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Economic and Monetary Union: What Kind of Convergence?

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Abstract: This paper explores the complexities of convergence within the European Union, focusing on both nominal and real convergence in the context of the Economic and Monetary Union (EMU). The authors revisit the theoretical underpinnings of monetary integration, drawing from Optimal Currency Area (OCA) theory and its evolution, while analysing the benefits and costs of membership in a monetary union. Special attention is given to the convergence paths of EU Member States not yet part of the Eurozone, evaluating their alignment with Maastricht criteria, structural preparedness, and real convergence trends. Through a combination of theoretical insights and empirical assessments, the study presents a comparative analysis of inflation rates, exchange rate volatility, long-term interest rates, and fiscal indicators in non-EMU countries. It highlights growing disparities in economic performance and inflation post-2020, intensified by recent macroeconomic shocks. The research underscores the importance of not just satisfying nominal entry criteria but achieving sustainable real convergence – reflected in GDP per capita, labour market flexibility, and structural similarity with Euro-zone economies. The findings suggest that while Denmark, Sweden, Czechia and Bulgaria appear institutionally and economically aligned for euro adoption, countries like Hungary, Poland and Romania lag in meeting core convergence metrics. A more holistic and policy-driven approach to integration could be essential, promoting structural cohesion and solidarity mechanisms to mitigate regional disparities and ensure the long-term viability of the EMU.

Keywords: economic and monetary union; nominal convergence; real convergence; optimal currency area theory; sustainable integration.

JEL classification: F15; F45; O23.

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1. INTRODUCTION

Research of the *catching up* process of Eurozone candidate countries is essential to understand the future of the Economic and Monetary Union and its economic strategy, especially because it is difficult to assess convergence and divergence processes among different economies. The contemporary literature about convergence and monetary integration is quite extensive and diverse, tackling general questions and specific situations, such as the assessment of potential integration of a country into monetary unions and the comprehensive analysis of potential scenarios of real and structural convergence of less advanced economies.

In this paper we address several aspects, including the basics of monetary integrations: What are the benefits and costs, what are the preconditions for joining such a project, how potential impacts of integration can be determined? Furthermore, the context of nominal vs. real convergence for candidate EU countries for the introduction of the euro is presented, with some empirical representations suggesting the current perspectives of non-EMU countries. As the Maastricht Treaty envisages an obligation to join eventually (except maybe for Denmark), we treat all non-EMU Member States of the EU as candidates for the euro. Besides the nominal convergence criteria which formally determines which countries can finally join the Euro-zone, which we analysed partially from a different perspective, it is essential to estimate other relevant criteria and aspects. This gives more ground to comprehensive assessments and preparations for a proper integration into an economic and not only monetary union, as suggested by many economists and proven by real events. Therefore, we present in a concise manner some crucial aspects of real convergence and the Optimal Currency Area theory criteria. The Discussion section elaborates some of the findings and combines with other authors' estimates and conclusions, in order to point out the complexity of the issue and to highlight positive tendencies and necessary adjustments for countries gradually integrating into the Euro-zone.

In our research we have done an extensive literature review, combining traditional theoretical foundations with more recent research of several aspects related primarily to nominal and real convergence aspects. In the empirical parts, we combined data mostly from Eurostat and the ECB, the World Bank and UNCTAD to present convergence in several dimensions. Our main goal of the research was to comprehensively cover major nominal and real convergence controversies and evaluate currents trends of convergence, using specific assessments. Furthermore, we tried to point out to necessary adjustments and repercussions of these complex economic and political dimensions. In this way we contribute to the discussion on the purpose and sustainability of the Economic and Monetary Union, trying to determine improvement possibilities as well. We find this to be extremely important as persistent disparities in living standards fuel migration pressures, political fragmentation and public distrust in the European integration project. Thus, understanding different aspects of convergence processes and promoting it in all parts of the EU consequently reduces risks for peripheral countries and regions to remain "in the backlog", while the core regions and countries increasingly prosper and progress.

