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Economic convergence of Central and Eastern European countries in the European Union

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ABSTRACT

Eight Central and Eastern European (CEE) countries joined the European Union in 2004, and three later joined, aiming to align with the EU's average economic development. The main objective of this study is to assess the economic development status of CEE countries compared with the EU average and forecast their convergence by 2027. The study uses time-series analysis, normality tests, and convergence indices to determine the level of convergence achieved by CEE countries and various extrapolation methods to assess the level of convergence expected shortly. The results are ambivalent; in 2022, Lithuania, the Czech Republic, and Slovenia exceeded the EU average, while Croatia and Bulgaria lagged significantly behind. This study supports the neoclassical transition path theory, noting that in 2004, even less developed countries achieved the most dynamic growth by 2022. Despite the strong GDP correlation between EU and CEE countries, the drivers of GDP growth remain different. According to forecasting methods, Estonia will be next to reach an economic development level above the EU average. According to the results of extrapolation methods, Estonia may be followed by Poland, Romania and Slovakia in catching up with the EU.

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CEE countries; European Union; convergence; economic growth; extrapolation

Introduction

Economic growth is at the centre of convergence theories in economics. It examines how economically less developed regions are catching up with more developed ones. According to the primary position of neoclassical economics, if the factors can flow freely and comparative advantages prevail, then in the long term, due to the flow of labour and capital in opposite directions, convergence will occur between countries with different levels of development. The previous statement indicates that less developed countries and regions catch up to more developed areas and countries by growing faster. This hypothesis has been tested in several studies, and the convergence process has been investigated by country and region (Breinlich, Ottaviano, and Temple 2014; Ertur and

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Gallo 2009; Eurofound 2018; Fischer and Stumpner 2010; Le Gallo and Fingleton 2014; Lesage and Fischer 2009).

Such a catch-up process began in CEE countries after the political-economic system changed.

In the western and eastern half of Europe, 32 years ago, political and economic actors and members of society looked with great expectations and hopes of the new situation created due to regime change in CEE countries. For objective reasons, they were neither in the western part of Europe nor in the transition countries and could not be adequately prepared for the manifold consequences of the profound transformation. The citizens of the system-changing CEE countries primarily believed in the rise of their standard of living and that their quality of life would quickly reach the level of citizens of developed Western Europe. Joining the European Union has fuelled these expectations. In theory, the free flow of goods, capital, labour, and services also promotes convergence to the West because capital flows to regions with lower wages and labour flows to regions with higher salaries. Despite this, however, the data used in the study show that 32 years later, 2022 was the first year in which three countries reached at least the average level of development of the EU among the system-changing CEE countries.

When CEE countries joined the EU, catching up was not sure, nor could it be expected that convergence would occur at a constant and even speed. It is known from neoclassical theory that *ceteris paribus*, the involvement of a low-developed economy in international trade naturally starts the country's catch-up. However, a successful convergence cannot be taken for granted. Political and social disturbances, external conflicts, and faulty economic policy decisions can hinder or reverse an economy's catch-up.

The EU implements the support of member states through its regional policy, which aims to reduce economic inequalities and catch up with backward regions. The indirect aim of subsidies is to increase the economic development of the supported country. To achieve this goal, the EU supports less-developed countries, mainly Eastern and Southern European countries, with vast sums of money annually.

The conceptualization of CEE convergence means that the term convergence used in this study refers to the process of economic convergence of less economically developed (CEE) countries towards the average level of development of the EU. The convergence index is a measure that compares the economic development of CEE countries to the average level of development of the EU, and allows for the determination of the degree of development. Neoclassical transition path theory suggests that less developed economies grow faster through economic integration and free markets and catch up with more developed countries, mainly due to the flow of capital and labour. The concept of economic development is best measured in terms of gross domestic product (GDP); however, it is also possible to consider the level of education, infrastructure, and innovation, which also determine a country's economic potential. GDP per capita is the most widely used and professionally accepted indicator for measuring economic development. The time-series analysis and normality tests used in this study help to understand the trends of economic development and predict the pace of convergence. The methodological innovation used in this study represents a new approach for more accurately and quantitatively measuring the level of development in terms of the economic convergence of CEE countries.

The investigation presented in my study aims to show the extent to which the 11 CEE countries with different starting conditions and economic policy guidelines achieved

catch-up compared to the more developed countries that joined the EU earlier. Examining this is vital because the EU and the examined CEE region are facing a more significant challenge than ever: the de facto appearance of the multispeed European Union. Thus, for the 11 CEE countries, the central dilemma of the near future is whether they want and can be part of the renewing EU and what tools the EU should deploy to catch up with the countries still lagging fully.

This study attempts to answer the following questions: Where was the economic development of the CEE countries compared to the EU average at the end of 2022 (2023 data were not yet available at the time of writing the study); are there any CEE countries that have managed to reach the EU average in terms of economic development, and which countries will be the ones that will get the desired development level for the first time based on their own and the EU's past development data; if there is or will be such countries, in their case, when is the average development level of the EU expected to be reached?

One of the contributions of this study is that its results confirm neoclassical theory for CEE countries. According to this theory, a lower level of economic development during accession enables faster catch-up. The second contribution of the study is that it precisely shows the level of convergence of individual CEE countries based on the latest data. The third contribution of this study is that it calculates the development of individual CEE countries compared to the average level of the EU using a methodology that has not been used for this purpose. This mathematical value is shown in the study by the 'catch-up index' in [Table 4](#).

For convenience, this study uses the terms economic growth and economic development synonymously. However, it should be noted that economic growth refers to the increase in GDP, which is a quantitative indicator of a country's economic performance, while economic development is a broader concept that includes improvements in social well-being, quality of life and sustainability.

Literature review

Growth theories that describe the long-term growth path of national economies have a history of economic development that goes back several decades. In the last two or three decades, the theory of endogenous growth has been strengthened, according to which the level of workforce education, the supply of information, the level of adapted technology, and human capital in individual countries can be obstacles to catching up (Lucas 1990; Mankiw, Romer, and Weil 1992; Rebelo 1992; Romer 1990).

With the approach of the accession of CEE countries (at the beginning of the 2000s), the debate concerning European Union countries also began in a specific way regarding whether the convergence will continue until full catch-up. The question then was whether the income levels of EU member states were entirely converging (Cuadrado-Roura 2001; Geppert, Happich, and Stephan 2005; López-Bazo 2017; Yin, Zestos, and Michelis 2003) or whether the member states were only approaching their equilibrium trajectories, and a certain degree of income differences may persist (Cappelen et al. 2003).

The disintegration of former socialist countries occurred in different ways. Some authors have highlighted various aspects of regime changes in CEE countries. According to one study, the transformation of these countries proved to be a deviant case in the

history of revolutions. In the linked article, the particularity of velvet revolutions was highlighted, touching on the role of elites, the international situation, and the loss of legitimacy of previous regimes (von Beyme 2001). Various researchers have sought answers to the question of what the economic results achieved immediately after the regime change depended on in the case of CEE countries. Several authors have tried to explain the financial results of the transition process and the differences in the magnitude of the results based on the speed and order of transition policies (Bitzenis and Marangos 2007; Bitzenis and Marangos 2008; Ellman 2005). Other authors have examined the transformation of financial markets. It was found that in the first years of the regime change (1990–1996), experiences with the economic system showed that the changes were slow. Still, the banking systems of Central European countries caught up with their Western counterparts faster than their stock markets (Scholtens 2000).

