the highest in the region) development level. The Czech relative GDP per capita amounted to 65% in 1997 and even after increasing by merely 15 percentage points it represents 80% of the EU-15 figure, the highest level in the region.

The general rule that countries starting from a lower level of development tend to converge faster seems to be confirmed for the CEE countries (except for Bulgaria). The standard deviation of GDP per capita in the group relative to the CEE average has been decreasing over time. The pace of this decrease gradually accelerated in 2000–2008 and slowed down thereafter (Figure 4.8). Thus, both beta and sigma convergence is by and large confirmed.

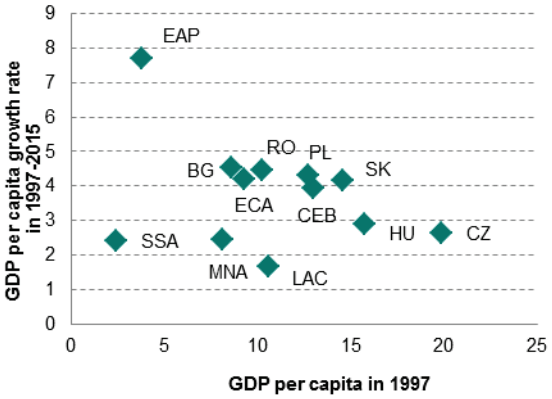
Figure 4.3. GDP per capita in 1997 and 2015 (in PPS, thousands of constant 2011 international USD)



* EAP: East Asia & Pacific; ECA: Europe & Central Asia; LAC: Latin America & Caribbean; MENA: Middle East & North Africa; SSA: Sub-Saharan Africa, CEB: Central Europe and the Baltics.
** Data till 2014 for MNA countries.

Source: World Bank data, own calculations.

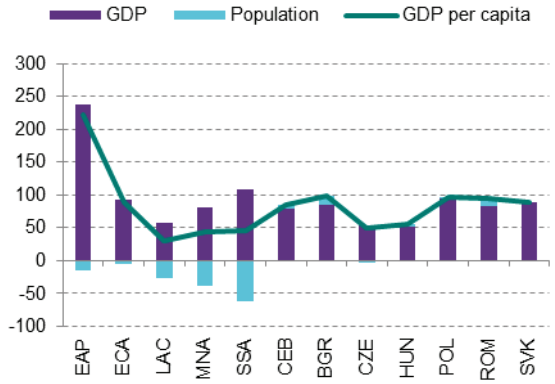
Figure 4.4. GDP per capita in 1997 (in PPS, thousands of constant 2011 international USD) and its average annual growth in 1997–2015 (%)



* See Figure 4.3 for notes.

Source: World Bank data, own calculations.

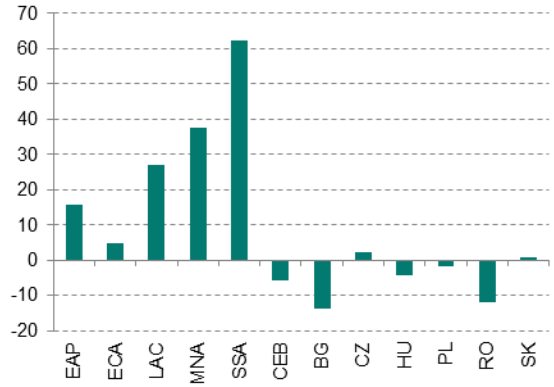
Figure 4.5. Decomposition of GDP per capita growth in CEE and other EMEs in 1997–2015 (%)



* See Figure 4.3 for notes.

Source: World Bank data, own calculations.

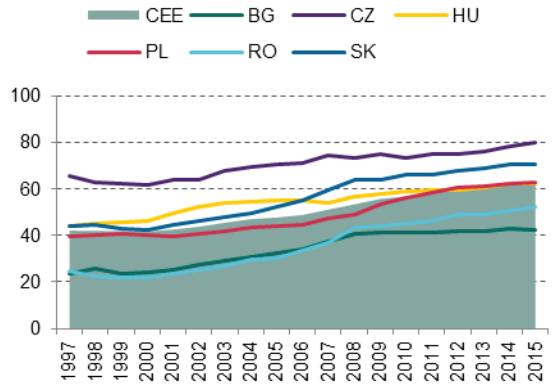
Figure 4.6. Population change in 1997–2015 (%)



* See Figure 4.3 for notes.

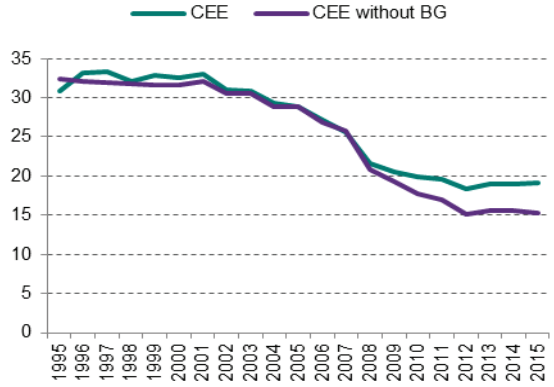
Source: World Bank data, own calculations.

Figure 4.7. GDP per capita in CEE countries (% of the EU-15 GDP per capita, in PPS)



Source: Eurostat.

Figure 4.8. Standard deviation of GDP per capita in CEE countries (% of CEE average)



Source: Eurostat.

4.3. Structural convergence

4.3.1. Convergence in terms of value added

Convergence in GDP per capita has been driven, among other things, by structural changes that took place in the CEE economies during the period under review. Below we investigate whether in the CEE countries structural changes that were driving real convergence resulted in structural convergence with the EU-15 economies. We analyse changes in the structures of value added, employment and consumption, looking at the evolution of Krugman index (Krugman, 1993), a widely used, synthetic measure of structures similarity.

Differences in value added (VA) between the CEE and EU-15 economies at the beginning of the EU integration process were determined mainly by the communist past of the former. In 1997, the structure of VA in the CEE economies differed significantly from that in the EU-15. The former group was characterised by large shares of industry and agriculture in total VA while services played a relatively small role. This was in contrast with the EU-15 where services dominated in total VA while the shares of industry and agriculture were much smaller.

On average, while EU integration has contributed to closing the GDP per capita gap relative to the EU-15, it has not led to convergence in VA structures. In the CEE countries, the role of industry in VA has been systematically growing while the role of services has been declining; the process was particularly dynamic in the years 2000–2007 and slowed down after the 2008 crisis. In the EU-15 countries, by contrast, the role of industry in VA has been systematically declining while the opposite has been observed for services. Only the shares of agriculture have followed similar, declining paths both in the CEE countries and in the EU-15 (Figure 4.9).

Developments in the Krugman index suggest divergence in VA structures between the CEE countries and the EU-15 (Figure 4.10). The Krugman index is a standard specialisation measure indicating how the economic structure of a country differs from the economic structure of a reference region (here the EU-15). The higher the index, the more the economic structure of a country deviates from the reference region (and the more a country is considered to be specialised). The value of the index is given by

$$K = \sum_i |s_{iC} - s_{iR}|, \tag{2.7}$$

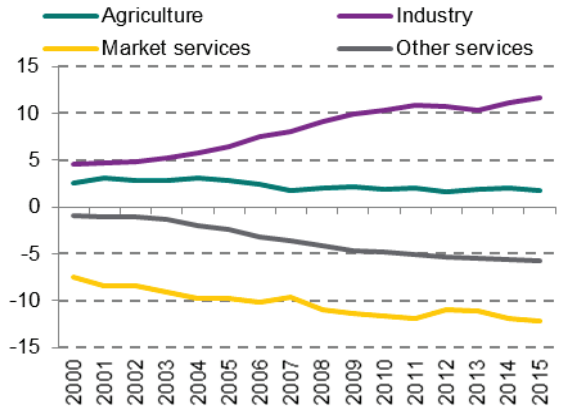
where s_{iC} is the share of sector i in total value added (or employment) of country C and s_{iR} is the share of sector i in the total value added (or employment) of the reference region R. Divergence in VA structures could be observed both for the region as a whole and for the individual countries (except for Bulgaria and Romania[10]). This is explained by the rising role of industry coupled with declining role of services in the CEE countries' VA, contrasting with the trends

[10] Bulgaria's VA structure has slightly converged to (rather than diverged from) that of the EU-15 due to the relatively small increase of the share of industry in VA coupled with a very sharp drop in the share of agriculture (related to its initial very high share). In Romania, the effects of the increasing role of industry have been neutralised by a drop in the share of agriculture and a rise in the share of services (related to their initial insignificant role).

in the EU-15. The joint experience of declining role of agriculture in VA has had an insufficient scale to counteract these effects.

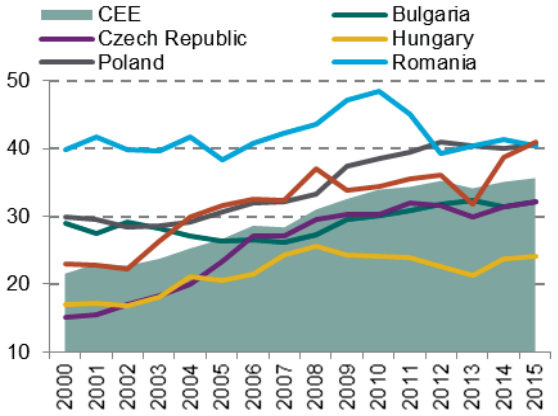
At the same time, the VA structure converged within the CEE region. Convergence has been the strongest for countries with the largest shares of agriculture and lowest shares of industry in VA, i.e. Bulgaria and Romania. The other four economies had more similar VA structures at the outset so the changes were relatively weaker. For all countries, the convergence was more rapid between 2000 and 2007 and abated after the 2008 crisis (Table 4.1).

Figure 4.9. Differences in value added shares between the CEE and the EU-15 by sector (% of VA)



Source: Eurostat.

Figure 4.10. Krugman index for value added for the CEE countries vs. the EU-15



Source: Eurostat, own calculations.

Table 4.1. Krugman index for value added for the CEE vs. the EU-15 and within the CEE group in 2015 compared to 2000

	Krugman index for VA in 2015					
	EU-15	Bulgaria	Czech Republic	Hungary	Poland	Romania
Bulgaria	32.1					
Czech Republic	32.1	21.4				
Hungary	24.1	25.8	16.9			
Poland	40.7	24.6	16.8	22.0		
Romania	40.3	25.0	16.5	21.3	24.1	
Slovakia	41.0	20.0	15.9	20.5	11.6	24.1
	Krugman index for VA, change between 2000 and 2015					
	EU-15	Bulgaria	Czech Republic	Hungary	Poland	Romania
Bulgaria	3.2					
Czech Republic	17.1	-1.4				
Hungary	7.1	2.2	7.8			
Poland	10.8	-10.0	-7.1	-5.3		
Romania	0.5	-5.1	-13.9	-3.7	-22.5	
Slovakia	18.0	-8.7	-1.0	-3.9	1.2	-18.5

Source: Eurostat, own calculations.

4.3.2. Convergence in terms of employment structure

In 2000[11] the employment structure in the CEE region differed from that observed in the EU-15, reflecting historical patterns of employment. On average, agriculture and industry played the most important role, while services still had a relatively small share in employment. In the EU-15, the role of services was dominant, with industry playing a significantly smaller and agriculture a minor role in employment.

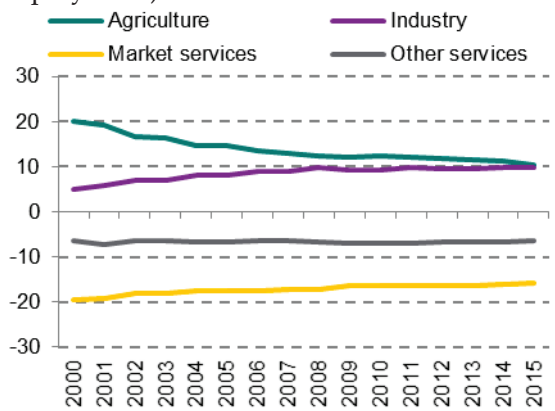
Structural changes in the CEE economies have made employment structures in the region and the EU-15 more similar, mainly on the back of converging shares of agriculture and services (Figure 4.11). During the period under review, changes in employment were mainly fuelled by adjustment in employment in agriculture and a rise in services, which was a natural process of correction in employment mismatches from the socialist past and constituted the main driver of convergence between the CEE and the EU-15 employment structures. By contrast to the EU-15, in the CEE region the role of industry did not diminish, leading to a rise in differences in shares of industry in employment.

The developments in the employment structures generally point to a convergence between the CEE region and the EU-15 (as reflected by the Krugman indices), albeit with different patterns across countries (Figure 4.12). Only the Czech Republic and Slovakia, i.e. the economies which were the most similar to the EU-15 in terms of employment structures at the outset and have seen a minor role of agriculture throughout the period under review, diverged slightly from the EU-15 on the back of increasing differences in the shares of industry in total employment. In the other CEE countries, more different from the EU-15 in terms of employment shares of agriculture and services, the effect of convergence of employment in agriculture and services to the EU-15 patterns dominated over divergence observed in industrial sector employment. These countries have seen convergence of employment structures towards the EU-15. The strongest catching up effects were observed in Romania, where the share of employment in agriculture fell from nearly 45% in 2000 to markedly less than 30% in 2015. The

[11] Time frame differs from the period analyzed in the rest of this chapter due to data availability.

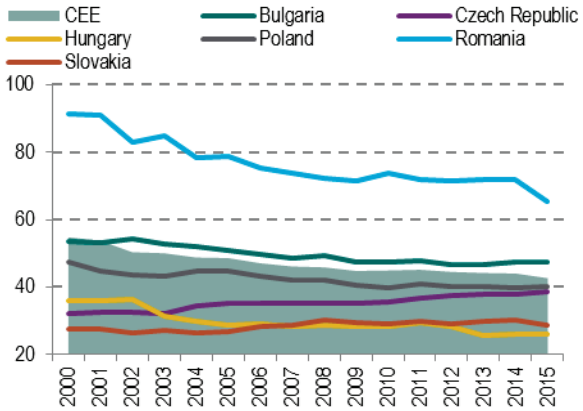
degree of employment structure convergence of Bulgaria, the country with the second largest share of employment in agriculture, was much smaller due to weaker convergence of the non-market services' share in employment (Table 4.2).

Figure 4.11. Differences in employment shares between the CEE and the EU-15 by sector (% of employment)



Source: Eurostat.

Figure 4.12. Krugman index for employment for the CEE countries vs. the EU-15



Source: Eurostat, own calculations.

Table 4.2. Krugman index for employment for the CEE countries vs. the EU-15 and within the CEE group in 2015 compared to 2000

	Krugman index for employment in 2015					
	EU-15	Bulgaria	Czech Republic	Hungary	Poland	Romania
Bulgaria	47.4					
Czech Republic	38.4	33.8				
Hungary	25.9	26.3	20.4			
Poland	40.0	21.2	23.6	15.8		
Romania	65.3	19.9	46.8	40.9	30.3	
Slovakia	28.8	31.2	15.2	15.1	18.4	30.3
	Krugman index for employment, change between 2000 and 2015					
	EU-15	Bulgaria	Czech Republic	Hungary	Poland	Romania
Bulgaria	-6.2					
Czech Republic	6.2	-7.1				
Hungary	-10.1	3.3	-0.7			
Poland	-7.5	10.2	-13.7	-2.3		
Romania	-25.9	-23.7	-32.8	-23.1	-19.5	
Slovakia	1.3	-4.0	2.6	-0.8	-9.6	-45.9

Source: Eurostat, own calculations.