2. THEORETICAL CONTEXT OF MONETARY INTEGRATIONS AND THE CONVERGENCE PROCESS

In today's highly globalized world, independent nations can "link" their economies to a greater or lesser extent in order to accomplish the benefits that come with the removal of trade obstacles and the size effects (IMF - External Relations Dept, 1984), such as greater internal efficiency and greater resilience to external events (WTO, 2021). The net effect of borders depends on the size of the integrated countries and on pre-existing levels of income (Spolaore, 2016). Economies with different levels of economic prosperity which remove border obstacles to trade and investment have to be careful in assessing the effects of integration, including the monetary aspect. The size effect needs to outweigh the fact that the neighbour might be poorer. For example, in case of France and Germany merging, according to Spolaore and Wacziarg (2002), they would have benefited from induced growth because they have similar income levels, but also because their large market size plays an important role in a unified market.

Many would argue that one of the (if not the) greatest achievement of the European economic integration is the Economic and Monetary Union – bringing stability, shared identity and unity. Despite some imperfections and occasional crisis, it could be seen as a valuable long-term investment for Member States and the overall integration process (Pisani-Ferry, 2021; Issing, 2005; De Grauwe, 2006).

The EMU basically removes specific obstacles for the free movement of goods, services, capital and labour, the essence of the European Internal Market. The idea of additional removal of obstacles to economic integration is based on convergence processes between member countries (European Economy, 1990). They need to adhere to specific legal, political and economic criteria in order to efficiently participate in this Union, which is not just a monetary union (represented by a single currency – the euro). More openness and more interconnectedness play a role in setting up more advanced stages of economic and political integration (Arribas et al, 2020). Although the original Rome Treaty did not formally ask for a monetary integration among European Economic Community (EEC) countries, but rather focused on free trade and liberalized mobility of capital and labour, the single (and then internal) market created new impetus for further integration in the late 1980-ies and early 1990-ies (European Economy, 1990; Bayoumi and Eichengreen, 1996). Considering converging political and economic trends, the monetary integration among EU Member States was not a surprise, but rather a logical move toward stronger integration and stronger monetary stability, which was built-up during the period of the European Monetary System. The EMS helped EEC Member States and their currencies to rely less on the US dollar, reduce exchange rate volatility and harmonize/coordinate policies, not only in the monetary sphere (European Economy, 1990). Nevertheless, the foundation of the EMU is the monetary union. So, what is a 'monetary union'?

A monetary union is usually defined as a currency area within which the exchange rates of the Member States' currencies are irrevocably fixed (Kandžija and Cvečić, 2010). Members lose control, and supervision, over their exchange rates, interest rates and money supply, i.e. they lose monetary sovereignty (Kandžija and Cvečić, 2010). In the context of the EMU, Wieser et all. (2024) warn that those countries staying outside the Euro-zone could be subject to: persistent exchange-rate volatility, higher interest-rate spreads, weaker monetary-policy transmission, and fragmented capital markets. So, what are than the benefits of a monetary union? Theory and practice indicate to different benefits, but such initiatives usually cause

specific costs, as well. Table no. 1 summarizes some of the most often mentioned benefits and costs of monetary unions.

Table no. 1 – Comparison of benefits and costs of monetary unions

Benefits:	Costs:
▪ Mostly at the micro level (cancellation of direct transaction costs of currency conversion; payment costs; indirect benefits due to higher price comparability) ▪ Reducing uncertainty over credible exchange rate fixing ▪ Higher certainty regarding future prices due to permanently fixed exchange rates (influences investment, production, consumption decisions ...) ▪ Expressing commodity prices on the Global Market in a domestic currency ▪ Absence of currency risk for external debt ▪ International reserves - facilitated financing of the current account deficit ▪ A common currency contributes to the integration of financial systems, which deepens them and increases their liquidity ▪ Facilitated risk diversification	▪ Losing monetary policy as an instrument of economic policy ▪ Exchange rate fixed, interest rates exogenous ▪ Loss of inflation tax and the possibility of devaluation ▪ Transitional instability ▪ Extinction of *seignorage*