After the regime change, Western European countries hoped for adaptable political partners, cheap, favourable production sites and wages for companies, and easy-to-conquer new markets in East-Central Europe (Ecirlia et al. 2014), and hoped for a quick return on working capital flowing from the West to the East (Jirasavetakul and Rahman 2018; McKinsey Global Institute 2016). The countries in the eastern half of the region hoped to quickly catch up, integrate as soon as possible, and achieve a high standard of living in Western countries. The accession of CEE countries to the EU helped achieve these goals. In the relationship between the EU and CEE countries, the implementation of the association and the accession took place by taking a long and bumpy road. From the regime change to EU membership, 15 years of effort was needed in Central and Eastern European countries, and the EU was by no means in a hurry to expand to the East. From the point of view of foreign and domestic policy, economy, finance, and security policy, the EU and NATO have become the basic orientation compass and centre of attraction for the states of the Central and Eastern European region.

To comply with EU rules, CEE countries had to reform their economic, legal, and social structures, and as many scholars claim, the process itself had a profound impact on the new Eastern European accession states (Schimmelfennig and Sedelmeier 2005). Several studies have thoroughly researched the effects of accession on the internal structural transformation of the economy and politics of joining countries in several studies (Ekiert, Kubik, and Vachudova 2007; Featherstone and Radaelli 2002; Grabbe 2006). Additional studies have been conducted on socioeconomic changes in Central and Eastern European countries. These articles primarily present research on economic growth, the labour market, social inequalities, and some welfare indicators (Kostadinova and Neshkova 2019; Lawson 1993; Mishler and Rose 2003; Pei 1996; Rose and Mishler 2007).

The second step in joining the European Union was the institutional adaptation process that took place. The Visegrad countries (Poland, Czech Republic, Slovakia, Hungary), Slovenia, and the three Baltic states (Estonia, Latvia, Lithuania) joined the EU in 2004, while Bulgaria and Romania became member states in 2007, and Croatia in 2013. During the accession process, legal harmonization with the EU legal system took place in the newly joined countries, which took place in the same way for each state and legal area, but to a different extent. Of the 11 new EU member states, five smaller states (Estonia, Latvia, Lithuania, Slovakia, and Slovenia) joined the Eurozone, which was a big step towards even more complete economic integration.

The transformation trajectories of CEE states, the rate of income growth, and the development of inequalities were also shaped by significant differences. First, they arrive at the beginning of the catch-up and integration processes after a different historical heritage. For example, the economic development of the Czech Republic and Slovenia was much closer to that of the EU15 than the other accession countries due to the influence of the era before socialist times. CEE countries also differed in terms of economic structure, population demographics, educational attainment, and ethnic diversity.

Many studies have examined the accession of CEE countries to the EU, with each study highlighting different aspects of the accession. For example, the analysis (Kuc-Czarnecka et al. 2021) points to an unfavourable turn of events for CEE countries, which have suffered significant losses in their rapid integration process in the world and EU economies. Examining the effects of accession, the general conclusion of the analysis is that, at this stage, the economics of rapid and unilateral euroization were extremely ambiguous and probably harmful for joining CEE countries (Wójcik and Backé 2005). One study provides different estimates of the impact of CEE countries joining internal markets for various industries and other countries. The effect of joining the internal market is enormous in agriculture, textiles, commercial services, transport, non-metallic minerals, and food processing (Nahuis 2004).

The EU accession is a watershed in Central and Eastern Europe (CEE). During enlargement, these acceding countries underwent a pervasive 'Europeanization' – an EU-led process of their political and economic systems (Matlak, Schimmelfennig, and Wozniakowski 2018). Owing to convergence, public administration systems also had to change. One study analyses the transformation of the public administration of CEE countries after they accede to the EU. In this article, the author examines the motives, processes, and results of regional or meso-level administrative reforms, considering whether the EU shaped these reforms to a greater extent than incumbent member states (Brusis 2002). The use of cluster analysis methods in one study enabled a focus on heterogeneity in the five selected dimensions of interest: institutions and governance, a single market and openness, macroeconomic policies, symmetry and convergence, and competitiveness. The study found that the specific macroeconomic policy of CEE countries during the transition period was less decisive for a successful transition than the level of (non-elite) political stability (Najman et al. 2013). One study follows the evolution of the financial systems of former socialist (CEE) countries as they prepare to join the European Union (EU). Experts often state that EU accession provides CEE countries with a crucial external anchor; however, the analysis presented in the cited study proves that the integration process represents a serious financial risk in these countries (Pistor 2012). One article examined the evolution of productivity in CEE countries. The author claims that the conditions of EU membership were favourable to Central and Eastern European countries during the transformation and economic recovery period, while Soviet successor states were not interested in this process. According to Tridico (2015), it is very likely that EU membership was an essential factor that influenced the transformation process of CEE countries and contributed to the increase in productivity (Tridico 2015). CEE countries need capital injection under favourable conditions and technology transfer for comprehensive modernization and to increase the economic development of the economy. Both occur under unfavourable conditions, especially with regard to raising capital (Groh and von Liechtenstein 2009; Tihanyi and Roath 2002).

The transfer of capital and know-how from EU to CEE countries has two main areas with different characteristics. First, in the framework of large projects, large international companies establish supply sites based on long-term investment and subsidiary strategies with highly capital-intensive technology in CEE countries. Large-scale investments were made with a dual purpose: the cost advantage gained through cheap deliveries is significant for the Western partner because it induces exports and obtains a market for the manufactured products in CEE countries by conquering the market, displacing the producers of the given countries, and draining the consumer's purchasing power visited these countries (Andrieş, Cazan, and Sprincean 2021; Baran and Saikėvičius 2015; Ipsmiller and Dikova 2021). The second peculiarity is that the relatively small investments of small Western companies (which, however, are significant in absolute value) in CEE countries were realized mainly in the distribution of various products and services and partially in hospitality. Most aims for short-term profit maximization and extra profit are achieved in previous deficit areas. The market penetration of EU companies into CEE countries was large-scale and showed significant dynamics until the 2008 crisis, whereas the reverse did not occur. In this area, the benefits are asymmetric in favour of old EU member states.

For example, one research team examined the convergence of eight CEE countries (Egri and Lengyel 2023). Their empirical results showed convergence among Central and Eastern European countries. In addition, the authors rejected the hypothesis of convergence of the CEE-8 towards the old EU-15. According to their conclusion, CEE-8 is close to the two largest EU countries in terms of economic development: Germany and France. The catch-up of the CEE countries was examined at the regional level in their study (Głodowska and Pera 2019), where they measured the convergence to the development of the 14 older member states of the EU between 2000 and 2019. Their analysis was carried out in the case of 185 urban-rural regions of the EU. The study showed that the growth of all Central and Eastern European countries (CEE) and their regions was faster than the growth average of the old EU14 member states. A study examined the convergence of ten Central and Eastern European countries between 1995 and 2016 (Pečarić, Kusanović, and Jakovac 2021). This article states the convergence hypothesis developed in the CEE10 and EU15 (old) countries. The positive effect of economic integration on the convergence of CEE10 countries as well as the dependence of these countries' growth on the EU's business environment was confirmed.