4.3.3. Convergence in terms of consumption structure

Increasing GDP per capita contributed to changes in the consumption structure in the CEE countries. The increase in consumption was observed for all categories of goods and was the

strongest in the case of durable goods, while the consumption of non-durable goods and services grew at a weaker pace. This led to a significant rise in the share of durable goods in consumption, a slight increase in the share of non-durable goods and a decrease in the share of services in overall consumption.

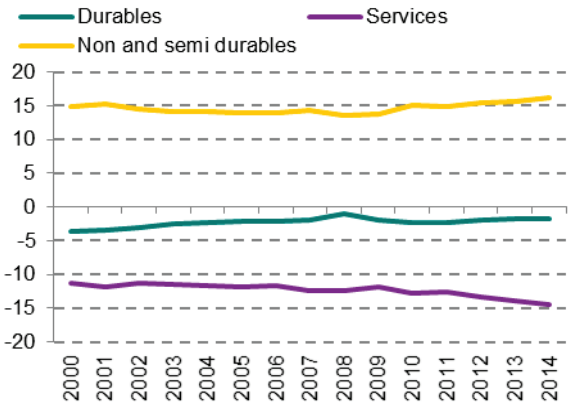
Vivid growth in consumption of durable goods has brought the share of those goods in total consumption closer to the EU-15 levels. The shares of durable goods consumption have been rising throughout the analysed period both in the CEE region and in the EU-15. By contrast, the shares of non-durable goods and services diverged from those observed in the EU-15 as a result of relatively strong growth in consumption of non-durable goods and a relatively subdued growth in consumption of services in the former group of economies (Figure 4.13).

The overall effect of these changes, as shown by the Krugman index, has been a slight divergence of the CEE and the EU-15 consumption structures (Figure 4.13)**.** Specifically, services have had a smaller (and decreasing) and non-durable goods a higher (and increasing) share in CEE economies' consumption (Figure 4.14). Nevertheless, in particular countries such as the Czech Republic, Slovakia or Bulgaria a certain degree of convergence to the EU-15 consumption structure has been observed.

Concluding, there is no evidence for convergence in real incomes between CEE and EU-15 being followed by structural convergence. In terms of value added creation one can observe divergence between the CEE and EU-15 countries. The CEE countries rely to an increasing extent on industry to fuel GDP growth. While in EU-15 it is the services that play an increasing role in value added creation. The situation is only slightly different when comparing changes in employment structures. On the one hand aggregate numbers tend to indicate that a convergence in employment structures between CEE and EU-15 countries effectively takes place. On the other hand, disaggregated figures tend to unveil that this convergence is led mainly by a decreasing share of agriculture employment in CEE countries. Convergence of employment shares in the services sector is marginal, while employment shares clearly diverged in the case of industry. Finally a slight divergence between CEE and EU-15 countries was also observed in consumption structures. Structural differences result from (among others) different growth

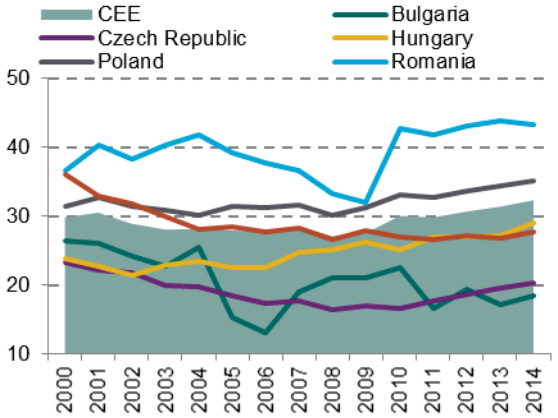
models and consumption preferences and as such do not constitute an obstacle to convergence of real incomes between CEE and EU-15 countries.

Figure 4.13. Differences in consumption shares between the CEE and the EU-15 (% of total consumption expenditures)



Source: Eurostat.

Figure 4.14. Krugman index for consumption for the CEE countries vs. the EU-15



Source: Eurostat, own calculations.

Table 4.3. Krugman index for consumption in the CEE countries vs. the EU-15 and within the CEE group in 2015 compared to 2000

	Krugman index for consumption in 2015					
	EU-15	Bulgaria	Czech Republic	Hungary	Poland	Romania
Bulgaria	18.4					
Czech Republic	20.3	2.0				
Hungary	29.1	10.7	8.7			
Poland	35.2	16.8	14.9	8.4		
Romania	43.3	24.9	23.0	14.2	8.1	
Slovakia	27.7	9.6	8.7	5.7	7.7	8.1
	Krugman index for consumption. change between 2000 and 2015					
	EU-15	Bulgaria	Czech Republic	Hungary	Poland	Romania
Bulgaria	-8.0					
Czech Republic	-3.0	-7.4				
Hungary	5.3	-1.9	5.0			
Poland	3.8	6.8	6.8	0.8		
Romania	6.7	7.5	9.7	1.4	0.7	
Slovakia	-8.3	-7.8	-4.0	-6.5	0.3	7.5

Source: Eurostat, own calculations.

5. Review of the empirical literature

5.1. Empirical studies of convergence in the CEE region

Despite different methods used and different time periods analysed, most of the abundant empirical literature confirms real (beta and sigma) convergence of the CEE countries. Empirical studies[12] show that the differentials in GDP per capita between the CEE countries and the EU-15 have diminished (beta convergence, Figure 5.1) and the dispersion of GDP per capita among CEE countries has decreased (sigma convergence; Figure 5.2).

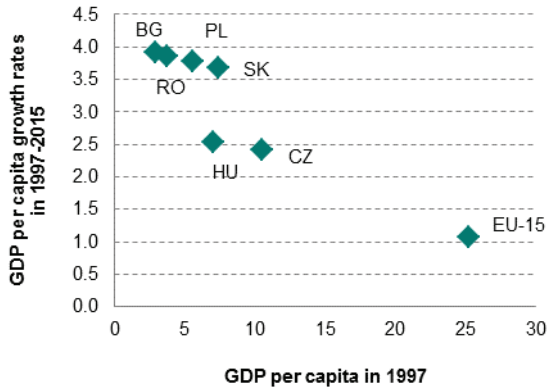
The estimates of speed of convergence vary strongly across papers due to different periods analysed, methods applied and the set of control variables used in the conditional convergence equation. For instance, Próchniak and Witkowski (2014c) find a relatively rapid pace of convergence among the EU-28 countries, with an average value of the beta coefficient at 6.1% in 1992–2012. Rapacki and Próchniak (2014) confirm convergence between 26 EU countries (the EU group without Malta and Cyprus) in 1995–2013 with an average value of beta equal to 2.1%. Cavenaille and Dubois (2010) find the average speed of convergence in 27 EU countries (all EU countries except Croatia) at 2.9% but notice significant heterogeneity inside the sample: the beta coefficient is 3.8% in the NMS and only 1.1% among the old member states.

Moreover, research generally confirms that the speed of convergence in CEE was not constant in the analysed period. According to Próchniak and Witkowski (2014c), after some trough in the second half of the 1990s, a gradual acceleration of the pace of the catching up process in the 2000s was observed. Rapacki and Próchniak (2014) also find that the speed of convergence (the beta parameter in equation 2.3 in section 2.1) increased from 1.9% in 1995–2004 to 2.6% in 2004–2013. The results support earlier findings of Rapacki and Próchniak (2009) where the beta parameter increased from 0.78% in 1996-2001 to 4.15% in 2001-2007 period. The acceleration was, in the authors' view, related to the EU enlargement.

[12] Among the recent papers, the following are worth mentioning: Cavenaille and Dubois (2010), Colak (2015), Kutan and Yigit (2009), Matkowski et al. (2016), Próchniak and Witkowski (2014a, b, c, 2015), Rapacki and Próchniak (2014), and Spruk (2011).

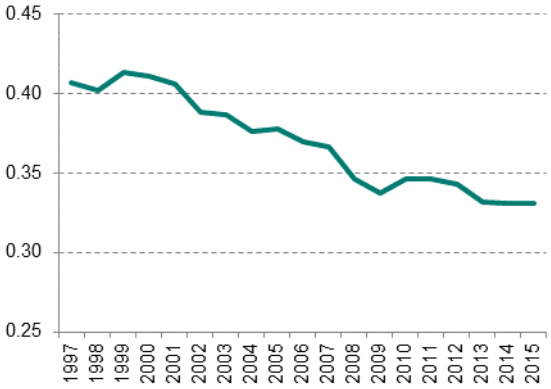
Empirical studies provide some evidence of convergence clubs among the CEE countries. Cuestas et al. (2012) conduct cluster analyses of the EU member states in 1990-2009 to test whether there is evidence of club convergence in the EU. The results for the NMS show that there are two groups of countries which converge to different steady states. In the case of the NMS the first group consists of Bulgaria, Hungary, Latvia, Lithuania, Poland and Romania. The second club includes the Czech Republic, Estonia, Slovakia and Slovenia. The existence of subgroups that converge to different steady states among the NMS is confirmed by Borsi and Metiu (2013). According to their estimates for the 1995–2010 period, the first group consists of the Czech Republic, Latvia, Lithuania and Slovakia, the second one includes Bulgaria, Hungary and Poland, and the results indicate divergence in the case of Romania.

Figure 5.1. Beta convergence, i.e. the relation between initial GDP per capita in 1997 and its growth in 1997-2015



Source: Eurostat data, own calculations.

Figure 5.2. Sigma convergence, i.e. cross-sectional coefficient of variation of GDP per capita in CEE countries in 1997-2015



Source: Eurostat data, own calculations.

5.2. Factors driving convergence in the CEE region

From the supply-side perspective, the CEE countries have mostly benefitted from capital accumulation. GDP growth decomposition (

Figure 5.3, see detailed description in Appendix 1) implies that the average contribution of capital accumulation to output growth in 1997–2014[13] equalled 2.4 percentage points per annum. The dominant role of capital deepening can be explained by the relatively low initial level of capital and output in these countries in 1997 (Figure 5.4). These results suggest that the CEE region has been following the process of (neoclassical) real convergence towards the developed EU economies characterised by a higher degree of capital intensity in the period under review. Apart from that, the aforementioned increase in capital intensity in the CEE countries can be additionally explained by the shift in sectoral composition of economic activity, i.e. from agriculture towards export-oriented manufacturing, and the substantial influx of foreign capital and technology. Moreover, the importance of capital accumulation has also been increased by the global decline in the labour share (Karabarbounis and Neiman, 2014) and the higher capital share in GDP in the CEE economies than in the EU-15 countries.[14]

Economic growth in the CEE countries has also been driven by an increase in the technical efficiency of production. Ignoring Bulgaria, whose GDP growth decomposition should be interpreted with special caution and will therefore be excluded from the analysis in this section[15], the average contribution of total factor productivity (TFP) to the annual output growth in CEE countries in 1997–2014 has amounted to over 1.1 percentage points per annum, ranging from 0.5 percentage points for Hungary to 1.5 percentage points for Poland and Slovakia. Moreover, the aforementioned gain was substantially higher than in the EU-15 where it amounted to 0.3 percentage points per annum. In relative terms, the contribution of TFP to output growth in the CEE economies exceeded 35% and was very close to that of Germany (37%). These numbers highlight the magnitude of improvement in the technical efficiency of production. The successful technology adoption in the CEE countries can be explained jointly by several factors: a large influx of foreign technologies, i.e. technology spillover effects, a boost in innovation activity and institutional changes.

[13] As of 30th June 2016 (the cut-off date for the statistical data included in this paper), no data for the factor shares for 2015 were available.
[14] The average labour share in the CEE countries in 1997–2014 has been about 0.53, ranging from 0.46 for Romania to 0.60 for Poland, while the labour share in the EU-15 countries has equalled on average 0.59.
[15] This is because the contribution of TFP to GDP growth is strongly negative, which is related to a spectacular scale of capital deepening. From 1997 to 2014, the aggregate real investment in Bulgaria rose by 290%.

Since the outburst of the global financial crisis, the speed of real convergence of the CEE region towards the EU-15 economies has been hindered due to slower capital accumulation as well as lower TFP gains (Figure 5.5). In comparison with the period of spectacular economic growth between 2004 and 2008, the contribution of capital deepening in the CEE countries has slightly decreased from 2.1 to 1.7 percentage points in 2009–2014. The diminishing role of capital accumulation can be linked to the long-lasting global decline in investment demand. Moreover, by contrast to the previous period, growth in the CEE economies since the outbreak of the crisis has not been supported by improvements in the technical efficiency of aggregate production. Akin to the EU-15 economies, the average contribution of TFP has even become negative and has fallen from 2.7 to –0.5 percentage points per annum. Poland is an exception: the country weathered the global financial crisis relatively well and the TFP contribution has remained positive (see Gradzewicz et al., 2014, for a discussion). Although the slowdown in TFP suggests a decrease in technological efficiency of production, it should rather be interpreted as a consequence of extraordinarily weak domestic and external demand in the analysed sub-period.[16]

Empirical studies confirm the role of TFP growth for the CEE countries' convergence. Labour productivity changes have been the main driver of changes in GDP per capita (see Box 2.1). Schadler et al. (2006) underline that the contribution of TFP to economic growth in the region was much higher than in other EMEs. In their view, it was the result of huge inefficiencies inherited from central planning which left much scope for managerial improvements, labour shedding and gains from inter-industry resource reallocation.

Restructuring and reallocation of resources as well as the adaptability of firms were the major factors driving productivity growth. The CEE countries have enjoyed substantial productivity gains from the reallocation of labour and capital to more productive sectors and enterprises, from the entry of new firms and the exit of obsolete firms, and from using re-

[16] The contribution of TFP in the CEE region was positive and slightly above 0.6 percentage points in 2014. This confirms the fact that the slowdown in TFP after the global crisis has been rather transitory and has been deepened by the low level of capacity utilisation.

sources more efficiently. Many workers moved out of manufacturing and into services, a sector that had been underdeveloped under central planning. The productivity surge in the CEE countries was also largely driven by the ability of firms to adapt flexibly to changing external conditions. Firms did so by investing in worker skills and adopting new technologies, abandoning old production lines and introducing new ones, manufacturing new products, and accessing new markets (Alam et al., 2008).

Empirical studies confirm that huge capital inflows were the most important factor behind the convergence of the CEE countries. Bijsterbosch and Kolasa (2009) find a strong effect of FDI inflows on productivity convergence in the CEE countries. They show, however, that the impact of FDI on productivity critically depends on the absorptive capacity of the recipient countries and industries. These results support the earlier findings of Schadler et al. (2006) and Tondl and Vuksic (2003). Moreover, Schadler et al. (2006) find that both FDI and foreign non-FDI financing capital positively contributed to the CEE economies' growth. Their interpretation of these results is that integration with the EU facilitated an increased use of foreign savings (even when it was not FDI), giving the CEE countries a growth advantage over other EMEs. Próchniak and Witkowski (2014b) also confirm the statistical impact of the total investment rate on economic growth in the EU-28 countries. Moreover, they find that an increase in the investment rate leads to the acceleration of GDP growth not only within the given economy but also in other EU countries, which points to very beneficial effects of investments in the EU as a whole.