Source: Authors' own work

More comprehensive analyses of impacts of monetary unions were discussed within the Optimal Currency Area (OCA) Theory, developed through several decades – traditionally by Robert Mundell (1961), Ronald McKinnon (1963) and Peter Kenen (1969), and later by Paul Krugman (1993), Jeffrey Frankel and Andrew Rose (1998), Tamim Bayoumi and Barry Eichengreen (1992) and many others, especially during and after the establishment of the EMU. More recent versions of the theory are mostly concentrated on the endogeneity, specialization, and business cycles synchronization issues, while even shifting towards a more policy oriented theory (Stoykova, 2018; Creel, 2018).

While the OCA theory takes into account specific real economic conditions and trends (mobility of production factors, labour mobility and labour market integration, price and wage flexibility, similarity in inflation rates, trade openness and connectedness, fiscal solidarity and federalisation, financial Integration, symmetry of economic shocks…), the formal creation of the EMU included primarily a set of five monetary and fiscal criteria, defined by the Maastricht Treaty as *nominal convergence criteria* (Kandžija and Cvečić, 2010). There had been many discussions about the relevance and actuality of these criteria, as well as about reforms to the convergence and economic governance rules (Szegedi and Teleki, 2024; Pucar, 2020; Creel, 2018; Diaz del Hoyo *et all.*, 2017; Iancu, 2009), but for countries accessing the Eurozone the nominal convergence process is still the same as defined in 1992.

The concept of *real convergence* has had significant support through economic discourse for several decades. The crucial point is to follow the diminishing gaps in prosperity among different economies. Sustainable real convergence is the process where the Gross domestic product *per capita* levels of lower-income economies "catch-up" with those of higher-income economies on a durable basis (European Central Bank, 2015). Real convergence implies income levels convergence between countries, but besides the GDP *per capita*, it can be measured also by assessing the openness of the economy (trade openness index), the share of

bilateral trade with other members in total foreign trade, and the structure of the economy (i.e. the share of main sectors in the GDP – agriculture, industry, services) (Dulgheriu, 2015). According to the 'iron-law' conditional convergence is close to 2% a year, which means that countries where real *per capita* GDP is below its potential level, reduce the gap on average by 2% striving to converge to their long-run path to the higher GDP level (Barro, 2015; Bação *et all.*, 2019).

Usually, theories on economic growth capture two concepts of real convergence: beta (β-convergence) and sigma (σ–convergence). Beta convergence entails that lower-income countries grow faster than higher-income entities, as there is negative partial correlation between growth in income over time and its initial level. Sigma convergence refers to a reduction in the dispersion of income levels across different economies (Young et all., 2008). Neoclassical concepts assume that the level of technology determines the effectiveness of the production process, while different growth rates among countries occur because countries have different physical capital stocks (Solow, 1956; Solow and Swan, 1956; Barro and Sala-i-Martin, 1992; European Central Bank, 2015). The catching-up process happens because poorer countries usually have a higher expected rate of return on investment, while persistent differences among countries remain often because of disparate preferences and other institutional features – such as corruption (Gashi and Avdulaj, 2024). On the other hand, endogenous growth models (Uzawa, 1963; Lucas, 1988; Mankiw et all. 1992; European Central Bank, 2015) include human capital (and their knowledge) as a factor of production. This allows the assumption that persistent differences among economies exist because human capital is less mobile and flexible than physical. Additionally, Romer (1986) suggests that lower-income economies need a high rate of technological growth (through investments in research and development) in order to boost convergence, while Barro and Sala-i-Martin (1997) suggest that public policies on property rights, taxation and infrastructure can boost attractive environments for production and research of "technical leaders".