Not all studies have confirmed the convergence of CEE countries. For example, according to (Glawe and Wagner 2021), the EU market integration model based on financial openness leads to divergence and sectoral specialization, which calls into question the EU convergence of Eastern European EU countries (CEE). This study posits that foreign direct investment (FDI) has different effects on the growth and development of CEE countries. The authors assume that capital inflows into the manufacturing sector are more intense and impact economic growth than those into the service sector.

Contrary to the results of this study, another study pessimistically describes EU-level convergence. According to the article, the EU has achieved the goals of income and institutional catch-up over a long period. However, this convergence development has weakened in the last decade or two and even diverged (Cichowicz and Rollnik-Sadowska 2018).

Other researchers have used other indicators to illustrate the development and catch-up of CEE countries. This indicator determines the degree of inclusive growth, considering the indicators assigned to the seven pillars among CEE countries. The main results of the research indicate that Estonia, Slovenia, and the Czech Republic have the highest level of inclusive growth, whereas the measured indicators are at the lowest level in Bulgaria and Romania (Cieřlik and Wciřlik 2020).

A study observed the convergence of Central and Eastern European countries (CEE) towards old EU member states. The results are similar to those of the present study, as it claims that CEE-8 countries are converging towards the two largest EU countries, Germany and France (Matkowski, Prochniak, and Rapacki 2016). The study, like this article, also forecasted the expected economic development of CEE countries. This study presents forecasts of the convergence prospects of CEE countries, with three scenarios for future economic growth, and presents predictions about the convergence prospects of CEE countries, with three scenarios for future economic growth. The first two scenarios assume the continuation of past or current growth trends and the maintenance of positive growth rate differentials, indicating how long each CEE country is expected to take to reach the average GDP per capita observed in Western Europe. One scenario is an extrapolation of past growth trends, assuming that the group of CEE countries (EU11) and EU15 maintain their average annual growth rate, expressed by GDP per capita recorded in 1993–2015. Based on this assumption, individual CEE countries would need 11–39 years to reach the average GDP per capita level compared to the EU15 group. This study, prepared and referenced in 2016, predicts a more pessimistic picture compared to the results of this article because, from its point of view, even according to the most optimistic scenario, 2027 may be the first year in which one of the CEE countries will be able to reach the average economic development of the EU.

The topic of economic growth and development has been examined by Batrancea et al. in several studies, such as the sustainability of economic growth (Batrancea et al. 2022), the impact of various factors on economic growth (Batrancea et al. 2022), the role of small and medium-sized enterprises Batrancea et al. (2022), the sustainability of economic development Batrancea et al. (2022), the impact of export-import on growth Batrancea (2022), the influence of inflation Batrancea (2021), the impact of corruption on economic growth Batrancea et al. (2023a), infrastructural factors Batrancea et al. (2023a), and economic factors in CEE countries Batrancea (2023).

The European Commission's cohesion reports make relevant contributions when examining the convergence of CEE countries. In their study, Licchetta and Mattozzi (2022) conducted an absolute and conditional beta convergence and sigma convergence analysis on GDP per capita data for the period 1995–2021, supplemented by an econometric model to examine the impact of the COVID-19 shock. According to their results, the COVID-19 crisis slowed convergence only temporarily and to a much lesser extent than the 2008 global financial crisis. Overall, the EU-27 and Euro area countries continued to catch up between 1995 and 2021 (however, no convergence can be detected in the group of old Eurozone member states). The main reasons for the slowdown in convergence after 2008 were the decline in investment rates and lagging catch-up in productivity (TFP). Nevertheless, it was confirmed that boosting trade and investing in human and physical capital would help promote convergence. The study's policy recommendations include the need for productivity-enhancing reforms; the deepening of

the single market, banking union, and capital markets union to support convergence; and the importance of developing human capital and stimulating investment to help lagging countries catch up.

Crespo-Cuaresma et al. (2010) used Bayesian model averaging and quantile regression on growth data for 255 European regions between 1995 and 2005 to identify robust drivers of growth and their differential effects across groups of slow- and fast-growing areas. Their findings show that the pace of regional growth is very uneven: the catch-up of new CEE member states has contributed significantly to convergence between countries, but significant differences remain between regions within countries. High human capital (the proportion of highly skilled workers) and significant physical capital accumulation are generally associated with faster regional growth. However, the impact of these factors differs depending on the level of development: physical investment stimulates growth more strongly in more developed, 'overperforming' regions, while improving human capital is more critical in catching up in lagging areas. Accordingly, there is no single policy that can be applied everywhere: development policy must be adapted to the specificities of the regions; in less developed areas, developing human capital and raising the level of education are the most effective growth stimulants, while in more developed areas, expanding physical capital investments can yield more significant results.

Goecke and Hüther (2016) analysed the convergence of GDP per capita in NUTS 3 European regions after 2000. They used quantitative methods (beta convergence calculation and a regression model) to identify the factors behind convergence. According to the authors' results, there has been noticeable convergence between regions since 2000. However, along very different paths, several Eastern European, Spanish, and Portuguese regions show rapid convergence, while many regions in Greece, Italy, and the United Kingdom experience a persistent lag. The empirical analysis revealed that a higher industrial employment rate and higher education (human capital) significantly increase a region's chance of convergence and that an Eastern European location is conducive to convergence. However, border location alone is not a significant factor. In addition, researchers found that EU cohesion funding significantly promotes convergence when used in the right sectors and areas (e.g. manufacturing, infrastructure, or environment). The study recommends increasing the effectiveness of development policy instruments: strengthening the conditions of EU funding (ex-ante conditionalities) and its implementation at the regional level for better targeting and competition, and strengthening the regional economic structure (especially industry and innovation), as their existence is conducive to the sustainable convergence of regions.

In summary, it can be stated that the EU accession gave an impetus to the organic development of the CEE countries since the region's economies became part of the common market of the block that brought together the developed countries. Obstacles to the free flow of Western capital, technology, and knowledge poured into the newly joined Eastern Member States were also removed. In addition, due to the legal framework in the EU region, the economic environment became more predictable, which also favoured new member states looking for investors. The extent to which EU membership increased the chances of successful catch-up is clearly shown by the fact that CEE countries have achieved more significant development than, for example, those remaining outside the EU (e.g. Serbia, Ukraine, Western Balkan states). Obtaining EU membership

supported organic growth, but the latter occurred more or less automatically after transitioning to a market economy. This process is explained by the so-called conditional convergence theory, which states that every country has an attainable level of development to which it converges (Huffman and Huffman 2021; Rodríguez and Santos 2018; Ukpolo and Murthy 1999). This theory is based on neoclassical economic growth theory formulated by two authors (Solow 1956; Swan 1956). According to this theory, the steady state of an economy's per capita income is determined by the rate of savings, population growth, and the externally determined rate of technological development.