Not only the amount but also the sectoral structure of capital inflows has played a significant role in the CEE countries' growth. Kinoshita (2011) analyses fifteen Central, Eastern and South-Eastern European countries in 2000–2007 and finds that FDI inflows had differential impact on the recipient economies depending on the sector to which they were directed (tradable vs. non-tradable). Investments in manufacturing positively affected exports growth and the current account balance while investments in the non-tradable sector led to increased imports and macroeconomic imbalances. Fidrmuc and Martin (2011) confirm the positive impact of FDI in the Central, Eastern and South-Eastern European region on industrial production

and economic growth and the weak relation between portfolio investment and the region's industrial growth.

The EU accession provided a strong impetus for reforms that boosted the CEE countries' export performance, deepened integration with the EU markets and supported income convergence. Rapacki and Próchniak (2009) indicate that the impact of the EU enlargement on economic growth in the region took place via two channels. The first channel entails the EU actions aimed at speeding up the progress of structural reforms in the CEE countries, changing their institutional environment and facilitating the flow of goods, services, capital, and labour. The second channel involves the EU policies aimed at direct reduction of income differences between countries and regions: the pre-accession funds and the EU cohesion policy after the accession. The structural and cohesion funds have been an additional source of financing investment in the NMS. This notwithstanding, regional disparities within the CEE countries have increased (see Box 2.2). According to Marzinotto (2012), the growing disparities may be due to inefficient allocation of EU funds, their poor management, their use for unsuccessful investments, or a combination of all three. Pukeline and Butkus (2012) underline that persistent differences between regions may have a negative impact on country' economic growth through ineffective distribution of resources.

The positive impact of the CEE economies' integration with the EU has been confirmed by abundant papers. IMF (2015) underlines that the EU accession provided a strong impetus for reforms that boosted the NMS export performance, deepened integration with the EU markets and supported income convergence. The EU single market provides opportunities for firms to grow, while at the same time subjecting them to stronger competition, raising incentives to improve productivity. Schadler et al. (2006) point out that the CEE countries embraced unique opportunities from trade-induced competition, pressures for policy reform and greater financial integration. Rapacki and Próchniak (2009) show that the catching up process accelerated when the EU enlargement was approaching: the speed of convergence amounted to 0.78% in 1996–2001 and 4.15% in 2001–2007. Similar results were obtained by Rapacki and Próchniak (2014): the beta parameter for the period after the EU accession was higher than in the previous period. The authors find that the EU enlargement significantly contributed to economic

growth of ten CEE NMS.[17] The results show a significant positive impact of foreign investments, economic freedom, progress of structural reforms and aid inflow on GDP growth rates.

Among the standard production factors, the increase in human capital has also had a positive impact on the CEE countries' convergence. Together with relatively low wages, the marked improvement in human capital was an important factor fostering growth in the region. Spruk (2011) analyses the conditional convergence in seven CEE countries[18] in 1991–2007. His estimates suggest that one additional year of total schooling boosts the rate of real GDP per capita growth by ca. 0.03 percentage points on average, holding all other factors constant. Kutan and Yigit (2009) find that human capital was the most important source of labour productivity growth in eight NMS[19] in 1995–2006. A McKinsey report (Labaye et al., 2013) lists the highly educated workforce and relatively low wages as core strengths of the CEE region in the eyes of foreign investors.

The literature also confirms the positive impact of expenditure on research and development, especially in the business sector, on growth and convergence. Pop Silaghi et al. (2014) find that business R&D spending positively contributed to economic growth in ten NMS[20] in 1998–2008. Importantly, the impact of public R&D spending was insignificant.

Trade integration and globalisation also positively affected economic growth in the CEE countries. The accession of those countries to the World Trade Organisation before joining the EU had a positive impact on trade and FDI, enhancing productivity growth by stimulating technology and know-how spill-overs as well as innovation activity. World Trade Organisation membership also helped lock in domestic reforms and improved foreign investors' confidence in the policy environment (Alam et al., 2008). Gurgul and Lach (2014) found the growth-stimulating effects of globalisation (as captured by the globalisation indexes published by the Swiss Economic Institute) in ten NMS[21] to be strong and robust, especially in the social and

[17] Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.
[18] Croatia, the Czech Republic, Estonia, Hungary, Poland, Slovakia, Slovenia.
[19] The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia.
[20] Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.
[21] Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.

economic dimensions. Interestingly, the social dimension (i.e. the number of internet and television users as well as trade in newspapers) had an equally strong or stronger positive impact on economic development in the CEE economies in the first two decades of transition as the economic dimension (i.e. the rise in international trade and FDI as well as reduction of import barriers). In turn, Próchniak and Witkowski (2014b) find positive impact of both the degree of openness and current account balance on economic growth in the EU-28 countries in 1993–2013.

Furthermore, before the global financial crisis empirical research underlined the role of financial deepening in fostering economic growth in EMEs whose financial systems are generally underdeveloped. According to the estimations of Abiad et al. (2007), in 1975–2004 financial integration and thus capital inflows have been two main factors contributing to per capita income growth and convergence within the EU. As argued in chapter 3, capital inflows in the CEE countries and in some countries of the euro area have accelerated the speed of convergence towards GDP per capita levels of higher income countries. Cojocaru et al. (2015) examine the impact of the private sector credit volume and of the banking system efficiency on economic growth in the CEE and CIS countries in 1990–2008. They find that banking system efficiency was more important and statistically significant, while the impact of private sector credit was quantitatively smaller and statistically insignificant. These results demonstrate that financial market efficiency and competitiveness were more important triggers of economic growth than the market size. Moreover, analysing 25 transition economies, Friedrich et al. (2010) find that the effect of financial integration was the strongest for countries that were most highly politically integrated with the EU. This suggests that political and financial integration were complementary and that political integration can considerably increase the benefits of financial integration.

In turn, research undertaken since the outbreak of the global crisis has focused on domestic financial markets and domestic savings rather than financial market development as such. As mentioned in section 2.3 above, Sahay et al. (2015), analysing a sample of 128 countries over 1980–2013, find that the relation between financial market development and growth is bell-

shaped: the positive effect of financial market development on growth weakens and eventually reverses at higher levels of that development. The authors find a similar non-linear effect of financial development on economic stability. Importantly, they show that too fast pace of financial development leads to instability. Claessens et al. (2011) analyse the behaviour of the major macroeconomic and financial variables over business and financial cycles. Their results show that financial cycles appear to play an important role in shaping recessions and recoveries. Recessions accompanied with financial disruptions tend to be longer and deeper than those that are not, and recoveries associated with financial booms tend to be shorter and stronger than other recoveries. World Bank (2014) underlines the role of sustainable financial development with a solid and transparent regulation and supervision framework for financial sector policies fostering growth. These results are consistent with the experience of those European EMEs which experienced a boom-bust cycle in the first decade of the 21st century (see section 3.2.3).

Among the domestic factors, macroeconomic stability, the quality of governance and business environment, and investments in infrastructure (particularly in information and communication technology, ICT), were important drivers of productivity growth and convergence of the CEE economies. The World Bank research (Alam et al., 2008) demonstrates that after the initial period of transition, macroeconomic stabilisation was one of the key factors attracting FDI and stimulating economic growth. Labaye et al. (2013) underline that the CEE economies have had relatively strong balance sheets and their exchange rates have been comparatively stable versus the euro. The stabilisation of inflation after the initial period of transition[22] also played a positive role in fostering growth and convergence. This is confirmed e.g. by Rogut and Roszkowska (2006) who find the relation between inflation and GDP growth in transition economies to be non-linear: low inflation supports economic growth but higher inflation rates destabilise the economy and decrease growth. This is because high inflation is usually volatile and difficult to predict, making current and future returns to investment less predictable and thus reducing the propensity to invest. On the other hand, low inflation may

[22] After the initial period of high inflation, in late 1990s inflation in most of the CEE countries has stabilised at levels observed in more developed Western European economies. Romania, where inflation continued at two-digit levels until 2004, is an exception.

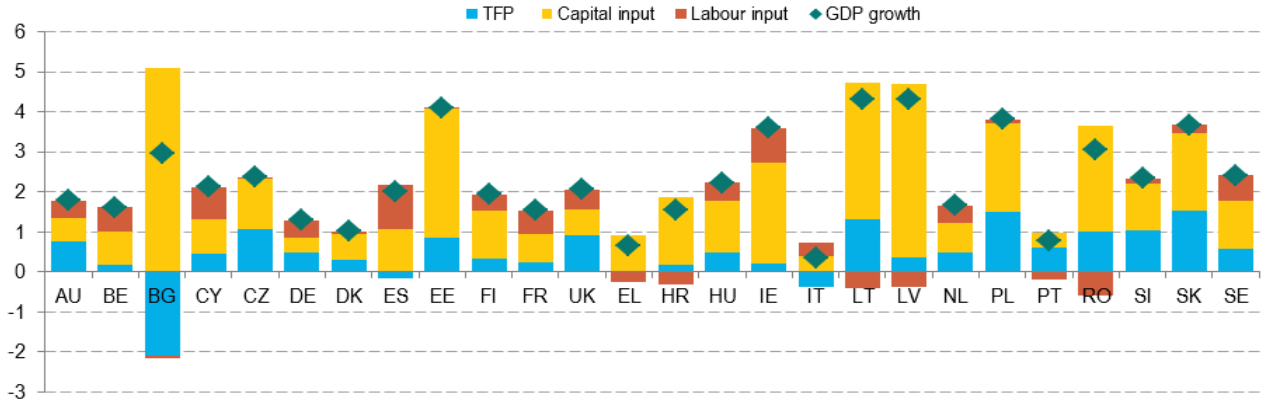
positively affect production by reducing real wages or declining the real interest rates (Wojtyna, 1996). In turn, the improvement of business environment, relatively low tax rates and low corruption help to attract investments. Labaye at al. (2013) underline that the CEE region ranks just behind the OECD high-income economies in terms of ease of doing business. Moreover, statutory corporate tax rates average 18%, compared with an average of 26% in the EU-15, 22% in Asia, 28% in Latin America, and 29% in Africa. On metrics of corruption, the CEE economies lag behind the EU-15 nations but are far ahead of China, India, Brazil, and Russia.

Furthermore, empirical research confirms the significant role of the government sector size and of the magnitude of administrative burden for GDP growth. Although most papers find a negative relation between government consumption and economic growth, this relation also depends on the structure of government spending and the quality of institutions. Afonso and Jalles (2014) analyse a panel of 155 developed and developing countries over the period 1970–2008. Their results show that high levels of expenditure on social security and welfare can be detrimental to growth, whereas government spending on both education and health tends to boost growth. Jerzmanowski (2011) demonstrates that a large scale of government spending lowers growth when combined with good institutions and increases growth in countries with weak institutions – in other words, government spending can make up for insufficiently mature institutions. In a similar vein, Próchniak and Witkowski (2014b) find positive impact of a high degree of economic freedom (measured by the Fraser Institute's Economic Freedom of the World index) as well as good quality of governance (measured by the World Bank Worldwide Governance Indicator) on GDP per capita growth in the EU-28 countries in 1993–2013.

The structure of the enterprise sector is another factor affecting the economic growth in the CEE countries. Alam et al. (2008) find that the location, size, age and ownership structure of firms had a significant impact on productivity growth in the NMS. The bulk of productivity growth has been achieved through efficiency gains within firms, especially among the larger ones. Moreover, reallocation of resources tends to contribute more to productivity growth in private firms than in state-owned ones, and foreign-owned firms tend to depict higher productivity growth than domestic ones, whether private or state-owned. Dall'Olio et al. (2014), using

a panel of micro-data on firms from the EU countries in 2003–2008, analyse the impact of both country-specific factors and firm characteristics on productivity growth. For ten NMS of the EU[23], they find that the former set of variables (the stock of inward FDI, business regulations facilitating foreign investment, and the availability of private credit) are the dominant factors. However, their analysis shows that the structure of the enterprise sector, especially the share of international companies, also matters. These results suggest that accession to the EU has been beneficial for the NMS because the ease with which foreign firms may penetrate their markets facilitated the transfer of technology and the diffusion of best practices.

Figure 5.3. Decomposition of GDP growth (percentage points, 1997–2014 averages)

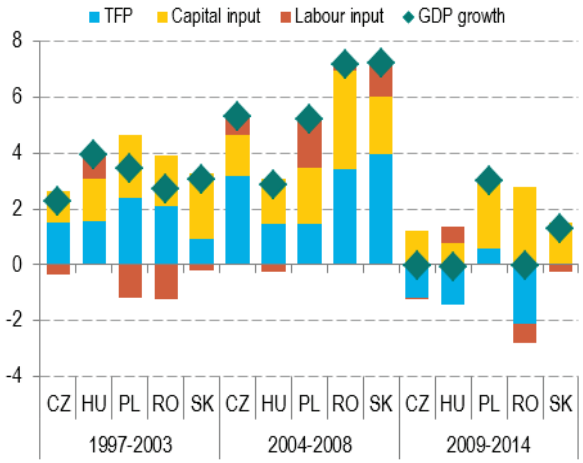


Source: Eurostat data, own calculations.

Figure 5.4. GDP per capita in 1997 (log of thousand EUR in PPS, horizontal axis) and average contribution of capital deepening to GDP growth in 1997–2014 (percentage points, vertical axis)

Source: Eurostat data, own calculations.

Figure 5.5. Contributions to GDP growth in 1997–2014 (subsamples averages)



Source: Eurostat data, own calculations.

[23] Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia.

Box 5.1 Decomposition of differences in GDP per capita between the CEE and the EU-15 countries

A useful way to analyse the growth in GDP per capita is to break it down into three major components: labour productivity as well as labour market and demographic effects (OECD, 2000; Alam et al., 2008; GUS, 2015). Labour productivity is represented by the GDP divided by the total number of working hours (the number of employed persons multiplied by the average number of hours worked). The labour market effect is measured by changes in employment, activity rates and hours worked, and demographics is described by the share of working age population in total population. This decomposition is reflected by the following equation:

$$\frac{GDP}{POP} = \frac{GDP}{E*H} + \frac{E}{LF} + \frac{LF}{WAP} + \frac{WAP}{POP} + H, \qquad \text{(B.2.1)}$$

where *E* stands for employment, *H* for the number of hours worked, *LF* for the labour force (active population), *WAP* for the working age population (i.e. aged 15 to 64), and *POP* for the total population. To answer the question which factors contribute the most to the differences in economic development level of the CEE versus the EU-15 countries, differences between the level of each component in the two country groups are calculated.

The differences in GDP per capita between the CEE and the EU-15 countries are mainly due to differences in labour productivity (Figure **B 5.1**). Labour productivity in the CEE countries is much lower than the EU-15 average, with the highest differences observed in Bulgaria and Romania and the lowest in the Czech Republic and Slovakia. The second-important factor is significantly lower labour utilisation in the CEE countries (except for the Czech Republic) compared to the EU-15 countries. The activity rates are particularly low in Romania, Poland and Hungary. In turn, a higher average number of hours worked and better demographic structures in the CEE countries are the factors diminishing the differences in GDP per capita versus the EU-15 countries. In recent years, moreover, relatively low unemployment rates in the CEE countries have contributed to closing the GDP per capita gap.