More recent variations of the OCA Theory usually include combinations of multiple criteria, such as the case of the alignment of business cycles and trade openness or connectedness (Frankel and Rose, 1998; Hafner and Jager, 2013). When economies connect closely by trade, this influences the spill-overs of economic activity (Bayoumi and Eichengreen, 1996; Bräuning and Sheremirov, 2021). But, more important is the similarity of production („production diversification" criterion) and consumption („homogeneity of preferences" criterion) structures between integrated countries, as well as the similarity of trade, i.e. intra-industry trade (Krugman and Venables, 1996; Frankel and Rose, 1998; Fidrmuc, 2001; Steinert and Althammer, 2025). Such specific trade of similar and complementary commodities is more important as a criterion than the total volume of trade (especially if countries exchange different goods and services based on specialisation forces).

The cost-benefit ratio of monetary integration depends on the ability of participating countries to absorb asymmetric shocks, and the joint response to foreign exchange market disturbances. Asymmetric macroeconomic shocks unequally affect countries, regions and sectors. In the case of symmetric shocks, the single monetary policy should be able to preserve price stability without affecting the distribution of economic activity (Peersman, 2007). However, in case of significant asymmetries, other modes should be considered and implemented. Usually, they include (Patterson and Amati, 1998; Hafner and Jager, 2013):

- Market mechanisms such as wage and price flexibility, mobility of labour, and mobility of capital

- Institutional mechanisms such as fiscal transfers ('fiscal federalism') or specific action by public authorities.

In a more drastic move, significant asymmetric shocks could prompt exchange rate changes. That could shift aggregate demand curves toward the starting position for affected countries/regions, but would also mean that they diverge from the rest of the monetary union (Patterson and Amati, 1998; Lane, 2000). As a change in the exchange rate would require that asymmetrically affected countries replace the joint currency with another, while complete mobility of unemployed people would not be feasible, at least not in a short period, the EMU Member States would have to consider wage and price policies, or rely on more fiscal transfers. Without appropriate structural policies and adjustment mechanisms, all shocks become asymmetric, and potentially problematic (Mundell, 2002; Buti and Sapir, 2002; Theodoropoulos, 2005; Krugman, 2013).

The transfer criterion deals with fiscal solidarity. It refers to the situation where a high degree of centralization of the budget in political unions basically enables automatic transfers toward regions/states affected by asymmetric shocks (Report Macdougall, 1977; Pacheco, 2000; Belke and Baumgärtner, 2005; Burriel et all., 2020). However, the EU budget is only about 1% of the Union's GDP. That does not represent a significant mechanism for (re)boosting convergence. However, the Eurozone Member States managed to agree on additional solidarity instruments after 2010 (especially the European Stability Mechanism, since October 2012), as a response to the Eurozone (debt) crisis, which saw countries like Greece, Portugal, Ireland, Cyprus and Spain get substantial financial assistance from these instruments during their toughest years (Dabrowski, 2015). The absence of such solidarity resources could have caused some countries leaving the Eurozone, or even a collapse of the single currency. However, during that period Eurozone and EU Member States chose solidarity. Perhaps the exception might be the United Kingdom, where the majority of voters on the 2016 BREXIT referendum chose to leave the EU, while the rest of the EU decided to close ranks, including considerations about a closer political union. Accordingly, the future of the EMU vis-à-vis its costs and benefits will depend on the continuation of the political and economic integration process in Europe.

3. ANALYTICAL FRAMEWORKS FOR CONVERGENCE ASSESSMENT

In order to assess the convergence processes in the European Economic and Monetary Union, our analytical frameworks focus on several convergence aspects. Several indicators related to nominal criteria (set by the Maastricht Treaty) and real convergence variables associated with the OCA Theory were used to assess the convergence dynamics of particular EU Member States still not using the euro.

3.1 Nominal convergence

Key nominal convergence criteria include monetary and fiscal criteria. The price stability criterion and the interest rate criterion focus on monetary policy aspects, while the exchange rate criterion includes the minimum period of two years of participation to the Exchange Rate mechanism II (ERM-2). Fiscal criteria refer to two government finances aspects: Public debt ratio and government deficit ratio (Kesner – Škreb, 2006; Cvečić and Tomljanović, 2022). These criteria are summarized in Table no. 2.