Table 1 organizes the relevant literature and presents the common features of each research (e.g. applied theories, such as neoclassical theory, or newer theories, such as endogenous growth theories), the statistical and econometric methods used (e.g. panel data analysis, regression models, etc.), and the results they obtained, which help to understand the dynamics of economic convergence in CEE countries.

Table 1. Theories, methodologies and results of relevant literature related to the convergence of CEE countries.

Author/s and year	Country/region/theory analysed.	Methodology	Results
Romer (1990)	Endogenous Growth Theory	Model analysis	Education, human capital key to growth
Rebelo (1992)	Endogenous Growth Theory	Model analysis	Role of technology and human capital
Mankiw, Romer, and Weil (1992)	Cross-country comparison	Econometric analysis	Human capital crucial for growth
Lucas (1990)	Endogenous growth	Theoretical framework	Human capital as growth driver
Cuadrado-Roura (2001)	EU	Panel data, regression	Convergence in some sectors, divergence in others
López-Bazo (2017)	EU	Econometric analysis	Income levels diverging, partial convergence
Yin, Zestos, and Michelis (2003)	EU regions	Panel data, regression	Partial convergence, no full income convergence
Geppert, Happich, and Stephan (2005)	EU	Statistical analysis	Convergence patterns, different speeds
von Beyme (2001)	CEE countries	Qualitative case study	Velvet revolutions, elites and legitimacy loss
Bitzenis and Marangos (2007)	CEE countries	Case study	Transition speed, policy impact on growth
Ecirlia et al. (2014)	CEE countries	Qualitative analysis	Western firms expect cheap labour, new markets
McKinsey Global Institute (2016)	CEE countries	Report	EU integration boosts capital inflows
Jirasavetakul and Rahman (2018)	CEE countries	Report	Capital flows benefit from EU membership
Schimmelfennig and Sedelmeier (2005)	CEE countries	Qualitative study	Reforms and EU impact on politics, economy
Featherstone and Radaelli (2002)	CEE countries	Case study	Impact of EU accession on politics and economy
Grabbe (2006)	CEE countries	Qualitative analysis	EU's influence on economic and political transformation
Ekiert, Kubik, and Vachudova (2007)	EU countries	Survey, regression	Socioeconomic changes, inequalities in CEE
Mishler and Rose (2003)	EU countries	Survey analysis	Impact of EU integration on social changes
Goecke and Hüther (2016)	European regions	Beta convergence and regression model	Ambivalent convergence paths for EU development

Source: own editing.

Based on a review of neoclassical economics and empirical studies, the study formulates two hypotheses:

H1: The lower economic development of the Central and Eastern European countries at the time of accession allows for a faster catch-up with the average level of development of the EU, in line with the neoclassical theory that less developed economies grow faster than more developed countries.

H2: The average level of development of the EU will be reached first by those Central and Eastern European countries whose economic growth is the most dynamic and closest to the average level of development of the EU at the time of their accession.

Method and data

The study combined several methods and economic indicators to answer the question of CEE countries' development level at the end of 2022 compared to the average level of development of the EU. One such indicator is GDP/capita.

The most important indicator of economic development is GDP per capita, measured by purchasing power parity (PPP), and has two components. One is GDP itself, that is, the added value created in a given economy during a year, which is divided per capita to obtain the nominal level of development. However, this does not provide a complete picture because for international comparisons, different price levels must be eliminated. This is what PPP is meant to serve, and if it is adjusted to this, one country's development can be seen more precisely. This study specifically deals with the changes in GDP per capita measured at PPP prices in the EU average and CEE countries. It is also important to note that, although economic development is closely related to the standard of living, GDP per capita calculated at PPP prices is not an income indicator, so it does not directly reflect the standard of living (Török 2023).

Another method used is the time-series analysis. This study uses general statistics to analyse the time series.

The data measured after accession in 2004 were essential for answering the study's central question. The table shows that the information measuring the economic development of the CEE and the EU is incomplete without the data measured after accession in 2004.

The data in Table 2 show that the catch-up of CEE countries has progressed dynamically between 2004 and 2022. While the average value of the EU increased by 177 per cent, the GDP per capita of CEE countries increased by 221 per cent. Romania, Bulgaria, and Lithuania achieved the highest growth, in that order.

According to neoclassical theory, a lower level of economic development at the time of accession enables a faster catch-up. By adopting advanced technology, backward economies can enter a so-called transition path, on which they temporarily grow at a much higher rate than countries at the forefront of technology. The nature of the neoclassical transition path has been discussed in detail (Barro 1997). Based on this, it can be expected that the more significant the initial difference from the EU average, the steeper the country's growth curve. Neoclassical theory was robustly confirmed in the case of the three least-developed countries (Romania, Bulgaria, and Lithuania). No. 1 According to the data in the table, these countries had the lowest GDP per capita in 2004 (12, 10, and 15,000 dollars per person, respectively).

Table 2. CEE and EU GDP 2004–2022 (thousand US dollars/capita, at PPP prices).

Country	2004	2006	2008	2010	2012	2014	2016	2018	2020	2022	Pearson
BG	10	12	15	15	16	18	20	23	24	32	0.9296
HR	17	20	22	21	21	22	25	29	28	40	0.8419
CZ	21	25	28	28	29	33	36	41	41	48	0.9639
EE	18	23	25	22	26	29	31	36	38	45	0.9318
HU	19	21	23	22	23	26	28	32	33	42	0.9014
LV	14	18	21	18	21	24	27	31	32	39	0.9404
LT	15	19	23	21	25	28	31	36	39	47	0.9439
PL	14	17	20	21	24	25	28	33	34	44	0.9387
RO	12	15	19	17	20	21	24	30	31	39	0.9242
SK	16	20	25	25	27	29	30	33	34	40	0.9664
SI	22	26	30	28	29	31	34	39	40	49	0.9112
EU	26	29	32	33	35	40	41	44	42	46	1.0000

Sources: EU GDP, 2004–2022 (The World Bank 2024); CEE GDP, 2004–2022 (International Monetary Fund 2024).

The third method was correlation calculation. The last column of Table 2 shows the value of the Pearson correlation, which indicates how closely the development of the GDP per capita of each CEE country is correlated with the average value of the EU. The correlation of the GDP per capita of CEE countries with the average GDP of the EU shows the extent to which the economic development of each CEE country follows the average development rate of the EU. High correlation values indicate that the economies of CEE countries are closely linked to the EU economy, whereas low correlation values may mean that the development of CEE countries is more independent of the EU.

A test (fourth method) was performed with the correlation values, which examined whether the (r) values followed a normal distribution. A test was performed with the correlation values to examine whether the (r) values followed a normal distribution. The results of the test were as follows: The Shapiro–Wilk test did not show a significant departure from normality, $W(11) = .87, p = .078$; test results: P -value: 0.07804, W : 0.8683, sample size (n): 11, average (\bar{x}): 0.9267, median: 0.9318, Sample Standard Deviation (S): 0.0342, Sum of Squares: 0.0117, b : 0.1008, skewness: -1.5429 .