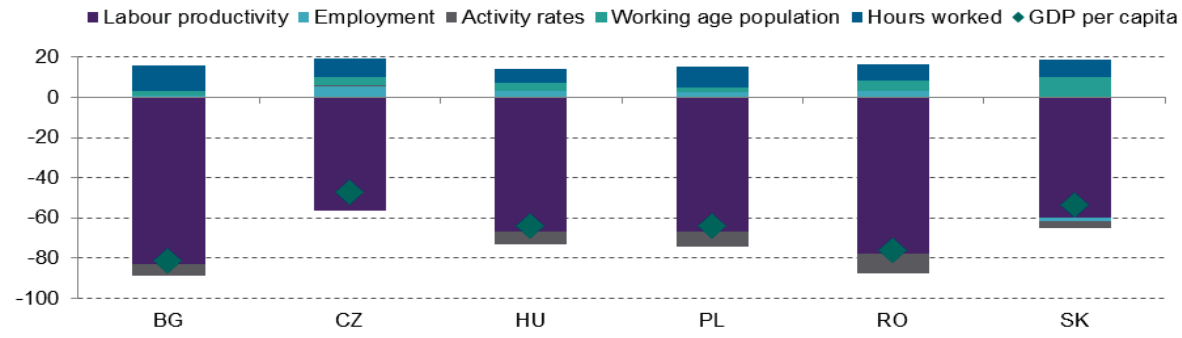
Labour productivity growth has been the main factor determining the growth of GDP per capita in all six CEE countries in 2000–2015 (Figure B 5.2). The decomposition of GDP per

capita *growth rates* (see equation B.2.2 below) shows that, in most of the CEE countries, labour productivity growth was much higher in the years before and just after the EU accession and has slowed down after 2009 in all countries except for Poland.

$$\Delta_t\left(\frac{GDP}{POP}\right) = \Delta_t\left(\frac{GDP}{E*H}\right) + \Delta_t\left(\frac{E}{LF}\right) + \Delta_t\left(\frac{LF}{WAP}\right) + \Delta_t\left(\frac{WAP}{POP}\right) + \Delta_t(H) \qquad \text{(B.2.2)}$$

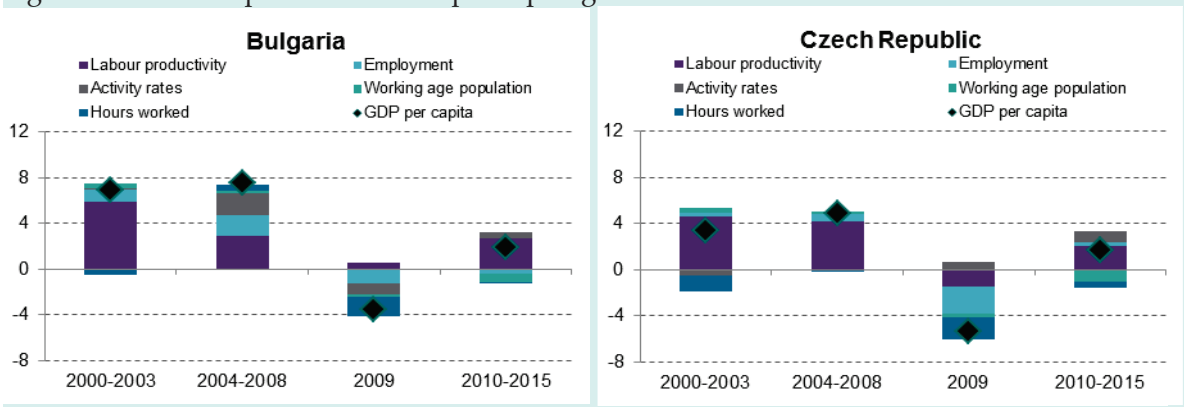
The second-important factor positively contributing to economic growth in CEE countries in 2009–2015 was an increase in the labour force. Activity rates increased visibly, most notably in Hungary, the Czech Republic and Poland. On the other hand, in all CEE countries demographic effects in that period were negative, i.e. the share of working age population in total population decreased. A decrease in the average number of hours worked also contributed to lower GDP per capita growth after the crisis in all CEE economies.

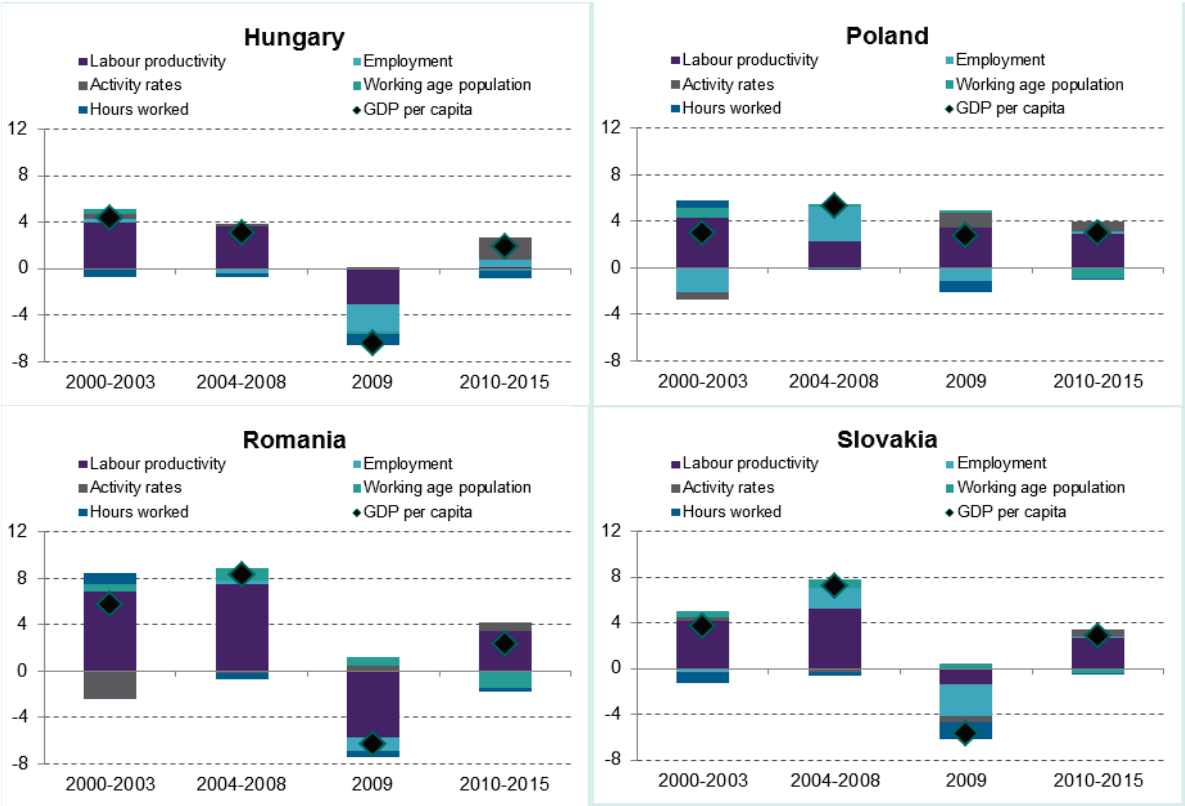
Figure B 5.1 Decomposition of relative differences in GDP per capita between the CEE and the EU-15 countries in 2015 (% of the EU-15 average)



Source: Eurostat data, own calculations.

Figure B 5.2 Decomposition of GDP per capita growth in 2000–2015





* Data for Bulgaria start in 2001.

Source: Eurostat data, own calculations.

Box 5.2 Cross-country versus within-country income convergence

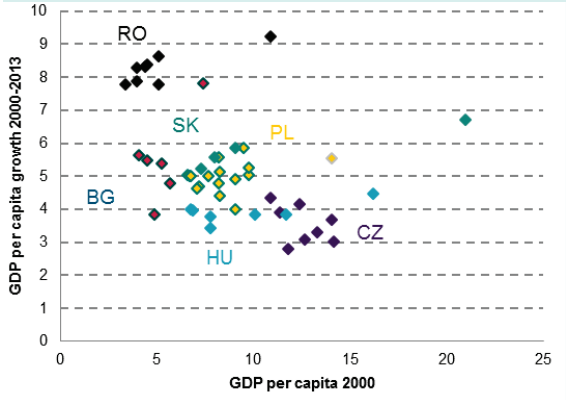
The convergence of GDP per capita across countries has been accompanied by both beta and sigma divergence within the CEE countries, i.e. across the countries' regions. Monastiriotis (2011) finds that regional disparities in the region increased substantially over the previous two decades and regional productivities and incomes became significantly polarised. Also Smętkowski and Wójcik (2009) demonstrate both beta and sigma divergence across regions of the NMS in 1998–2006. They indicate that regional disparity of GDP per capita within countries has increased, to the largest extent in Bulgaria and Romania. The results confirm the findings of earlier research (e.g. Tondl and Vuksic, 2003).

Capital areas grow much faster than other regions due to agglomeration advantages and better resources (e.g. higher human capital or more research institutions). Smętkowski and

Wójcik (2009) show that the nature of the region (metropolitan or industrial) and the shares of market services and the public sector in value added were the most important factors determining regional economic growth in the CEE countries (Figure **B 5.1**). Moreover, Tondl and Vuksic (2003) find that the EU border regions of the Czech Republic, Slovakia, Hungary, Poland and Slovenia, which receive a large share of FDI and have established intensive cross border relations, generally enjoy higher growth than other regions of the analysed countries.

The highest regional differences in GDP per capita among the CEE countries are observed in Romania and Slovakia. In 2014[1)] GDP per capita in the most developed region in Romania was almost four times as high as the value in the least developed region. In Slovakia the ratio was 3.5. Poland has the lowest regional differences in GDP per capita: the highest to lowest GDP per capita ratio was 2.2. The Czech Republic has relatively large and Bulgaria and Hungary relatively small regional GDP per capita differences (Figure B 5.2). The disparities are mainly due to very high GDP per capita levels of the capital cities. E.g. in Romania, after excluding the Bucharest region, the regional differences in GDP per capita decline by more than a half. In Poland, by contrast, the capital region (Mazowieckie) includes not only the very rich Warsaw district but also relatively poor, rural districts to the east.

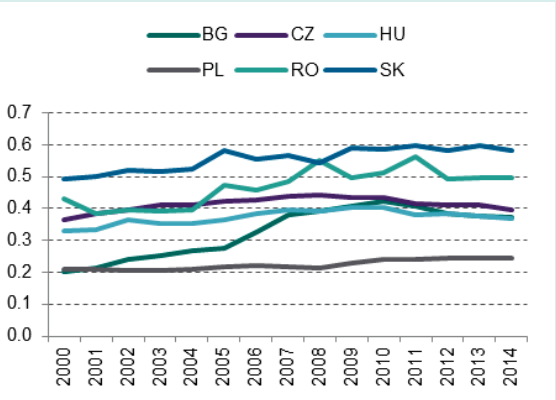
Figure B 5.3. Beta convergence on the regional level in 2000–2014



* The regions are defined at the NUTS2 level based on Eurostat's NUTS classification (Nomenclature of territorial units for statistics).

Source: Eurostat data, own calculations.

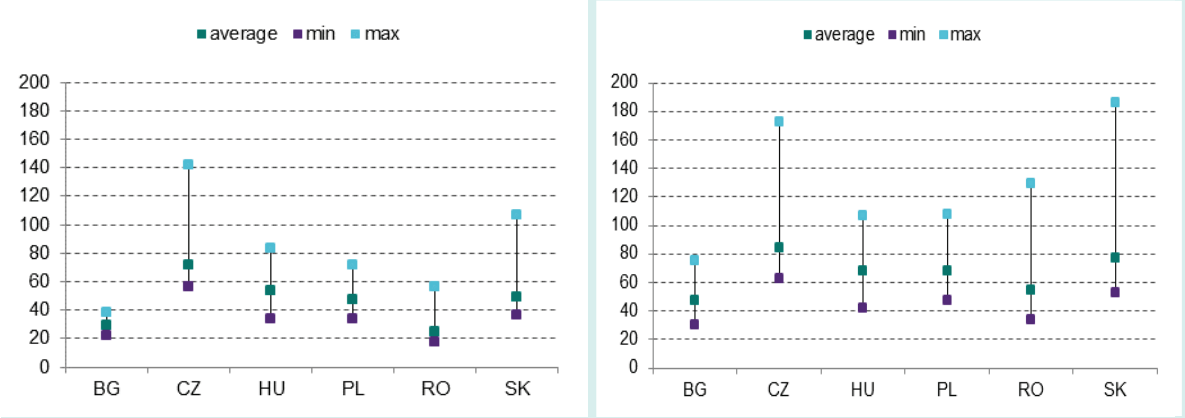
Figure B 5.4. Sigma convergence on the regional level in 2000–2014



* See Figure B.2.3 for notes.

Source: Eurostat data, own calculations.

Figure B 5.5. Regional development of GDP per capita (in PPS) in 2000 (left panel) and 2014 (right panel) (% of the EU average)



* See Figure B.2.3 for notes.

Source: Eurostat data, own calculations.

[1)] As of 30th June 2016 (the cut-off date for the statistical data included in this paper), the GDP per capita data at the regional level for 2015 were not available yet.

6. Empirical analysis

6.1. Data and empirical approach

In the following, we report the results of our empirical analysis of real convergence of CEE countries towards more developed EU countries over 1997–2014. The explained variable is the GDP per capita measured in 2010 constant prices (source: Eurostat). The sample covers EU-26 countries, i.e. the EU group without Croatia and Luxemburg over the years 1997–2014 due to availability of the statistical data. Data availability was one of the most serious constraints of our analysis: in most cases usable data for the NMS are available only from the second half of the 1990s. Moreover, our panel is unbalanced in the case of some variables due to missing observations. We start from analysing the absolute and conditional convergence of CEE and other NMS countries towards more developed EU economies. Then we aim to answer the question which factors were crucial for the GDP per capita growth in CEE countries.

Pinpointing precisely all the variables that matter for GDP per capita growth is hardly possible but there is consensus as to which variables are the key growth factors. Sala-i-Martin et al. (2004) deal with the problem of variable choice using the Bayesian averaging of classical estimates. More recently this approach was applied by Próchniak and Witkowski (2013) to the panel of 127 countries. They found that the variables which are crucial for economic growth are: investment rate, life expectancy, population growth and an indicator of economic freedom. This is in line with the prevailing growth models where GDP per capita growth is the function of savings rate, population growth, depreciation rate and technological progress. Among other variables significantly affecting growth, Próchniak and Witkowski (2013) indicate: expenditures on education, domestic credit for private sector, population aged 15–64, and inflation. The results are in line with the initial findings of Sala-i-Martin et al. (2004) who also showed that the statistically significant variables include: a measure of value added structure, openness of the economy and primary schooling enrolment rate (positive impact on growth) and the fraction of primary exports in total exports as well as real exchange rate distortions (negative impact). In any case, the initial GDP per capita level turns out generally crucial in growth regressions.

Drawing on the results of other authors as well as the theoretical literature and having in mind data limitations, we have chosen several variables which could affect GDP per capita growth in the CEE and other EU countries in the analysed period of time. Optimally, the time series representing the explanatory variables should be available for all countries for a considerably long period of time. Ideally, they should cover several economic cycles and not include any serious regime shifts, which in the case of the NMS is hardly possible. As a result, we came up with the set of potential regressors which we divided into the following sub-sets: the traditional (core) growth factors, human capital, innovation activity, the quality of institutions, demographic trends, external trade and FDIs, financial market development, and macroeconomic stability measures (Table A. 1 in Appendix 2).