Table no. 2 – Maastricht criteria of nominal convergence (summary)

Monetary		
The **price stability criterion** or inflation criterion implies maintaining a high level of price stability, i.e. "*the inflation rate of a given Member State must not exceed 1.5 percentage points of the average inflation rate (measured with the Harmonized Index of Consumer Prices) for the three EU countries with the lowest inflation in the year preceding the review of the EMU candidate country*".	The interest rate criterion monitors the movements of **long-term interest rates** on government bonds, and according to this criterion the "*nominal long-term interest rate (on government bonds or similar securities) may not exceed the corresponding interest rate by more than two percentage points*", whereas the corresponding rate is calculated as an average rate of the three EU Member States with the lowest inflation [***Durability of convergence***].	The **exchange rate stability criterion** implies the country's participation in the ERM II, i.e. maintaining stable exchange rate levels (without "severe tensions"; i.e. devaluation) for at least two consecutive years before joining the EMU.
Fiscal		
The public finances criterion analyses the trends of public debt and budget surplus/deficit; according to this criterion, "the share of *gross general government debt in the GDP* may not exceed 60% at the end of the previous financial year" [***Sustainable public finances***]…		…and also "the share of the *general government budget deficit in the GDP* may not exceed 3% at the end of the previous financial year." [***Sound public finances***]

Source: Authors' work based on Cvečić and Tomljanović (2022); pp. 219-220; and Council of the EU (2024)

Other variables are usually included in the nominal convergence assessment. The ECB actually analyses several other variables and categories related to the balance of payments, structure of the financial system, unit labour costs, etc. In the case of the Economic Community of West African States (ECOWAS), primary and secondary criteria are used for the convergence assessment, which include similar criteria as in the case of the EMU, but also: Central bank fiscal deficit financing and Gross external reserves (Oyadeyi, 2024).

One of the main nominal criteria assesses the exchange rates of currencies involved in the convergence process. Regarding that, we first present Table no. 3, which includes exchange rates of EU currencies for Member States still not making part of the EMU.

Table no. 3 – Exchange rates against the euro, 2014–24 (1 EUR = … national currency)

	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Bulgarian lev (BGN)	1.9558	1.9558	1.9558	1.9558	1.9558	1.9558	1.9558	1.9558	1.9558	1.9558	1.9558
Czech koruna (CZK)	27.536	27.279	27.034	26.326	25.647	25.670	26.455	25.640	24.566	24.004	25.120
Danish krone (DKK)	7.4548	7.4587	7.4452	7.4386	7.4532	7.4661	7.4542	7.4370	7.4396	7.4509	7.4589
Hungarian forint (HUF)	308.71	310.00	311.44	309.19	318.89	325.30	351.25	358.52	391.29	381.85	395.30
Polish zloty (PLN)	4.1843	4.1841	4.3632	4.2570	4.2615	4.2976	4.4430	4.5652	4.6861	4.5420	4.3058

Romanian leu (RON)	4.4437	4.4454	4.4904	4.5688	4.6540	4.7453	4.8383	4.9215	4.9313	4.9467	4.9746
Swedish krona (SEK)	9.0985	9.3535	9.4689	9.6351	10.2583	10.5891	10.4848	10.1465	10.6296	11.4788	11.4325

Source: Eurostat (online data code: ert_bil_eur_a), European Central Bank (ECB), 2025

The following graphics (Figure no. 1) represents the normalized values (Z-scores) of each currency in order to compare trends and adjust for their volatility. This gives a clearer picture about relative changes and the volatility of particular currencies. As the Bulgarian lev has a constant rate (1,9558 BGN for 1 €) through the whole time, as they implemented the currency board system since 1997, there is no exchange rate change during the assessed period. However, other currencies have experienced volatility. Furthermore, higher standard deviation of the exchange rates was quite clear in the case of the Hungarian forint (34.9), as the value of the currency varied from 308.71 for 1 euro in 2014, to 395.30 HUF in 2025. Besides that, the Czech koruna had the highest standard deviation value (1.118), followed by the Swedish krona (0.797).