Figure 1 shows the normal distribution of the correlation values of growth in the EU and CEE countries. The high Pearson correlation coefficients suggest a strong positive linear relationship between the GDP per capita of CEE countries and the average GDP per capita of the EU (see last column of Table 2). These strong correlation values are not accidental, as the development of the EU's average GDP per capita is determined by the values of the member countries, including those of CEE countries. However, the strong correlation cannot suggest that the common factors affecting GDP per capita are significantly the same for the EU and CEE countries.

I performed a kurtosis test with the GDP per capita values of CEE countries and the EU (see data in Table 2). I have written the results (due to reasons of length) only verbally at the end of Chapter 3 as follows: A Kurtosis test was performed using the GDP per capita data of the CEE countries and the EU. The test results show the following. The Kurtosis values calculated from the CEE countries and the EU average are negative, indicating that the GDP per capita data distribution is flatter than the normal distribution. The data are not concentrated around a narrow peak but show a broader distribution. Low Kurtosis values, especially between 2004 and 2022, indicate that the change in GDP per capita is relatively smooth and less volatile compared with samples with a normal distribution. This suggests that the economic development of EU and CEE countries does not

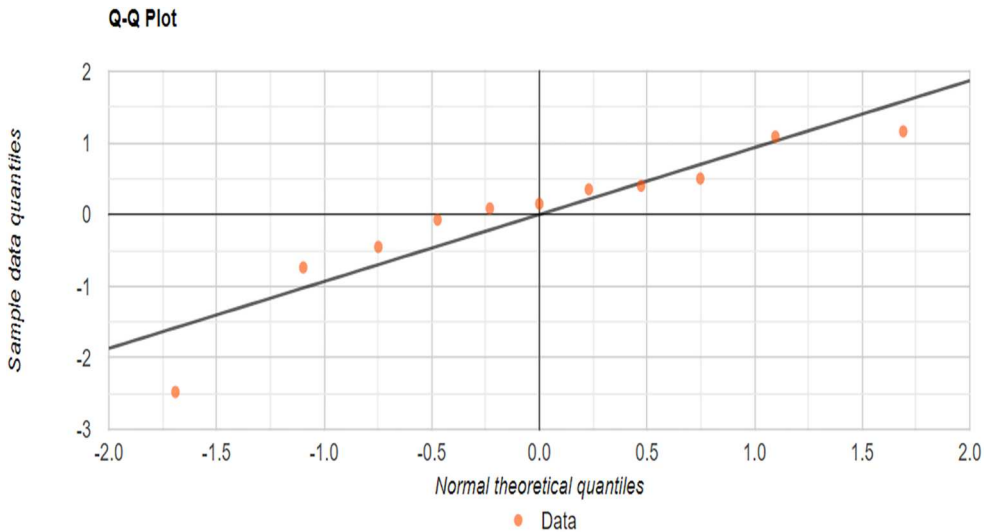


Figure 1. Distribution of the correlation between CEE countries and EU GDP/central values. Source: own editing.

follow a tight, peaked pattern, but rather a broader distribution with more minor fluctuations.

The fifth method calculated the ‘catch-up index,’ which was applied for the first time in CEE countries. Table 4 presents the methodology in detail.

Results

The results section contains quantitative and qualitative information and data derived from the analysis to determine the convergence level of CEE countries.

The path of convergence of CEE countries between 2004 and 2022

The eastern enlargement that began in 2004 triggered one of the most significant economic transformations in the Union’s history. Through EU accession, Central and Eastern European countries sought to accelerate their convergence with the average economic development of the EU.

Figure 2 illustrates how the GDP/capita trajectory of CEE countries developed between 2004 and 2022 compared to the European Union average. The figure shows that all countries, except for Bulgaria, have moved closer to the EU average; that is, convergence has been operating for the past 19 years. However, only three countries managed to catch up, namely, the Czech Republic, Lithuania, and Slovenia, whose GDP per capita exceeded the EU average by 2022.

The fact that the neoclassical hypothesis was more moderately fulfilled in the case of other CEE countries does not, of course, mean that the suggestion that it is easier to grow from a lower level is false; it only means that in addition to the initial level of development, other factors also play a role in economic performance. According to the theory of

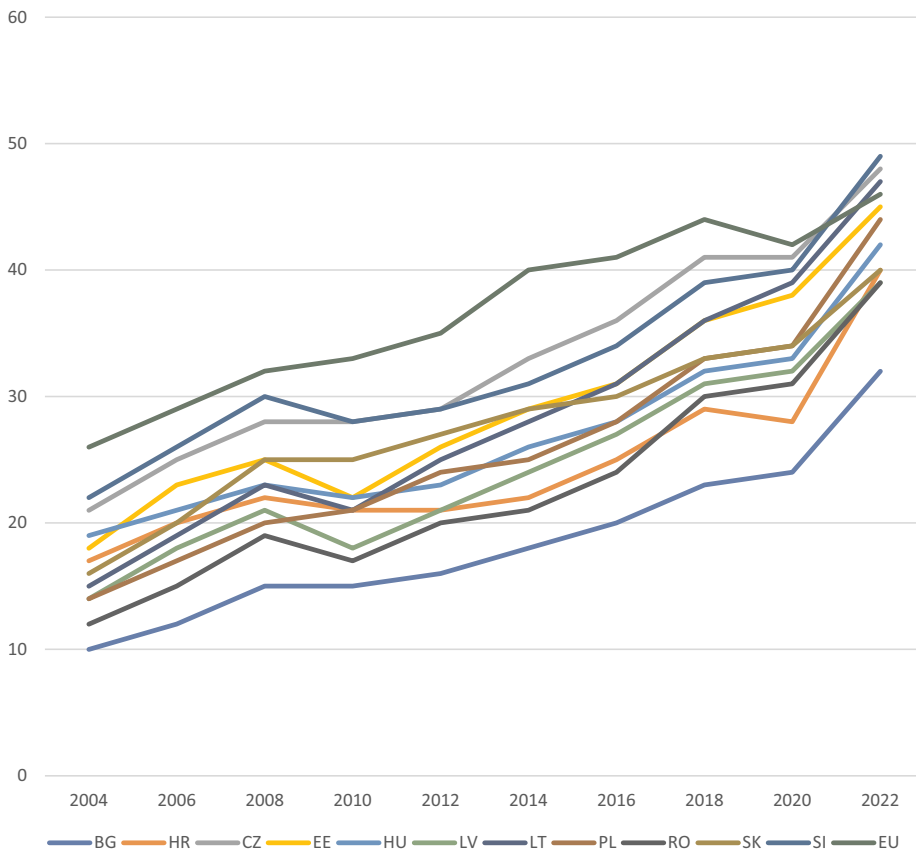


Figure 2. GDP per capita in CEE countries and the EU, 2004–2022 (thousand US dollars/capita, at PPP prices). Source: own compilation based on data from [Table 2](#).

conditional convergence, apart from other variables (level of education, geographical location, and institutional quality), the economic growth rate is inversely proportional to the level of development (Cieřlik and Wciřlik 2020).