In our empirical approach we use panel data to account not only for the differences between countries in the sample but also for the time series variation of the data. In the empirical growth literature two approaches are generally used to analyse the convergence process and the determinants of growth: cross-sectional or panel approach. In the cross-sectional approach, the GDP per capita growth rates are averaged over the entire time period analysed and the initial level of income per capita and contemporaneous averages of control variables serve as explanatory variables. The panel approach takes into account both the cross-sectional and the time-series components of the dataset, either by using annual observations or by taking averages of the dependent and explanatory variables over non-overlapping intervals, as well as the initial level of GDP per capita for each interval as one of the regressors (Borys et al., 2008). We decided to employ the panel approach because the variation of explanatory variables over time provides additional explanatory power and degrees of freedom for the regression analysis. Moreover, the cross-sectional regression would fail to take into account the time periods in which there was an unusual growth performance, such as the recession following the global financial crisis of 2009.

We decided to perform our analysis on annual data rather than data averaged for intervals of three to five years. The main advantage of the averaged data is that the results are not influenced by business cycle fluctuations. However, the significant reduction of the number of

observations is a serious disadvantage, particularly in relatively small samples such as ours[24] so we opted for the annual frequency of the panel.

To check the robustness of our results, we used different econometric techniques. The statistical difficulties related to the estimation of growth equations include: the dynamic nature of the data-generating process, endogenous regressors, the difficulty in finding valid instruments for instrumental variables estimation, measurement errors, omitted variable bias, and a small number of time periods (Cojocaru et al., 2015). In the literature, a variety of estimators are used in the convergence equations; among the more and more commonly used ones are the Arellano and Bond (1991) first-differenced general method of moments (GMM) estimator and the system GMM estimator introduced by Arrelano and Bover (1995) and further developed by Blundell and Bond (1998). However, Hauk and Wacziarg (2009) performed Monte Carlo simulations and found that the fixed-effects estimator and the Arellano-Bond GMM estimator overstate the speed of convergence under a wide variety of assumptions and bias towards zero the slope estimates on variables measuring the human and physical capital accumulation[25]. The Blundell-Bond system GMM estimator corrects for some of these deficiencies, but suffers from a violation of some moment conditions, similarly leading to a bias (Hauk and Wacziarg, 2009). To check the stability of our parameters of interest, we therefore use several estimators. We start from pooled ordinary least squares (OLS) and test the significance of the individual fixed and random effects for the analysed countries. Then we apply the generalised least squares (GLS) and the two-stage least squares (2SLS) estimators. Finally, we check the performance of first-differenced and system GMM estimators in our sample.

Apart from analysing the average impact of the growth factors over the entire time frame, we check the stability of the parameters of interest in time. In most empirical studies it is assumed that the relation captured by the estimated equation is stable over time and so are the

[24] After transforming the annual data into three-year non-overlapping intervals, the total number of observation in our sample would decrease from 468 (26 countries, 18 years) to 156 (26 countries, 6 intervals).

[25] According to Barro (2012), estimation of convergence equations with country fixed effects is appropriate in the case of samples with relatively long time frame; otherwise the fixed effect estimator is inefficient and may generate an overstated estimate of the convergence rate. In conditional convergence equation the introduction of fixed effects kills all variables that hardly vary over time within the sample (e.g. demographic variables). Moreover, the fixed effects estimator makes it hard for any slowly changing individual variables to turn out significant since they are highly co-linear with the fixed effects.

estimated coefficients. We relax this assumption and check the time stability of the parameters by either dividing the full sample period into three non-overlapping sub-periods or by performing the growth regression on five-year rolling windows. Additionally, in the case of absolute convergence, we performed year-by-year cross section estimates. To check the cross-country stability of the parameters, we ran separate regressions for the old and new EU member states and estimated the regressions skipping one country at a time.

6.2. Absolute convergence

In the first step we test for absolute (unconditional) convergence of CEE and other NMS countries towards more developed EU countries in 1997–2014. The explained variable is the average annual growth rate of the real GDP per capita at 2010 constant prices while the only explanatory variable is the one-period lagged logarithm of the GDP per capita level:

$$\frac{1}{T}\ln\frac{y_{i,t}}{y_{i,t-1}} = \alpha_0 + \alpha_1 \ln y_{i,t-1} + \varepsilon_{it} \qquad (6.1)$$

where the symbols used have the same interpretation as those in equation 2.1 in section 2.1. Negative and statistically significant value of the parameter α_1 is indicative of absolute β-convergence, the speed of which can be calculated as: $\beta = -\frac{1}{T}\ln(1-\alpha_1 T)$ (see equation 2.3 in section 2.1).

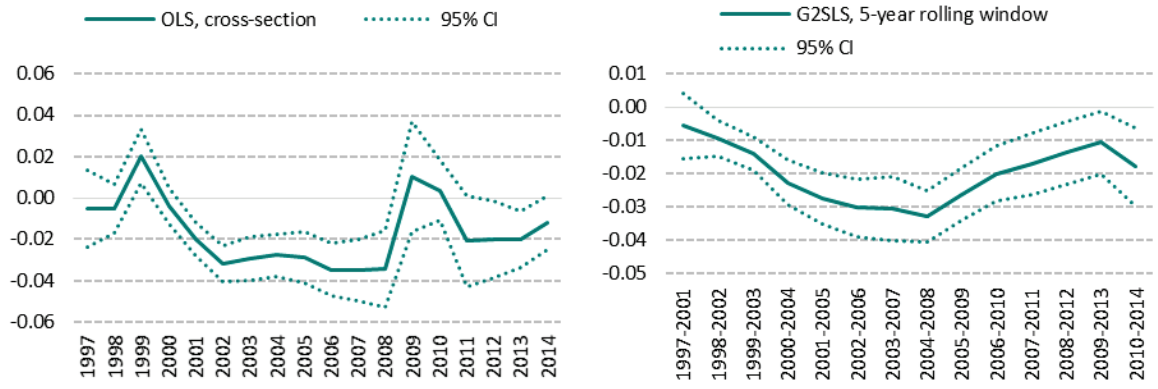
Our results confirm that CEE and other NMS countries converged towards more developed EU countries in absolute terms in 1997-2014. The estimates of lagged GDP per capita are negative and significant regardless of the estimation method, confirming that on average in the analysed period, GDP per capita growth in countries with lower initial GDP per capita level was higher than in more developed economies (Figure 5.1 in section 5.1). The results of OLS estimation indicate that the parameter by initial GDP per capita level varies around 2% on average (Table A.2 in Appendix 2) and is in line with the result prevailing in the literature that the convergence rate amounts to ca. 2% (Barro, 2012). The fixed-effects and Arellano-Bond estimations generate very high values of the parameter by lagged GDP per capita, overstating the speed of convergence. The best results are obtained with generalised two-stage least squares (G2SLS) estimator with random effects. The estimated parameter value is higher than

the corresponding fixed effects estimate and lower than the OLS one (see Bond et al., 2001). To check the robustness of the results we test the absolute convergence equation with time dummies, time trend and dummy for 2009 (Table A.3 in the Appendix 2).

The speed of absolute convergence of CEE and other NMS countries was not stable in the analysed period: relatively fast convergence observed in 2001–2008 was interrupted by the financial crisis. The results of year-by-year cross-section and five-year rolling window estimates (Figure 6.1) indicate that the parameter by lagged GDP per capita was negative and significant in 2001–2008, varying between –3.5% and –2.0%.[26] In 2009–2010 the parameter became insignificant and afterwards it was again negative but lower (in absolute value) than before the crisis, as signalled by an estimate of α_1 equal to –1.8% on average in 2010–2014.

When the sample was split into the 'old' and new EU member states, absolute convergence could only be confirmed for the latter group. For the 14 'old' member states (EU-14), the estimate of α_1 varied around zero and was not statistically significant (Table A.4 in Appendix 2). Moreover, in the last few years the parameter even became positive and significant (0.03 in the 2010–2014 sub-period), indicating real divergence among those countries. In the NMS, by contrast, the parameter was negative and significant, varying around –0.03 throughout the entire sample period (Figure 6.2).

Figure 6.1. Time stability of the absolute beta convergence parameter in the EU-26 in 1997–2014 (year-by-year cross-section – left panel, five-year moving average window – right panel)



* Left panel: OLS estimator; right panel: G2SLS random effects estimator.
Source: own estimates.

[26] The results of the system GMM estimator for the five-year sub-periods again show much higher values of the parameter by lagged (log) GDP per capita.

Figure 6.2. Stability of the absolute convergence parameter for 'old' and new EU member states in 1997–2014 (five-year moving average window)

* G2SLS random effects estimator.

Source: own estimates.

6.3. Conditional convergence

In this section we verify the conditional convergence of CEE and other NMS countries towards more developed EU countries in 1997–2014 i.e. we control for the fact that NMS can potentially converge to lower steady-state level than richer economies. The explained variable is again the annual growth rate of real GDP per capita at constant 2010 prices while the set of explanatory variables includes not only the one-period lagged (log of) GDP per capita but also various control variables capturing the differences in steady states between the analysed countries:

$$\Delta \ln y_{i,t} = \alpha_0 + \alpha_1 \ln y_{i,t-1} + \sum_{j=2}^{n} \alpha_{ij} x_{ij+1,t} + \varepsilon_{it}, \quad (6.2)$$

where the symbols used have the same interpretation as those in equation 2.1 in section 2.1.

In the first step, we analyse the role of traditional growth factors in the growth process of CEE and other EU countries and confirm their significance. Following the standard Solow growth model, we start with a simple equation where apart from initial GDP per capita level, the rate of investment (specifically, of gross fixed capital formation), the growth rate of labour

supply (as measured by economically active population), and population growth were included[27] (see Mankiw et al., 1992 or Barro, 2012). All these standard growth factors are significant and their signs are consistent with economic intuition (Table 6.1). In line with the Solow model, an increase in the investment ratio and in labour supply have a positive impact on GDP growth while the impact of population growth is negative. When we split the sample into non-overlapping time intervals, the results show that the investment rate was an important growth factor throughout all the subsamples while the impact of labour supply growth was positive and statistically significant only in the period before the global financial and economic crisis. The results are robust to the estimation method chosen.

The analysis of time stability of the conditional beta convergence shows that the process of convergence of CEE and other NMS countries towards more developed EU countries has come to a halt since the beginning of the crisis. The conditional beta convergence parameter is estimated at ca. –2% on average in the whole period (Table 6.1). However, the results of both five-year moving window and five-year non-overlapping window estimates show that before the crisis the coefficient by lagged GDP per capita was negative and significant. In the following years the parameter has become insignificant and close to zero (Figure 6.3).

The fall in investments and slowdown in convergence explains a significant part of the drop in GDP per capita growth in CEE countries after the crisis. We calculated to what extent changes in traditional growth factors (investment rate, labour force and population growth) can explain changes in GDP per capita growth between the pre-crisis period (2003–2007) and the more recent one (2010–2014). The results show that the drop in investments observed in most of the CEE countries (Poland is an exception) can explain a considerable part of the fall in their GDP per capita growth after the crisis (in Hungary and Slovak Republic drop in investments explains over 70 and 45% of the fall in the GDP per capita growth rate in these countries respectively;

[27] For robustness check we included dummy for 2009, time trend and time dummies. The best results were obtained with dummy for the crisis year 2009.

Figure 6.4). The second most important factor is the slowdown of the convergence process. In Poland it accounts for one fourth of the GDP per capita slowdown after the crisis. Changes in labour force and population were relatively less important.

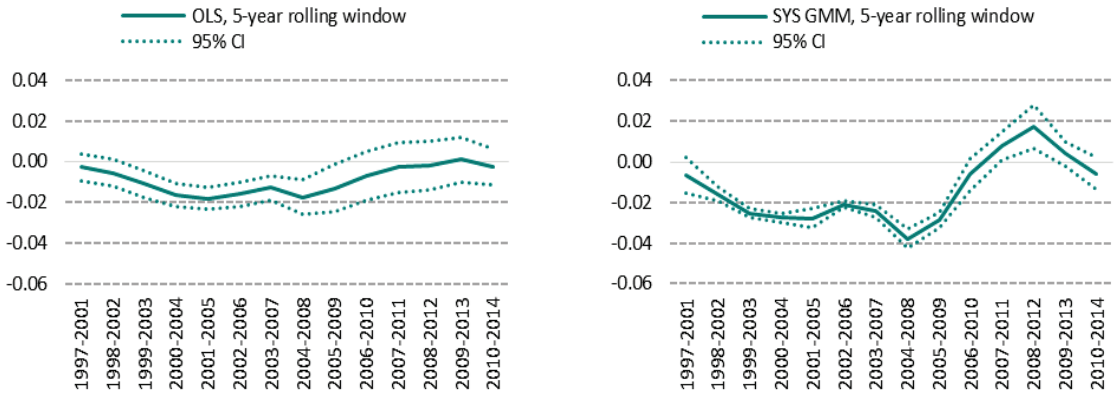
Table 6.1. The impact of core growth factors on GDP per capita growth in the EU-26 countries in 1997–2014

	OLS	FE	RE	GLS	DIFF GMM	SYS GMM
lnY(-1)	–0.009***	–0.054***	–0.010***	–0.009***	–0.061***	–0.019***
	(0.002)	(0.008)	(0.003)	(0.003)	(0.008)	(0.005)
INV	0.262***	0.417***	0.295***	0.245***	0.401***	0.420***
	(0.040)	(0.042)	(0.035)	(0.038)	(0.026)	(0.027)
DACTIVE	0.295***	0.221***	0.288**	0.155**	0.110*	0.238***
	(0.095)	(0.087)	(0.089)	(0.062)	(0.065)	(0.068)
DPOP	–1.033***	–1.229**	–1.011***	–1.000***	–0.882*	–0.955**
	(0.301)	(0.298)	(0.258)	(0.254)	(0.463)	(0.073)
D2009	–0.081***	–0.073***	–0.081***	–0.063***	–0.072***	–0.085***
	(0.009)	(0.005)	(0.005)	(0.003)	(0.001)	(0.002)
Obs.	445	445	445	445	432	445
Adj. R^2 within		0.56	0.52			
between		0.69	0.65			
overall	0.52	0.37	0.52			
F-test		4.29				
		(0.000)				
Hausman test			59.5			
			(0.000)			
AB(1)					–2.947	–3.649
					(0.003)	(0.000)
AB(2)					–1.950	–1.879
					(0.051)	(0.060)

OLS – ordinary least squares estimator with robust standard errors; FE / RE – fixed effects / random effects estimator; GLS – general least squares estimator with panel-specific AR1 autocorrelation structure and heteroscedastic error structure; DIFF GMM / SYS GMM – two-step Arellano-Bond / Blundell-Bond system estimator; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimations.

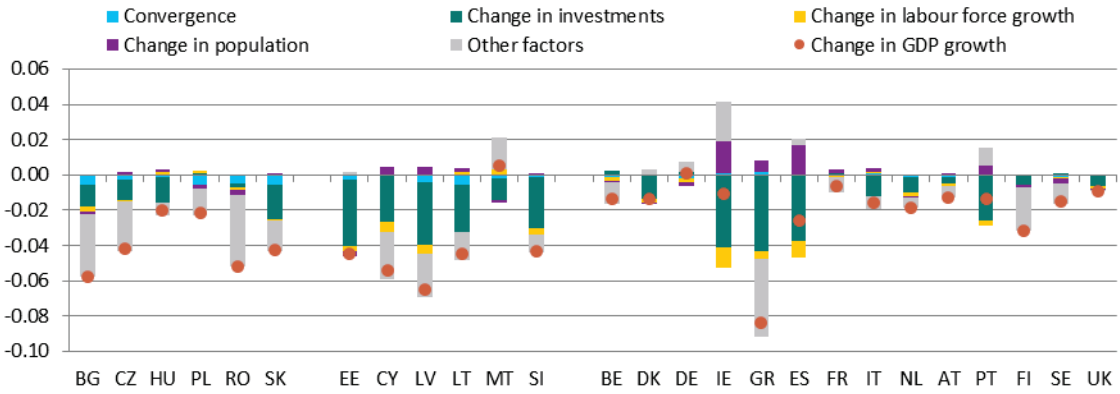
Figure 6.3. Estimates of the conditional convergence parameter in the EU-26 countries in 1997–2014 (five-year rolling window)



* Left panel: OLS estimation, right panel: system GMM estimation.