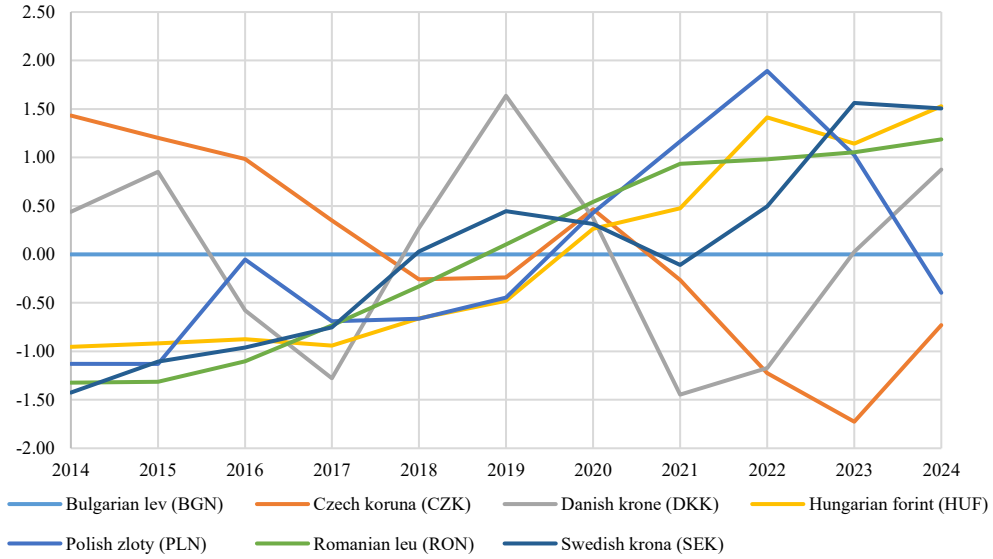

Figure no. 1 – Normalized values (Z-scores) of non-EMU currencies (2014-2024)
Source: Authors' work, based on Eurostat (2025a), ECB (2025)

Nevertheless, Figure no. 1 suggests more comparable volatility trends among these seven currencies, diminishing the nominal differences in the values of non-EMU currencies. Higher volatility was recorded after 2020, but general trends include a clear appreciation for the Czech koruna, and depreciation of the Romanian leu, Swedish krona and Hungarian forint. Z-scores for the Danish krone look quite volatile, but the standard deviation of the currency exchange rate is just 0.0094. Formally, only Bulgaria and Denmark are part of the ERM-2 system, making them the only viable candidates for a possible quick introduction of the euro.

Namely, candidate currencies need to be part of the ERM-2 for at least two years without severe tensions to the exchange rates (fluctuations between ±15%) (Iancu, 2009).

The next graphics (Figure no. 2) tackles with one of the nominal convergence criterion, which is also associated with the OCA theory – price stability. By using the data for annualised average rates for the Harmonised Indices of Consumer Prices (HICP), we calculated the deviations in the average annual inflation rates between particular non-EMU countries and the average rate for the Eurozone. The HICP is used by the ECB for monitoring inflation in the Eurozone, as well as for the assessment of inflation convergence as required under the Treaty. As Figure no. 2 shows, during the period 2013 – 2021 the rates were mostly in line with the Eurozone average. Nevertheless, in the period 2021 – 2024, inflation rates diverged noticeably, especially in the case of Hungary and Czechia, and a bit less in the case of Poland, Romania and Bulgaria. Inflation rates in Denmark and Sweden did not diverge.