In the first wave, on May 1, 2004, eight countries joined (Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Hungary, and Slovenia); in the second wave, on January 1, 2007, two more (Romania and Bulgaria); and in the third wave, on July 1, 2013, Croatia joined the EU. It is correct to state that the three countries that joined later had less time and resources available for convergence. This study considers the differences in the time of accession by repeatedly running the correlation calculation on the algorithm with the actual accession dates. However, the values did not change significantly; therefore, the data in [Table 1](#) remained unchanged. The explanation for this is that the accessions of 2007 and 2013 brought the same benefits provided by the EU to Romania, Bulgaria, and Croatia, even though the accession dates were different. The later accessions also responded quickly to the changes brought about by economic integration and growth, since their accession has been more dynamic than that of the earlier accession countries.

However, a calculation that shows the growth dynamics of the three later-accession countries has to be made since their actual accession.

In [Table 3](#), the values calculated from the IMF data show that the GDP per capita of previously joined CEE countries increased by 57 per cent from the date of accession to 2022. In contrast, Bulgaria's growth has been 120 per cent, Romania's 129 per cent, and Croatia's 100 per cent since their actual accession.

The values of the convergence index are relevant to the research objectives of this study.

[Table 4](#) shows the differences in catch-up performance among the CEE countries. Statistics show which countries have made the most progress; they are the champions of convergence; these countries have a level exceeding the EU average GDP per capita, above 100 per cent (Czech Republic, Lithuania, Slovenia). Poland is very close to the EU average level at 91.3 per cent, and Romania at 72.2 per cent. However, Estonia was the closest to the EU average of 93.5 per cent.

Based on previous data, CEE countries can be divided into four heterogeneous groups based on their economic development compared to the average growth of the EU in 2022. Groups: 1. catchers (Czech Republic, Lithuania, and Slovenia); 2. high performers (Estonia and Poland); and 3. average performers (Romania, Slovakia, Latvia, and Hungary); 4. Poor performers (Bulgaria and Croatia).

Estonia, Poland, and Romania have good chances of reaching the EU average level of development, but based on the results of extrapolations, this will definitely not happen between 2023 and 2027.

Table 3. Development of GDP per capita in CEE countries since their actual accession (in thousands of US dollars/capita).

Country Group/Country	Year of Accession	Value	Value	Index (%)
Eight country	2004	28	44	157
Bulgaria	2007	15	33	220
Romania	2007	17	39	229
Croatia	2013	20	40	200

Source: International Monetary Fund (2024).

Table 4. CEE countries' catch-up index compared to the EU average, 2004–2022.

Country	GDP 2004 (EU = 100)	GDP 2022 (EU = 100)	Δ GDP (percentage)	Catch-up index (percentage)*
BG	38	70	32	51.6
HR	65	87	22	62.9
CZ	81	104	23	Converged
EE	69	98	29	93.5
HU	73	91	18	66.7
LV	54	85	31	67.4
LT	58	102	44	Converged
PL	54	96	42	91.3
RO	46	85	39	72.2
SK	62	87	26	68.4
SI	85	107	22	Converged

Source: own calculation.

*Calculation of the catch-up index is shown in Bulgaria's example: Bulgaria stood at 38 per cent of the EU average in 2004, that is, it should have brought in 62 per cent by the time it caught up. By 2022, it reached 70 per cent of the EU average; the difference of 32 percentage points (70–38) means $32/62 = 51.6$ per cent of the way to catch up.

The differences between CEE countries are extraordinary if we consider that since the regime change in each country, economic development and convergence relied on foreign working capital investments. However, this development model was exhausted by the 2010s, and the middle-income trap (MIT) occurred: the wages of CEE countries were no longer low enough for an international competitive advantage, but at the same time, the conditions necessary for the development of a creativity-based (knowledge-based) production culture were only partially fulfilled. According to the data in [Table 2](#), the Czech Republic, Lithuania, and Slovenia seem to have been getting out of this trap.

Based on the data of the catch-up index, it can be reasonably stated that after the regime change, the CEE countries began to search and research the possibilities of achieving the economic development of Western Europe; however, despite the initial similar circumstances, these post-socialist countries reached different levels of development by the end of the examined period.

In the Discussion section, I compare this study's results with those of research examining the convergence of CEE countries to the EU.

The state of convergence of CEE countries shortly

In this subsection, we use various macroeconomic methods to forecast the economic convergence of CEE countries with regard to the EU's expected value. This subsection will answer the question of which CEE countries will be the ones that, based on their own and the EU's past development data, will be the first to reach the desired level of development (after the Czech Republic, Lithuania, and Slovenia, which have already achieved it) and in their case when it is expected to reach the EU's average level of development.

This prediction is essential because researchers' quantitative examination of past phenomena and processes, exploring the tendencies and connections that characterize the past, would be an activity for its own sake if the need for projection (extrapolation) is not connected to it. Any well-founded and professional analysis of the past would be worthless if researchers do not draw consequences for the future.

The extrapolation database was 1. provided by table data. The following methodologies were used for the calculations:

1. Autoregressive integrated moving average (ARIMA) models effectively analyse the patterns inherent in time series and are therefore suitable for forecasting the GDP development of CEE countries.

The formula used by the model:

$$Y_t = \mu + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + \xi_t - \theta_1 \xi_{t-1} - \theta_2 \xi_{t-2} - \dots - \theta_q \xi_{t-q} \quad (1)$$

where Y_t is the GDP value at time t , μ is the average value, p is the autoregressive (AR) order, d is the differentiation order of the time series, q is the moving average (MA) order, ϕ is the autoregressive coefficient, and θ is the moving average coefficient.

2. Holt-Winters Exponential smoothing (ETS): ETS models are suitable for smoothing and forecasting time series, particularly if the data show seasonal patterns.

The formula used by the model:

$$Y_{t+h} = I_{t+h} \cdot b \cdot b_t + S_{t-m} + (h \bmod m) \quad (2)$$

where Y_{t+h} is the expected GDP value at time $t+h$, I_t is the level, b_t is the dead space, S_t is the seasonal component, m is the length of the seasonal period, and h is the horizon.

3. State Space Models: This model separates GDP dynamics and trends, and forecasts are made based on the available data.

The general shape of the model:

$$Y_t = Z_t \alpha t + \xi_t, \quad \alpha_{t+1} = T_{tat} + R_t \eta_t \quad (3)$$

where Y_t is the observed GDP variable, αt is the hidden state, Z_t is the observation matrix, T_t is the transition matrix, R_t is the hidden state assignment matrix, ξ_t is the observation noise, and η_t is system noise.

4. GDP growth trend analysis: Analysis of past year trends with linear regression to predict the direction in which GDP will change in the long term in CEE countries.

The formula used by the model:

$$Y_t = \beta_0 + \beta_1 \cdot t + \varepsilon_t \quad (4)$$

where Y_t is the GDP value at time t ; β_0 and β_1 are the regression coefficients; t is time; and ε_t is the error term.