Source: own estimates.

Figure 6.4. The role of traditional growth factors in explaining the change in GDP per capita growth between 2003–2007 and 2010–2014



Source: own estimates.

In the second step, we scrutinise the relation between human capital and GDP per capita growth in EU countries and conclude that it is the capacity utilisation of educated labour force rather than the quantity that matters. Measurement of human capital presents great practical difficulties. We decided to use the share of active population or employed aged 20–64 with (i) tertiary, (ii) secondary or (iii) at least secondary education as our proxies for the quality of available labour force. In turn, we use the employment rates of those aged 20–64 with (i) tertiary or (ii) secondary education as our proxies for the capacity utilisation of the educated workforce in the production process. On average in the analysed period, the parameters by the human capital variables are not significant (Table A.5 in Appendix 2). However, estimates for five-year overlapping intervals show that in the past years the relation between

the employment rates among workers with tertiary and secondary education and the GDP per capita growth has become positive and significant (Figure 6.5).

Third, our results confirm a positive impact of innovation activity on the GDP per capita growth in the EU-26 countries, more so with time. Similarly as in the case of human capital, finding appropriate measures of innovation is difficult. Usually, total R&D expenditures or R&D expenditure of individual sectors (corporate and government sectors) are used in the growth equations. Apart from those proxies we have also tested employment in technology and knowledge-intensive sectors as well as the total number of total and high-technology patent applications. A significant relation between R&D expenditure and growth is rather rejected by data. In turn, our results point to a strong positive impact of the share of employment in high-technology and knowledge-intensive sectors in total employment (Table A.5 in Appendix 2), an impact that has become stronger and stronger over time (Figure 6.6). The impact of high-technology patent applications has also been positive (Figure 6.6).

Fourth, the role of trade in explaining the GDP per capita growth has increased over time, whereas the role of FDI has decreased. Our proxy for trade is the openness ratio (i.e. the sum of exports and imports relative to GDP) and change in the export market share (Table A. 1 and Table A.6 in Appendix 2), which turned out to be positively related with GDP growth, more so with time (Figure 6.7). By contrast, inward and outward FDI played an important role in explaining the GDP per capita growth in the EU-26 countries in 1997–2005. In the following years, their role has significantly decreased (Figure 6.8), which is an important result, consistent with our considerations in section 3.3.

Fifth, as regards financial market development, a large size of the domestic capital market is positively related to GDP growth while a large credit stock is negatively related to growth; it is worth noting that the former relation appears to be non-linear and is especially strong in the NMS. Our results show a significant positive relation between the market capitalisation of listed companies relative to GDP and GDP growth for most of the analysed period. However, after the global crisis the strength of the relation has weakened (Figure 6.9, left panel). In turn, the insignificant relation between domestic credit to private sector and growth

has become significant and negative after the crisis (Figure 6.9, right panel). The latter result may be largely driven by the fact that 'old' EU member states, which generally grow at slower rates, are characterised by higher stocks of credit to the private sector than the NMS. We checked the strength of the two relations separately for the two country groups and concluded that the size of the stock market was more important for the economic growth than the credit stock and that the relation between market capitalisation and growth was much stronger in the case of the NMS. With view to the recent findings that the relationship between financial market development and growth is non-linear (Sahay et al., 2015; see section 2.3), we tested this hypothesis and found that, indeed, it holds in the case of market capitalisation whose positive effects on growth weaken at higher levels of this indicator (Table A.8 in Appendix 2).

Sixth, our results confirm a positive and significant relation between the quality of institutions, especially credit and business regulations, and economic growth. Our choice of proxies for the quality of institutions is, to a large extent, dictated by the availability of sufficiently long time series. We use the Fraser Institute's Economic Freedom of the World index and its three sub-indices (the credit market regulations, labour market regulations and business regulations). Our results point to a positive and significant relation between the economic freedom, especially of the quality of credit and business regulations and GDP per capita growth (Table A.7 in Appendix 2). By contrast, labour market regulations are not correlated with GDP, which may be due to heterogeneous structure of the underlying indicator[28].

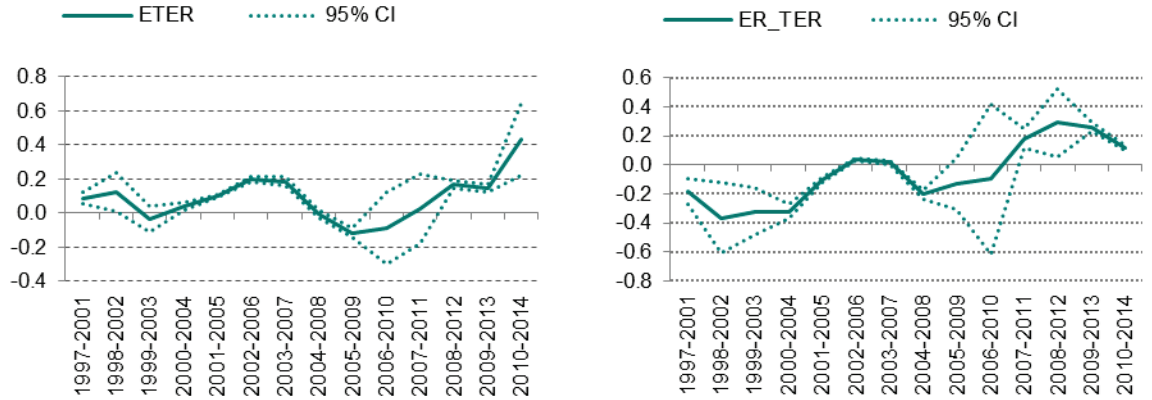
Last, testing the influence of macroeconomic stability measures on GDP per capita growth has also brought mixed results, with the negative relation between inflation and growth observed before the global crisis becoming insignificant post-crisis. Among variables measuring the degree of macroeconomic stability, we test the impact of inflation, share of government consumption in GDP and total government debt relative to GDP. We expect high share of government consumption and high debt to negatively affect the GDP per capita growth. As regards inflation, we expect that negative impact of inflation on growth can materialise only in relatively high inflation periods (see the considerations in section 5.2). Our results confirm

[28] The index comprises various labour market regulations: minimum wage regulations, hiring and firing regulations, centralised collective bargaining, hours regulations, and mandated cost of worker dismissal.

that the impact of inflation strongly depends on the level thereof. Before the crisis, the parameter by the inflation rate was negative. Since 2010, when price growth turned very low or negative in most of the EU-26 countries, the relation between inflation and growth became statistically insignificant (Figure 6.10). In turn, the relation between the share of government consumption in GDP and growth was negative and significant in 1998–2008. During the financial crisis it became insignificant and then again turned negative and significant in the post-crisis period. Finally, we could not confirm any significant relation between government debt and growth (Table A.7 in Appendix 2).

Given the above-discussed estimation results, we checked which factors – apart from the drop in investment rate and slowdown in convergence process – explain the decrease in the GDP per capita growth in the CEE countries. Specifically, we calculated to what extent changes in both traditional growth factors and other variables analysed above can explain changes in the GDP per capita growth between the pre-crisis period (2003–2007) and the post-crisis one (2010–2014). It turned out that apart from investments and slowdown in convergence, the slowdown in trade observed in all the CEE countries (but to largest extent in Slovak Republic, Poland and Hungary) explained significant part of the fall in their GDP per capita growth. In Hungary and the Slovak Republic part of the negative changes in the GDP per capita growth was also due to drop in innovation activity and capacity utilisation of educated labour force. Contrary, significant increase in employment rates in Poland and in innovation activity in Romania positively contributed to changes in the GDP per capita growth after the crisis (Figure 6.11).

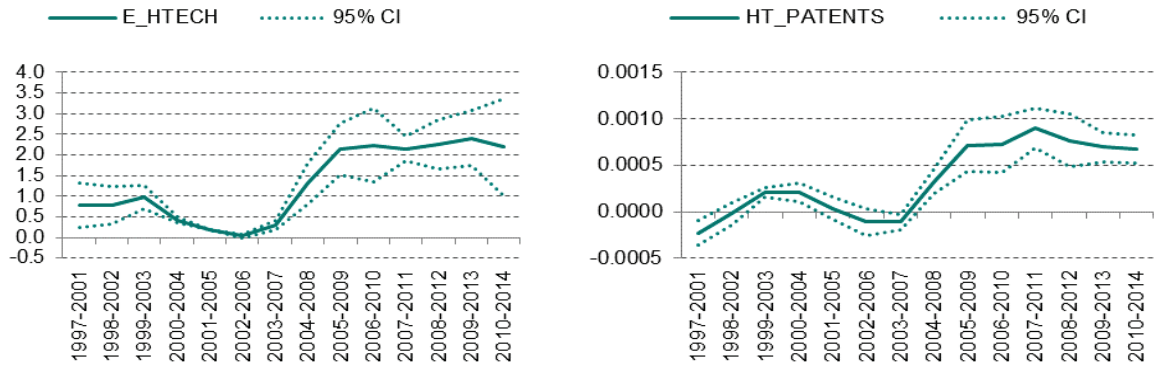
Figure 6.5. Changes in the estimated parameter by the share of employed (left panel) and employment rate (right panel) among workers with tertiary education in 1997–2014 (five-year rolling window)



* Estimated with two-step Blundell-Bond system estimator. Share of employed and employment rate are assumed to be endogenous.

Source: own estimates.

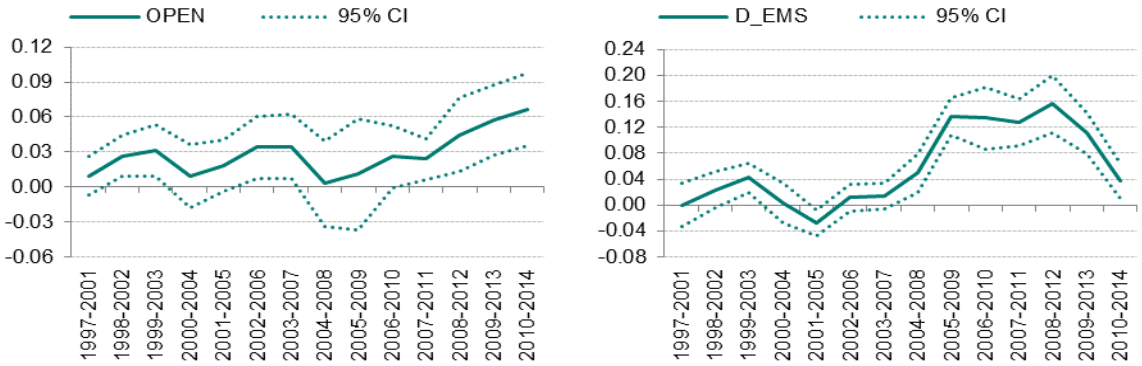
Figure 6.6. Relation between the share of employment in high-technology and knowledge-intensive sectors (left panel) as well as high-technology patent applications (right panel) and GDP per capita growth (five-year rolling window)



* Two-step Blundell-Bond system estimator. Employment in high-technology sector is assumed to be endogenous; the number of high-technology patents per inhabitant is assumed to be predetermined.

Source: own estimates.

Figure 6.7. Relation between the openness ratio (left panel) and change in the export market share (right panel) and GDP per capita growth (five-year rolling window)



* Two-step Blundell-Bond system estimator. Openness ratio and changes in the export market shares are assumed to be endogenous.

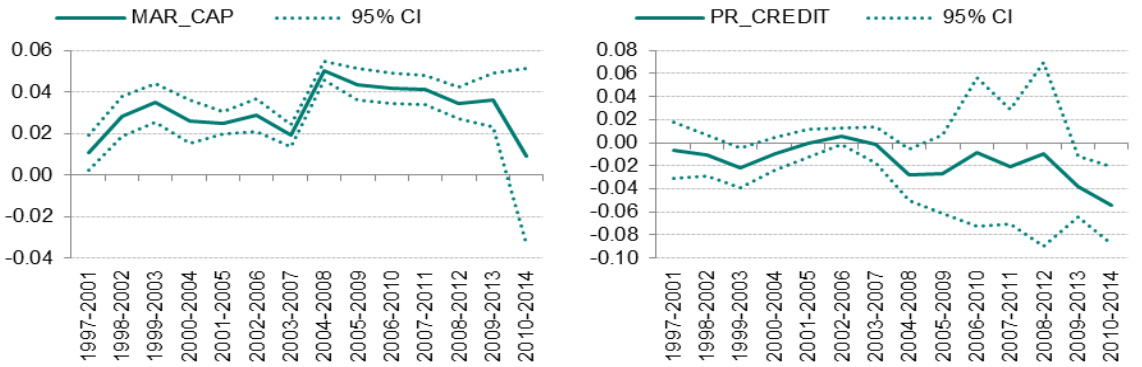
Source: own estimates.

Figure 6.8. Relation between inward and outward FDI and GDP per capita growth (five-year rolling window)

* Two-step Blundell-Bond system estimator. Inward and outward FDI are assumed to be endogenous.

Source: own estimates.

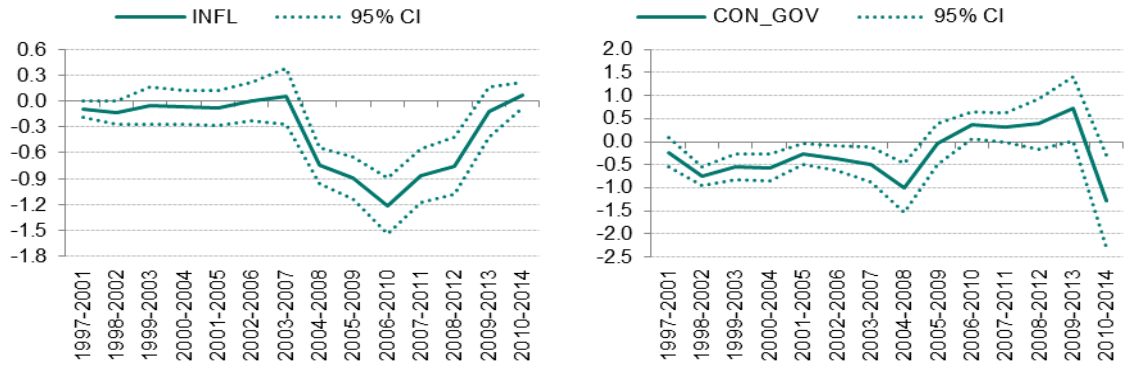
Figure 6.9. Relation between market capitalisation (left panel) and domestic credit to private sector (right panel) and GDP per capita growth (five-year rolling window)



* Two-step Blundell-Bond system estimator. Market capitalisation and domestic credit to private sector are assumed to be endogenous.

Source: own estimates.