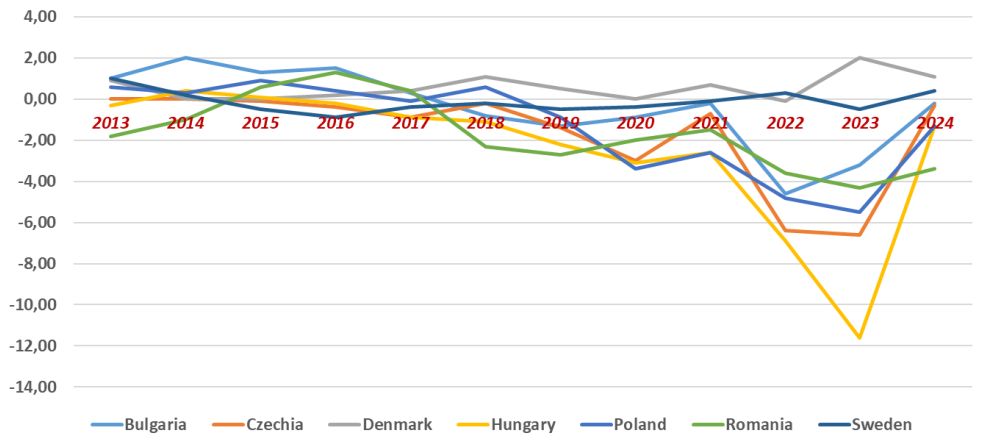

Figure no. 2 – Deviations in the average annual inflation rate in particular non-EMU countries from the average inflation rate in the Eurozone

Source: Authors' work, based on Eurostat (2025b)

Figure no. 3 depicts the deviations of the annual long-term interest rates of non-EMU Member States from the average Eurozone interest rates during the period 2015 – 2024. Danish and Swedish rates were in line with the Eurozone average rates during the whole period, while the Czech and Bulgarian rates were mostly in line: Czech rates diverge slightly since 2018, and more significantly in the period 2020 – 2023, but the Bulgarian rates diverge slightly since 2023. The Romanian interest rates diverged for most of the period, but the trend turned since 2023, while the Polish and Hungarian rates significantly diverged since 2020. For most countries analysed in Figure no. 3, rates deviated especially in 2022. A broader spectrum of trends shows that interest rates converged particularly strongly in the 1990-ies, as a transition of the main Eurozone countries to the single currency, and they remained completely harmonized during the first decade of the euro (Tokarski, 2019).

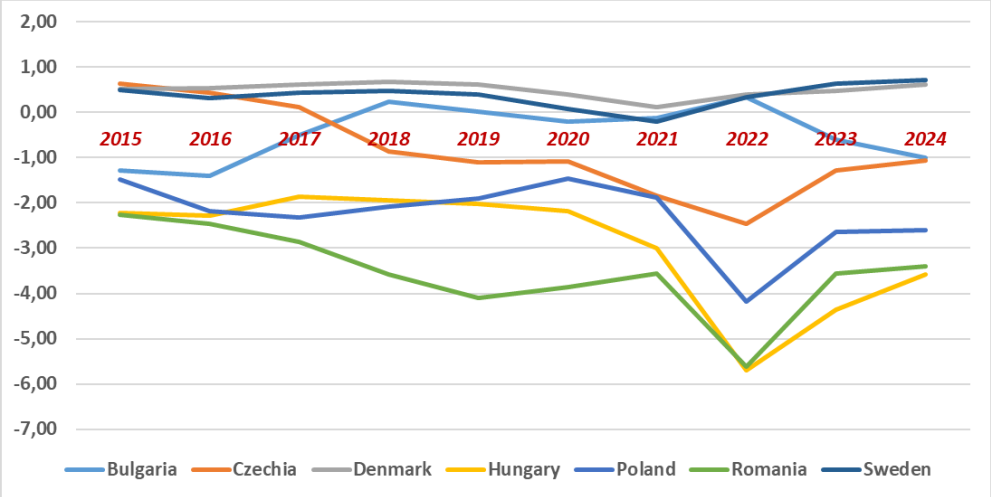

Figure no. 3 – Deviations in the annual long-term interest rates in particular non-EMU countries from the average interest rate in the Eurozone
Source: Authors' work, based on Eurostat (2025c)