The following conclusions can be drawn from the numerical results of the four macro models (see [Table 5](#)): Linear regression gave an optimistic forecast. It is sensitive to past trends and may provide estimates of past economic dynamics. The ETS model calculates optimistic forecasts for short-term changes. It reacts flexibly to short-term changes and seasonal fluctuations, which appear as noise in time series. Compared with the previous two models, the ARIMA model is usually pessimistic when making predictions. It is often less sensitive to short-term changes but is more adaptable to long-term trends. State-space models provided moderately pessimistic predictions. It strives for a more balanced and less prominent prediction result, considering the calculated model parameters.

Based on the data calculated with various macro models, it can be concluded that only Estonia is the CEE country that is likely to reach and exceed the average GDP value of the EU between 2023 and 2027 (along with the Czech Republic, Lithuania, and Slovenia). Based on GDP forecasts calculated with all four models (linear regression, ARIMA, ETS, and state-space models), these countries show increasing economic performance, and there is a chance that they will retain their position after catching up. At the same time, Croatia, Latvia, and Slovakia, which are still below the EU average based on their current data, will probably continue to lag in economic development between 2023 and 2027.

A growing economic trend can also be seen in Poland and Hungary, but the forecasts do not indicate that both countries would reach or exceed the EU average GDP. In

Table 5. Extrapolation of GDP/capita of EU and CEE countries with different macro models, (in thousand US dollars/capita, PPS prices).

	EU	BG	HR	CZ	EE	HU	LV	LT	PL	RO	SK	SI
ARIMA¹												
2023	47.7	35.8	38.5	47.9	47.5	42.8	40.3	51.6	45.2	38.9	40.2	49.6
2024	48.9	36.0	39.6	49.1	49.0	44.0	41.6	52.9	46.4	40.2	41.5	51.0
2025	50.2	36.9	40.9	50.4	50.4	45.3	43.1	54.2	47.7	41.5	43.0	52.3
2026	51.4	37.8	42.2	51.7	51.9	46.6	44.5	55.5	48.9	42.8	44.4	53.6
2027	52.6	38.8	43.4	52.9	53.4	47.9	45.9	56.8	50.2	44.1	45.8	54.9
ETS²												
2023	48.1	35.2	39.6	48.4	47.9	43.3	40.7	51.2	43.9	39.4	40.6	49.9
2024	49.1	36.0	40.6	49.3	48.9	44.5	42.1	52.4	45.0	40.5	41.9	51.1
2025	50.2	36.9	41.6	50.4	49.9	45.6	43.6	53.5	46.2	41.7	43.2	52.4
2026	51.4	37.8	42.6	51.5	51.0	46.8	45.0	54.8	47.5	42.9	44.6	53.7
2027	52.6	38.8	43.7	52.6	52.1	48.0	46.5	56.0	48.7	44.2	46.0	55.0
SSM³												
2023	48.1	34.5	39.4	48.5	48.3	43.6	40.9	51.2	44.0	39.5	40.6	49.7
2024	49.1	35.1	40.2	49.4	49.2	44.7	42.3	52.4	45.1	40.6	41.9	50.9
2025	50.2	35.9	41.1	50.3	50.1	45.8	43.7	53.6	46.3	41.8	43.3	52.2
2026	51.4	36.7	42.0	51.3	51.1	46.9	45.2	54.8	47.5	43.0	44.7	53.5
2027	52.6	37.5	43.0	52.3	52.1	48.1	46.6	56.0	48.7	44.2	46.1	54.8
LIN.REG⁴												
2023	48.9	33.6	40.7	49.8	48.1	43.9	41.4	50.7	43.7	39.9	41.0	50.4
2024	50.5	35.2	42.4	51.4	49.8	45.5	43.1	52.4	45.4	41.5	42.6	52.0
2025	52.2	36.9	44.0	53.1	51.4	47.2	44.7	54.0	47.0	43.2	44.3	53.6
2026	53.8	38.5	45.7	54.7	53.1	48.8	46.4	55.7	48.7	44.8	45.9	55.2
2027	55.5	40.2	47.3	56.4	54.7	50.5	48.0	57.9	50.3	46.5	47.6	56.8

Note: Model parameters: ¹ $d = 2, p = 10, q = 2$, ²between $\alpha, \beta, \gamma: 0.1-0.3$, ³level trend and seasonal = 2; slope: 1.65; intercept: -3232.5, ⁴ $\beta = 0.75$.

Source: own calculation.

Bulgaria and Romania, the model results suggest that the countries will be closer to the EU average, but in this case, they will be significantly behind. [Figure 3](#) illustrates data on the expected economic development of the examined countries.

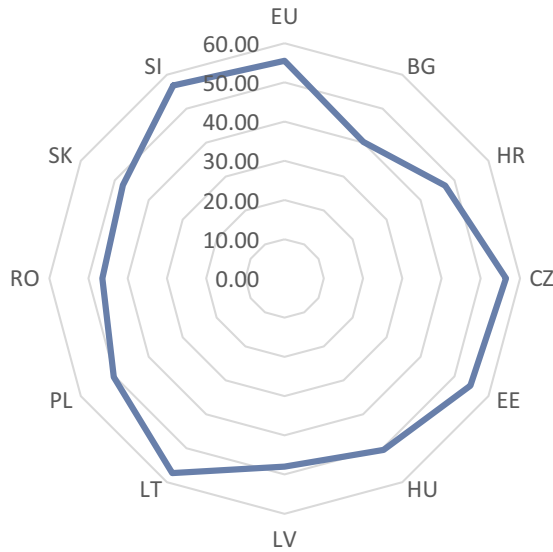


Figure 3. Extrapolated GDP/central values of CEE countries for 2027 based on the most optimistic scenario. Source: own editing.

Evaluating the GDP growth rate of CEE countries based on the data in [Table 5](#), it can be concluded that Slovakia, Romania, Croatia, and the Czech Republic may achieve the most dynamic economic growth between 2023 and 2027. Estonia, Latvia, Hungary, and Poland are in the middle ground, whereas Slovenia, Latvia, and Bulgaria are predicted to have the lowest growth rates between 2023 and 2027.

Discussion

The detailed results are presented in the previous chapter. In the following section, I briefly summarize the answers to the research questions formulated in the introduction.

At the end of 2022, the economic development shows an ambivalent picture compared to the EU average. Three CEE countries (Czech Republic, Lithuania, and Slovenia) reached the EU GDP per capita value, and two countries (Estonia and Poland) were close to reaching the level. The growth dynamics of four other countries (Romania, Slovakia, Latvia, and Hungary) are adequate, but they are still far from reaching the EU average level of economic development. In the case of Bulgaria and Croatia, the most significant lag behind the average development level of the EU is observed. Based on the extrapolations made with the four macroeconomic methodologies, Estonia has the best chance of reaching the EU average value in terms of GDP per capita as soon as possible, even if we know that this value is also constantly rising (sometimes with minor interruptions). In the following, I present studies that have examined where CEE countries converge with the EU and attempt to predict when these countries will reach the EU's average level of development.