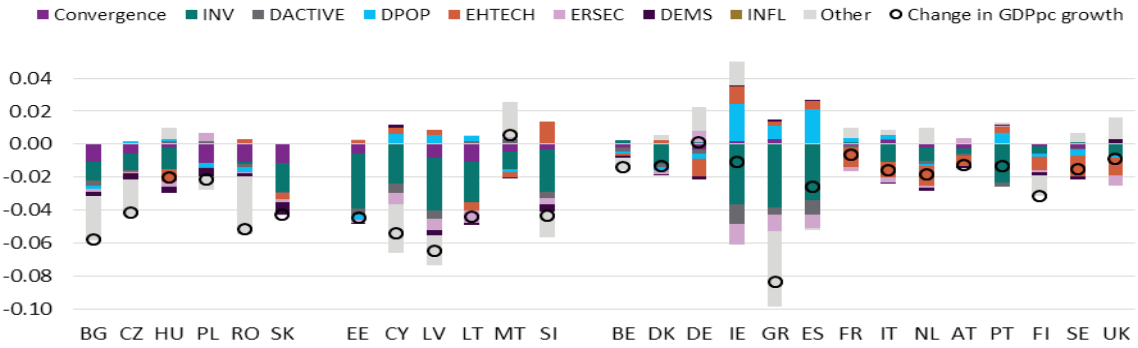
Figure 6.10. Relation between inflation (left panel) and government consumption (right panel) and GDP per capita growth (five-year rolling window)



* Two-step Blundell-Bond system estimator. Inflation rate and government consumption are assumed to be endogenous.

Source: own estimates.

Figure 6.11. The role of various growth factors in explaining the change in GDP per capita growth between 2003–2007 and 2010–2014



Source: own estimates.

6.4. Conclusions

The empirical results presented in this chapter confirm that CEE and other NMS converged in absolute terms towards more developed EU countries in 1997–2014, though its pace has slowed down after the outburst of the global financial crisis. On average in the analysed period, the GDP per capita growth rates in countries with lower initial GDP per capita level were higher than in more developed economies. However, the speed of absolute convergence was not stable in the analysed period – relatively fast convergence observed in 2001–2008 was interrupted by the global financial crisis. Since then, the absolute convergence of CEE countries has been slower than before the crisis.

Our estimates confirm a substantial role of traditional growth factors for the GDP per capita growth rates in CEE countries in the analysed period. The relation between the investment rate and growth was positive and significant independently of the specification. An additional factor positively affecting growth was the fall of relative investments prices observed in most of the EU countries. We could also confirm the significant role of the labour input. Although the relation between labour supply growth and the GDP per capita growth was significant only in the first years of the analysed period, the relation between the degree of capacity utilisation of educated labour force and growth has become significantly stronger with time.

Importantly, our results not only point to a significant positive relation between innovation activity and the GDP per capita growth but they also suggest that this relation has become stronger in the recent years. Countries with a higher share of persons employed in high-technology and knowledge-intensive sectors and with higher numbers of patents applications were characterised by higher economic growth throughout our sample period. Moreover, we show that the role of innovations in growth process has significantly increased. Another important result is that institutions matter for growth. Specifically, there is a significant relation between credit market and business regulations and growth in our sample: countries with good regulations tend to grow faster.

Finally, it is worth emphasising that, according to our results, the role of both the macroeconomic environment and the financial markets has changed after the crisis, which is consistent with our intuition presented in section 3.3. The relation between inflation and growth has become positive and significant, and the role of the financial markets and FDI for the growth and convergence in the EU has weakened.

7. Summary and conclusions

This paper was about the real convergence of six Central and Eastern European (CEE) countries towards the 'old' EU member states. Our major goal was to analyse empirically, by means of a panel data analysis, which factors have driven growth and convergence in the region in the last two decades. After a brief introduction (chapter 1), we presented an overview of the relevant theoretical issues: the basic concepts related to growth and convergence, the models of economic growth prevailing in the theoretical literature and the factors which affect growth (chapter 2). In chapter 3, we looked at the CEE economies from bird's eye view, underlining their common and individual features and analysing their growth model in the last two decades. Then we scrutinised the stylised facts on growth and convergence in the CEE region (chapter 4) and we reviewed the relevant empirical literature (chapter 5). In chapter 6, we reported the results of our empirical analysis based on data for 26 EU member states in 1997–2014. Below we summarise our results and draw conclusions.

Despite some differences, the CEE economies have shared a broadly similar growth model based on foreign capital inflows, mainly in the form of FDI. In the initial period of transition, foreign direct investment dominated the foreign capital inflows and had a very large scape. Favourable conditions offered by those countries to foreign investors, the geographical proximity of Western European economies as well as political and economic integration with the EU were the key factors behind these inflows. FDI positively affected domestic investment, contributing to closing the gap between the CEE countries' saving and investment rates. It also played a crucial role in shaping the structures of the CEE economies, strengthening the role of the manufacturing sector. Moreover, enhanced cooperation within the GVCs increased the CEE countries' trade openness and contributed to a more significant role of those economies in the EU trade.

Over time, a simultaneous large inflow of foreign capital via the expanding banking sector has made the CEE economies vulnerable to external shocks. The financial sector in the CEE region has been developing very fast in the last two decades, helping to spur domestic de-

mand. At the same time, strong dependence on foreign capital and the accumulation of domestic and external imbalances made the CEE region more vulnerable to external shocks. The CEE countries (except for Poland) were among those economies which were the most severely hit by the global financial crisis. Persistently low activity in Western Europe since 2008 led to a sharp drop in FDI in-flows and translated into a significant slowdown in exports growth.

During the last two decades, GDP in the CEE region grew on average more than twice as fast as in the EU-15. Growth patterns seem to be mixed: though GDP growth rates of individual countries were generally high, their volatility differed substantially. Strong growth in economic activity translated into substantial increases of GDP per capita, leading the CEE region to rank among the best performing regions worldwide. The general pattern of convergence in the analysed period has been changing over time and has differed across countries. The process included a moderate catching up from 1997 to 1999, an expansion during which most of the convergence took place (from 2000 to 2008) and a slowdown in the convergence process that has lasted until now. The general rule that countries starting from a lower level of development tend to con-verge faster seems to be confirmed for the CEE countries (except for Bulgaria), in line with neoclassical theory.

Despite different methods used and different time periods analysed, most of the abundant empirical literature confirms real (beta and sigma) convergence of the CEE countries towards Western Europe. The estimates of speed of convergence vary strongly across papers due to different periods analysed, methods applied and the set of control variables used in the conditional convergence equation. Moreover, research generally confirms that the speed of convergence in CEE was not constant in the analysed period, in line with the stylised facts described in the previous paragraph. From the supply-side perspective, the CEE countries have mostly benefitted from capital accumulation, but also from an increase in the technical efficiency of production. Since the outburst of the global financial crisis, the speed of real convergence has been hindered due to slower capital accumulation as well as lower TFP gains

Our empirical analysis showed that the real convergence within the EU-26 group of countries in 1997–2014 was driven by both traditional (core) and 'new growth theory' growth

factors (among other things, by innovation activity and trade). We demonstrated that the relatively fast convergence of CEE countries observed in the initial years of our sample period was interrupted by the global crisis in 2008. Since then, convergence has been slower. Importantly, we could only confirm convergence among the new member states of the EU but not for the 'old' member states. In the latter case, we observed a certain degree of divergence of real per capita incomes in the recent years. As regards the growth factors other than the traditional ones, variables related to the human capital and the high technology sector not only proved to be significantly related with GDP per capita growth, but their importance was increasing over time. The strength of the positive relation between the scale of international trade and GDP per capita growth was also on the increase, whereas that of the relation between FDI and growth was decreasing.

Overall, we believe – and have demonstrated – that the post-transition growth model has reached its limits and that further convergence of the CEE region to the more advanced EU economies cannot be achieved by simply replicating past efforts. As discussed in chapters 3 to 5 of this paper, before the financial crisis the convergence of the CEE economies was mainly driven by strong capital inflow facilitated by market reforms implemented at the beginning of the 1990s and accession of CEE countries to the European Union. The results of our empirical analysis presented in chapter 6 seem to confirm our intuition that this growth model has come to an end around the time of the global crisis. The CEE countries' growth and convergence will now be driven mainly by factors affecting structural competitiveness, especially innovation activity, institutional environment and policies (or lack thereof) targeted at diminishing the influence of demographic developments on the labour market outcomes.

The main thesis of this paper are confirmed by the existing analytical work on the Polish economy performed in the National Bank of Poland (Gradzewicz et al., 2014; NBP, 2014; NBP, 2016). Strong growth in the last two decades was based on the accumulation of capital, the inflow of new technologies from abroad and substantial progress in raising the level of education of Polish society. These factors contributed significantly to mitigate the effects of the global financial crisis on the Polish economy. However, the potential for further growth has gradually diminished since it will not be possible to maintain such a strong growth in physical

and human capital. In case of Poland it is crucial to seek for sustainable growth in total factor productivity, which can be done by developing the innovative potential of the domestic economy and by making use of global diffusion of foreign technology. A policy in the direction of increasing savings in the Polish economy can be also the answer to dwindling resources of the domestic capital.

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Appendix 1. Growth accounting

To scrutinise the role of the productions factors in GDP growth, a standard growth accounting exercise is carried out. Under the assumption of a Cobb-Douglas production function, the growth rate of real GDP can be decomposed into three factors:

$$\Delta y_t = \Delta tfp_t + (1 - \bar{\alpha}_t)\Delta l_t + \bar{\alpha}_t \Delta k_t, \quad \text{(A.1)}$$

where $\bar{\alpha}_t$ is the capital share in output and y_t, tfp_t, l_t, k_t denote respectively the logs of: the aggregate product, total factor productivity, labour input, and capital stock. The labour input is measured as the sum of employees and self-employed workers. The series of the capital stock are calculated using the perpetual inventory method (Caselli, 2005):

$$K_{t+1} = K_t(1 - \delta) + I_t, \quad \text{(A.2)}$$

where K_t, I_t stand respectively for the capital stock and aggregate real investment, and δ denotes the constant and exogenous depreciation rate which is fixed at 0.06 (Caselli, 2005). The initial level of capital stock is determined by the steady-state expression in the Solow model, i.e., $K_0 = I_0/(g + \delta)$, where g captures the long-run growth rate of investment.

To measure the factor shares, one needs to calculate the proportion of total remuneration of labour in aggregate output. The simple ratio of Compensation of Employees (CE_t) to GDP is not an appropriate proxy: it underestimates the labour share because it ignores the income earned by self-employed workers (Gollin, 2002). As discussed by Mućk et al. (2015), an adjustment by the number of the self-employed is not a good strategy either because the assumption of a dual price of employment for the self-employed[29] seems to be counterfactual. Therefore, GDP is reduced by the mixed income (MI_t) which is earned by self-employed workers and, as a result, cannot be unambiguously ascribed directly to labour or capital:

$$1 - \alpha_t = \frac{CE_t}{GDP_t - MI_t}. \quad \text{(A.3)}$$

Finally, the factor shares are allowed to change over time and $\bar{\alpha}_t$ is calculated as a Törnquist index, i.e.:

$$\bar{\alpha}_t = \frac{\alpha_{t-1} + \alpha_t}{2}. \quad \text{(A.4)}$$

[29] I.e. of the same average level of labour compensation for the employed and the self-employed.

Appendix 2. Analysis of convergence: estimation results

Table A. 1. Description of the variables used in the model

Variable	Short description	Data source	Expected sign	Remarks
	Dependent variable			
ΔY	Annual growth rates of GDP per capita (change in ln)	Eurostat		SK – data since 1998, IE – data since 1999, MT – data since 2001.
	Core variables			
Y	GDP per capita (constant 2010 prices; ln)	Eurostat	(–)	IE – data since 1998, MT – data since 2000
INV	Gross fixed capital formation (% of GDP)	Eurostat	(+)	
DPOP	Population growth (%)	Eurostat	(–)	IE – data since 1999.
DACTIVE	Active population growth (%)	Eurostat	(+)	EE, PL, RO – data since 1998, LV, LT, SK – data since 1999, CY – data since 2000, BG, MT – since 2001
	Measures of human capital			
LFTER / LFSEC / LFTERSEC	Labour force with tertiary / secondary / at least secondary education (20-64 years old, % of total labour force)	Eurostat	(+)	CZ, LV, LT, SK – data since 1998, CY – since 1999, BG, MT – since 2000
ETER / ESEC / ETERSEC	Employed with tertiary / secondary / at least secondary education (20-64 years old, % of total labour force)	Eurostat	(+)	BG, CY – data since 2000, MT – data since 2001, FR – data since 2003.
ERTER / ERSEC	Employment rate among workers (20-64 years old) with tertiary / secondary education (%)	Eurostat	(+)	CZ, LT, SK – data since 1998, CY – data since 1999, BG, MT – data since 2000. Some missing data interpolated.
	Technological progress and innovation			
PI_PC	Relative investment prices (ratio of investments to consumption prices)	Eurostat	(–)	MT – data since 2000
TRD / BRD / GRD	Total / business sector / government sector intramural R&D expenditure (% of GDP)	Eurostat	(+)	EE – data since 1998, MT – data since 2002 GR, SE – missing data interpolated
E_HTECH	Employment in technology and knowledge-intensive sectors (% of total employment)	Eurostat	(+)	LT, SK – data since 1998, LV – data since 1999, BG, MT – data since 2000. PL – data since 2004

Table A.1 continued

Variable	Short description	Data source	Expected sign	Expected sign
PATENTS	Patent applications to the EPO (per million inhabitants)	Eurostat	(+)	CY – data since 1998, LV – data up to 2013
HT PATENTS	High-tech patent applications to the EPO (per million inhabitants)	Eurostat	(+)	Data up to 2013, LV – data since 1999, CY, EE, LV, LT, SK – some missing data interpolated, MT – almost all data missing
	Demography			
AGE_DEP	Age dependency ratio, old (ratio of older dependents -people older than 64 to the working-age population -those ages 15-64, %)	WDI	(–)	
65_PLUS	Share of people at the age 65 or older in total population (%)	Eurostat	(–)	
DUR	Duration of working life (years)	Eurostat	(+)	Data since 2000.
	Trade and FDI			
OPEN	Openness ratio (share of export and import in GDP)	Eurostat	(+)	
DEMS	Change in export market share (%)	UnctadStat	(+)	
IN_FDI	Inflow FDI (% of GDP)	WDI	(+)	
OUT_FDI	Outflow FDI (% of GDP)	WDI	(+)	
	Financial market			
PRCREDIT	Domestic credit to private sector (% of GDP)	World Development Indicators Database, World Bank	(–)	LT – data since 2004, MT – data till 2013. Some missing data for several EU countries interpolated.
MARCAP	Market capitalization of listed companies (% of GDP)	World Development Indicators Database, World Bank	(+)	LT- since 2004, Data available till 2012.
	Macroeconomic environment			
INF	Inflation (annual rate of change, %)	Eurostat	(–)	BG – data since 1998, RO – very high values in 2000-2005.
CONGOV	Final consumption expenditure of general government (% of GDP)	Eurostat	(–)	
DEBT	General government gross debt (% of GDP)	Eurostat	(–)	DK – data since 2000.
	Institutional Variables			
FRASER	Fraser Institute's Economic Freedom of the World index	Fraser Institute	(+)	Data since 2000
FRCREDIT / FRLABOUR / FRBUSINESS	Credit market regulations / Labour market regulations / Business regulations, Sub-index of Fraser Institute's Economic Freedom of the World index	Fraser Institute	(+)	Data since 2000

Source: own elaboration.

Table A. 2. The results of the absolute convergence model among EU-26 countries in 1997–2014 (only lagged GDP per capita as a regressor)

	OLS	FE	RE	GLS	IVFE	IVRE	DIFF GMM (one-step)	DIFF GMM (two-step)	SYS GMM (one-step)	SYS GMM (two-step)
ln(Y(-1))	-0.019*** (0.003)	-0.075*** (0.010)	-0.020*** (0.003)	-0.017*** (0.002)	-0.093*** (0.010)	-0.022*** (0.003)	-0.101*** (0.018)	-0.100 (0.398)	-0.067*** (0.010)	-0.067 (0.070)
Obs.	461	461	461	461	457	457	457	457	461	461
Adj. R^2	0.12	0.13	0.13		0.13	0.13				
Year dummies	No	No	No	No	No	No	No	No	No	No
F-test		2.75 (0.000)			3.41 (0.000)					
Hausman test			32.4 (0.000)			50.5 (0.000)				
AB(1)							-2.535 (0.011)	-0.747 (0.455)	-2.683 (0.007)	-2.439 (0.015)
AB(2)							-2.565 (0.010)	-1.572 (0.116)	-2.583 (0.010)	-2.510 (0.012)

OLS – ordinary least squares estimator with robust standard errors; FE / RE – fixed effects / random effects estimator; GLS – general least squares estimator with panel-specific AR1 autocorrelation structure and heteroscedastic error structure; IVFE / IVRE - G2SLS fixed / random-effects estimator; DIFF GMM / SYS GMM – one or two-step Arellano-Bond / Blundell-Bond system estimator; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

Table A.3. The results of the absolute convergence model among EU-26 countries in 1997–2014 (dummy for 2009, trend or time dummies included)

	OLS	OLS	OLS	FE	FE	FE	SYS GMM	SYS GMM	SYS GMM	IVRE
ln(Y(-1))	-0.017*** (0.002)	-0.016*** (0.003)	-0.016*** (0.002)	-0.047*** (0.009)	-0.038*** (0.015)	-0.025*** (0.013)	-0.054*** (0.004)	-0.059*** (0.004)	-0.046 (0.176)	-0.018*** (0.003)
D2009	-0.084*** (0.008)	No	No	-0.080*** (0.006)	No	No	-0.083*** (0.001)	No	No	No
Trend	No	-0.002*** (0.000)	No	No	-0.001*** (0.000)	No	No	-0.001*** (0.000)	No	No
Year dummies	No	No	Yes	No	No	Yes	No	No	Yes	Yes
Adj. R^2	0.40	0.19	0.52	0.32	0.17	0.50				0.53
Obs.	461	461	461	461	461	461	461	461	461	457
F-test				2.55 (0.000)	1.56 (0.042)	2.52 (0.000)				
Hausman Test										8.51 (0.970)
AB(1)							-2.710 (0.007)	-2.821 (0.005)	-1.868 (0.062)	
AB(2)							-1.538 (0.124)	-2.560 (0.011)	-1.693 (0.091)	

OLS – ordinary least squares estimator with robust standard errors; FE – fixed effects estimator; SYS GMM – two-step Arellano-Bond / Blundell-Bond system estimator; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); IVRE - G2SLS random-effects estimator; AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

Table A.4. Absolute convergence among the 'old' and new EU member states in 1997–2014

	OLS	OLS	FE	FE	SYS GMM	SYS GMM	IVRE
				OLD-14			
ln(Y(-1))	-0.003 (0.006)	0.008* (0.005)	-0.133*** (0.015)	-0.083*** (0.028)	-0.039*** (0.018)	0.055*** (0.010)	0.004 (0.005)
D2009	-0.066*** (0.004)	-	-0.054*** (0.006)	-	-0.068*** (0.003)	-	-
Time dummies	No	Yes	No	Yes	No	Yes	Yes
Obs.	250	250	250	250	250	250	249
Adj. R^2	0.33	0.64	0.06	0.26			0.64
F test / Hausman test			7.20 (0.000)	2.74 (0.000)			33.30 (0.015)
AB(1)					-2.678 (0.007)	-1.871 (0.061)	
AB(2)					-2.427 (0.015)	-1.978 (0.048)	
				NEW-12			
ln(Y(-1))	-0.021*** (0.005)	-0.021*** (0.004)	-0.028** (0.011)	-0.068*** (0.025)	-0.031 (0.027)	-0.072*** (0.025)	-0.027*** (0.007)
D2009	-0.106*** (0.015)	-	-0.105*** (0.010)	-	-0.093*** (0.010)	-	-
Time dummies	No	Yes	No	Yes	No	Yes	Yes
Obs.	211	211	211	211	211	211	208
Adj. R^2	0.40	0.56	0.39	0.43			0.56
F test / Hausman test			1.81 (0.054)	2.70 (0.003)			10.46 (0.92)
AB(1)					-1.958 (0.050)	-1.121 (0.034)	
AB(2)					-1.182 (0.237)	-1.140 (0.032)	

OLS – ordinary least squares estimator with robust standard errors; FE – fixed effects estimator; SYS GMM – Blundell-Bond system estimator; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); IVRE - G2SLS random-effects estimator; AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

Table A.5. The impact of human capital variables and innovation activity on GDP per capita growth in EU-26 countries in 1997–2014

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(Y(-1))	-0.024**	-0.021***	-0.015*	-0.018	-0.023**	-0.027**	-0.036	-0.029***
	(0.018)	(0.008)	(0.008)	(0.011)	(0.011)	(0.012)	(0.023)	(0.011)
INV	0.433***	0.406***	0.439***	0.382***	0.412***	0.432***	0.377***	0.437***
	(0.059)	(0.040)	(0.075)	(0.079)	(0.109)	(0.071)	(0.051)	(0.072)
DACTIVE	0.172**	0.264***	0.252**	0.299***	0.235***	0.341***	0.373***	0.232***
	(0.070)	(0.027)	(0.117)	(0.102)	(0.142)	(0.084)	(0.062)	(0.045)
DPOP	-0.928***	-0.883	-1.147***	-1.048***	-0.830***	-1.042	-0.957	0.247
	(0.344)	(0.617)	(0.381)	(0.302)	(0.245)	(0.665)	(0.599)	(0.896)
ETER	-0.018							
	(0.036)							
ESEC		-0.010						
		(0.078)						
ERTER			-0.012					
			(0.111)					
ERSEC				0.052	0.032	-0.013	0.036	-0.040
				(0.098)	(0.074)	(0.099)	(0.053)	(0.103)
TRD(-1)					0.755			
					(1.236)			
EHTECH						1.002***		
						(0.297)		
PATENTS							0.0001**	
							(0.000)	
HT_PATENTS								0.0005***
								(0.000)
D2009	-0.083***	-0.085***	-0.083***	-0.086***	-0.085***	-0.077***	-0.081***	-0.082***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Obs.	424	424	445	445	442	439	444	412
AB(1)	-3.384	-3.507	-3.640	-3.814	-3.473	-3.714	-3.289	-2.964
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.003)
AB(2)	-1.832	-1.830	-1.970	-1.873	-1.720	-2.120	-1.966	-1.489
	(0.067)	(0.067)	(0.049)	(0.061)	(0.086)	(0.034)	(0.049)	(0.136)

* Two-step Blundell-Bond system estimator; investments rate, labour force growth, human capital variables, total R&D expenditures and employment in high-technology sector are assumed to be endogenous, number of patents and high-tech patents are assumed to be predetermined; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

Table A.6. The impact of trade and FDI on GDP per capita growth in EU-26 countries in 1997–2014

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(Y(-1))	-0.018	-0.060*	-0.035	-0.070**	-0.027	-0.045	-0.017
	(0.032)	(0.033)	(0.034)	(0.035)	(0.020)	(0.036)	(0.093)
INV	0.403***	0.383***	0.493***	0.375***	0.398***	0.301***	0.406***
	(0.059)	(0.097)	(0.118)	(0.063)	(0.098)	(0.098)	(0.066)
DACTIVE	0.421**	0.288***	0.208*	0.276***	0.032	0.191**	0.017
	(0.068)	(0.080)	(0.112)	(0.078)	(0.089)	(0.089)	(0.068)
DPOP	-0.752	0.009	0.380	0.288	-0.118	-0.436	-0.112
	(0.613)	(0.850)	(1.073)	(0.701)	(1.262)	(0.763)	(1.266)
ERSEC	-0.045	-0.030	-0.187	-0.040	-0.039	0.107	0.027
	(0.078)	(0.155)	(0.202)	(0.102)	(0.114)	(0.148)	(0.226)
PATENTS	0.0002***	0.0002**	0.0001	0.0002***	0.0001	0.0002	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OPEN	-0.002						
	(0.013)						
DEMS		0.073***	0.066***	0.069***	0.085***	0.068***	0.064***
		(0.009)	(0.010)	(0.007)	(0.009)	(0.006)	(0.017)
INFDI			0.047		0.020	0.0002	0.025
			(0.031)		(0.017)	(0.078)	(0.020)
OUTFDI				0.012			
				(0.021)			
MARCAP					0.031***		0.032***
					(0.005)		(0.004)
PRCREDIT						-0.022**	-0.026
						(0.011)	(0.026)
PIPC(-1)							-0.112
							(0.247)
D2009	-0.079***	-0.085***	-0.083***	-0.073***	-0.073***	-0.069***	-0.069**
	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.005)
Obs.	444	444	444	444	388	443	444
AB(1)	-2.988	-3.507	-2.441	-2.513	-2.372	-2.542	-3.289
	(0.003)	(0.001)	(0.015)	(0.012)	(0.018)	(0.011)	(0.001)
AB(2)	-2.083	-1.830	2.025	-1.697	-1.415	-2.004	-1.966
	(0.037)	(0.067)	(0.043)	(0.090)	(0.157)	(0.045)	(0.049)

* Two-step Blundell-Bond system estimator; investments rate, labour force growth, human capital variables, trade variables, FDI and financial variables are assumed to be endogenous, number of patents is assumed to be predetermined; relative investment prices are assumed to be exogenous; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

Table A.7. The impact of institutions and macroeconomic environment on GDP per capita growth in EU-26 countries in 1997–2014

	(1)	(2)	(3)	(4)	(5)	(6)
ln(Y(-1))	-0.025	-0.033	-0.047	-0.010	-0.043*	-0.057*
	(0.027)	(0.027)	(0.030)	(0.020)	(0.029)	(0.031)
INV	0.372***	0.304***	0.396***	0.346***	0.383**	0.471***
	(0.082)	(0.109)	(0.103)	(0.096)	(0.165)	(0.152)
DACTIVE	0.038	0.113	-0.116	0.084	-0.289	-0.066
	(0.147)	(0.193)	(0.264)	(0.194)	(0.285)	(0.259)
DPOP	-1.110	0.009	-0.402	-0.992	-0.027	-2.132
	(1.140)	(0.850)	(0.850)	(0.910)	(1.196)	(1.973)
ERSEC	0.066	0.046	0.054	0.127	0.045	0.105
	(0.157)	(0.154)	(0.132)	(0.140)	(0.149)	(0.183)
EHTEC	0.294	0.806**	1.468**	0.541	0.443	-0.415
	(0.413)	(0.384)	(0.715)	(0.388)	(0.497)	(1.119)
DEMS	0.062***	0.060***	0.048**	0.068***	0.056***	0.064***
	(0.020)	(0.022)	(0.021)	(0.020)	(0.016)	(0.020)
INFDI	0.017	0.010	0.014	0.009	0.034	0.015
	(0.015)	(0.009)	(0.013)	(0.015)	(0.022)	(0.029)
PRCREDIT	-0.020	-0.009	-0.008	-0.024*	-0.008	-0.008
	(0.016)	(0.013)	(0.009)	(0.014)	(0.015)	(0.017)
FRASER	0.018**				0.017**	0.010
	(0.009)				(0.007)	(0.012)
FRCREDIT		0.006***				
		(0.003)				
FRLABOUR			0.002			
			(0.004)			
FRBUSINESS				0.006***		
				(0.001)		
INFL					-0.097	-0.220
					(0.103)	(0.175)
CONGOV						-0.233
						(0.266)
D2009	-0.074***	-0.071***	-0.077***	-0.070***	-0.078***	-0.077***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.005)
Obs.	383	383	379	379	383	383
AB(1)	-2.309	-2.431	-2.419	-2.215	-2.024	-2.223
	(0.021)	(0.015)	(0.016)	(0.027)	(0.043)	(0.026)
AB(2)	-2.132	-2.135	-1.866	-2.562	-1.528	-2.174
	(0.033)	(0.033)	(0.062)	(0.010)	(0.127)	(0.030)

* Two-step Blundell-Bond system estimator; investments rate, labour force growth, human capital variables, employment in high-technology sector, inflation and government consumption are assumed to be endogenous, institutional variables are assumed to be predetermined; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

Table A.8. The relation between the financial market indicators and the GDP per capita growth in EU-26 countries in 2000–2014

	EU-26		OLD-14		NMS-12	
	(1)	(2)	(3)	(4)	(5)	(6)
lnY(-1)	-0.034***	-0.010*	-0.039***	-0.043***	-0.026***	-0.015***
	(0.007)	(0.006)	(0.015)	(0.008)	(0.009)	(0.009)
INV	0.357***	0.375***	0.458***	0.336***	0.308***	0.365***
	(0.038)	(0.034)	(0.112)	(0.111)	(0.071)	(0.060)
DACTIVE	0.237**	0.306***	0.322**	0.293***	0.215	0.326**
	(0.103)	(0.081)	(0.136)	(0.097)	(0.143)	(0.139)
DPOP	-1.250***	-0.922**	-2.187***		-0.798	-0.478
	(0.449)	(0.437)	(0.550)		(0.682)	(0.638)
ERSEC	-0.001	0.016	0.038	0.078***	0.017	-0.032
	(0.044)	(0.050)	(0.037)	(0.026)	(0.118)	(0.126)
EHTEC	0.490**	0.642***	0.710**	0.934***	-0.148	-0.007
	(0.252)	(0.251)	(0.318)	(0.196)	(0.238)	(0.382)
MARCAP	0.071***		0.051***		0.136***	
	(0.013)		(0.009)		(0.028)	
$MARCAP^2$	-0.023***		-0.016***		-0.100***	
	(0.005)		(0.004)		(0.024)	
PRCREDIT		-0.048***		-0.049***		-0.031***
		(0.014)		(0.019)		(0.019)
$PRCREDIT^2$		0.013**		0.015*		0.007
		(0.006)		(0.008)		(0.007)
D2009	-0.070***	-0.076***	-0.050***	-0.054***	-0.099***	-0.095***
	(0.008)	(0.009)	(0.005)	(0.005)	(0.016)	(0.016)
Obs.	382	438	222	250	160	188
AB(1)	-3.119	-3.515	-2.594	-2.648	-2.655	-2.488
	(0.002)	(0.000)	(0.010)	(0.008)	(0.008)	(0.013)
AB(2)	-1.631	-2.537	-1.902	-2.64	-0.655	-1.517
	(0.103)	(0.011)	(0.057)	(0.008)	(0.513)	(0.129)

* One-step Blundell-Bond system estimator; investment rate, labour force growth and financial variables are assumed to be endogenous; parameter of convergence was recalculated so that it represents β (see equation 2.2 in section 2.1); AB(1)/AB(2) – the Arellano-Bond test for first/second order serial correlation.

Source: own estimates.

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