Similar conclusions to the results of this research were reached by the studies cited in the literature: Egri and Lengyel (2023); (Głodowska and Pera 2019); (Pečarić, Kusanović, and Jakovac 2021) and (Matkowski, Prochniak, and Rapacki 2016). In contrast to previous studies, the following papers formulated conclusions that were more contradictory to the results of this study: Glawe and Wagner (2021), Cichowicz and Rollnik-Sadowska (2018), and Cieślík and Wciślík (2020).

Conclusions and professional policy recommendations

The convergence of the economic development of the EU's new CEE member states with that of older members has aroused widespread interest. The results of joining the EU should be reflected in this convergence, that is, economic catch-up (convergence), over time. From the mid-1990s, CEE countries that wanted to join the EU increasingly overcame the transformation recession and looked forward to joining the EU. However, the experiences of previous EU cohesion countries prove that accession does not automatically trigger a rapid catch-up in economic development. The pace of potential economic growth and catch-up accelerated after the accession in 2004. However, the degree of catch-up was (and still is) very different for individual CEE countries and periods. The catch-up rate of the new CEE member states that joined in 2004 and after was generally on the rise and, without exception, grew more dynamically than GDP per capita, which expresses the average economic development of the EU.

The results of the study strongly confirmed the first hypothesis. Those Central and Eastern European countries grew the fastest and were less developed at the beginning

of the period under study. In order, the following Central and Eastern European countries show the most dynamic economic growth (the development ranking of the given country at the beginning of the period under study is in brackets): Romania (10th), Bulgaria (11th), Poland (9th), Latvia (8th) and Lithuania (7th).

Hypothesis 2 was not fully met, as in 2004, the countries with the most dynamic economic growth (Romania, Bulgaria, Poland, Latvia, and Lithuania) were not the closest to the EU average level of development. According to the 2004 data, Slovenia, the Czech Republic, Hungary, Estonia, and Croatia were the closest to the EU average but not the most dynamically growing countries. Consequently, the hypothesis is partly correct, i.e. catching up to the EU average level of development did not depend exclusively on the dynamics of the economic growth of the Central and Eastern European countries. Although the countries with the most dynamic growth were not the first to reach the EU average level of development, according to the 2004 data, the catching up of the countries with lower economic development was faster. This suggests that the rapid growth of individual CEE countries was insufficient to bring a country up to the EU average level of development but that the initial level of development also played a significant role in the pace of catch-up.

The results of this study also confirmed the neoclassical theory in the case of Central and Eastern European countries, according to which lower economic development at the time of accession enables faster catch-up. By adopting advanced technology, the backward economies entered a so-called transition path, in which these countries temporarily grew at a much higher rate than the technologically advanced EU member states at the forefront. According to this study's assumption, CEE countries are currently on a relatively fast convergence path and will remain there, so there is still room for further catching up. After accession, CEE countries were on a transitional path, resulting in a significant degree of convergence. Theoretically, the pace of catching up may decrease or may even be interrupted as time progresses. The present study did not count on this theoretical possibility when it extrapolated the expected economic growth of CEE countries shortly (2023–2027), expressed in GDP, using various macroeconomic methods. The presented simulations assumed that the growth experienced until 2022 and unchanged (economic) policies in these countries. The forecasts for the near future are more optimistic than pessimistic, as the current and extrapolated situations of the Czech Republic, Lithuania, Slovenia, and Latvia are equally good, and the prospects for the economic development of Poland, Estonia, Hungary, and Romania are also encouraging. Bulgaria and Croatia are the two countries that lag behind the average economic development of the EU the most, and this situation (based on the results of extrapolations using different methods) will undoubtedly remain shortly. These forecasts seem justified only if regional or global shocks do not occur.

To join any economic group and achieve permanent development and the level of development of the group, many conditions must be met by the joining country. The present study highlights some of these (without claiming to be exhaustive). First, in the process of economic convergence of the CEE countries that joined the EU and the countries planning to join later (e.g. Serbia), the institutional system, which determines the entrepreneurial environment and influences the quality of political decision-making, is of particular importance. It has been proven several times that the economic strategy of a national economy and its institutional background are closely related, so

without good institutions, a high level of economic growth cannot be expected, even in an optimal socioeconomic environment. Second, several explanatory factors for the slow convergence of CEE countries have become permanent in these countries: a decreasing share of wages in production, the formation of development gaps (approaching in some periods, then moving away from the EU's leading edge again during the crisis), insufficient amount of internal financial savings and investments from own resources, etc. The third is to accelerate EU convergence and maintain a long-term growth path. In addition to modernization investments, increasing the human capital stock and expanding qualified employment are necessary. In the latter field, migrating the best-qualified workforce to the west is a permanent problem for CEE countries.

I contextualize the policy recommendations formulated above with the relevant literature in the following sentences. First, I draw attention to the importance of the quality of the institutional system. In this regard, one study highlights democratization, curbing corruption, strengthening social cohesion, and increasing government efficiency in CEE countries. In addition, according to empirical experience, demographic processes are essential, especially talent retention, entrepreneurship, and regional integration (Gill and Kharas 2015).

My second call for attention was aimed at decreasing the wage share in the production of CEE countries, which gradually reduced these countries' competitiveness. The research results showed that from 2009–2018, the labour force convergence between CEE countries and the EU15 was approximately 40 per cent at the aggregate level. On the other hand, in the examined period, the level of labour force convergence between CEE and EU15 was five times that of the economy (Prohorovs and Bistrova 2022).

Third, I draw attention to labour migration from CEE countries and the negatives of labour employment based on low wages. Empirical data shows that, for example, the Czech Republic, Slovenia, and Estonia have achieved quality-based competitiveness. At the same time, the rest of the CEE countries still compete primarily based on low labour costs. The low intensity of productivity growth makes economic growth in CEE countries a function of the number of production factors, which cannot be considered a sustainable catch-up path. This finding may be related to the policy recommendation that CEE countries should not worry about the impact of higher wages on foreign investors. For this reason, direct foreign capital investments will not flow from CEE countries. CEE countries overestimated this risk.

Limitations and future directions

As with all research, this study had some limitations. The present study examined the convergence of CEE countries that joined the EU in 2004 and, subsequently, the economic development of the EU. One of the limitations of this study is that the analysis was performed using a single variable, GDP per capita. However, this does not rule out the possibility of using another indicator to determine the level of convergence (e.g. the Human Development Index, HDI). However, there are many obstacles to catching up faster, some of which were listed in the previous section of the study. For example, future research on convergence could examine the adverse effects of factors hindering faster catch-up (e.g. migration of skilled labour to the West, insufficient internal savings, underdeveloped institutional structure) separately and together.

Ethics statement

The research did not involve human subjects, human data, tissues or animals.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The data supporting the study's findings are presented, and the results can be reproduced.

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Appendix

Central East European (CEE) countries that joined the EU in 2004 and after.

Bulgaria (BU), Croatia (HR), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Romania (RO), Slovakia (SK), and Slovenia (SI).