Finally, this section ends with a short overview of the fiscal convergence criteria for non-EMU Member States of the Union (Figure no. 4), which are also requirements of the Stability and Growth pact, showing fiscal stability necessary for a functioning economic (and not only monetary) integration. We chose a specific way of comparing both criteria (public debt and government deficit) in three specific years – 2015, 2019 and 2024. Several assumptions and conclusions can be drawn:

– All observed economies had a positive trend when comparing 2015 and 2019, except Romania (which started from an optimal position, but deteriorated its budget deficit, and started to increase its debt after 2019).

– All observed economies deteriorated their fiscal position, when comparing 2019 and 2024, except Denmark.

– The Eurozone average suggests that it does not meet both fiscal (and SGP) criteria in neither of the three analysed years, which makes it more complicated to determine the convergence of candidate countries which are required to meet public debt and government deficit criteria before the introduction of the single currency (which is not in line with the reality of the Eurozone).

– Regardless of the suggested trends, Denmark, Sweden, Czechia and Bulgaria meet the nominal criteria in all three years.

– In the case of Poland and Romania, they deteriorated their fiscal convergence, especially in 2024, but a reversed trend could bring them back within the required settings.

– The only country not falling in the required area (in all three years) is Hungary: Although the trend between 2015 and 2019 was promising, the figures for 2024 are moving them away from the stipulated fiscal targets.

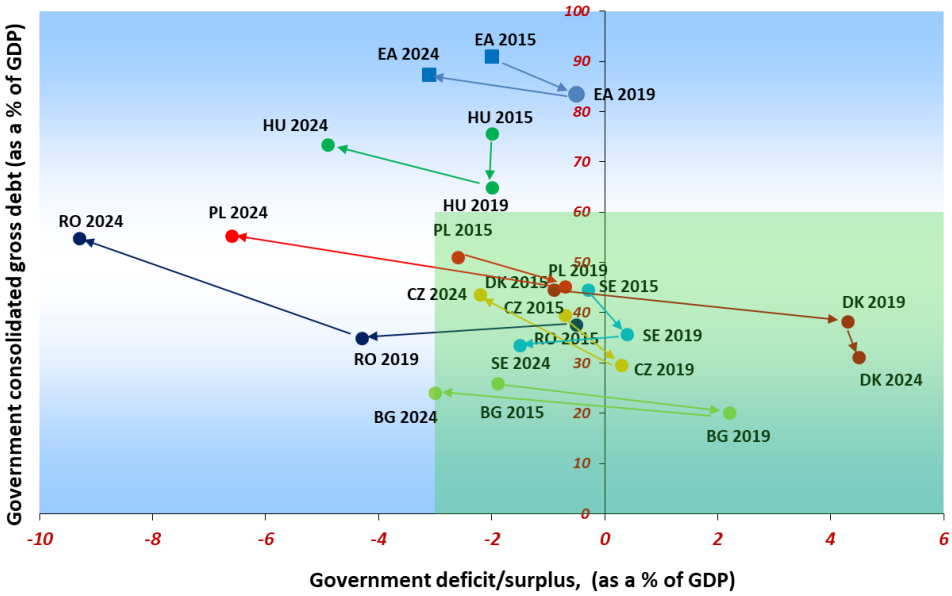

Figure no. 4 – Fiscal criteria of nominal convergence in particular non-EMU countries and the Eurozone (2015, 2019 and 2024)

Notes: The greenish quadrant on the lower right side (below 60% of GDP for the debt criteria, and below -3% of GDP for the deficit criteria) represents the area where both fiscal criteria are satisfied.
Source: Authors' work, based on Eurostat (2025d)

Summarizing nominal convergence, the ECB's Convergence Report (2024) suggests a different perspective, especially because none of the seven non-EMU countries, except Denmark, satisfied all five nominal criteria for the introduction of the euro. It has to be taken into account that the nominal criteria, especially for inflation and long-term interest rates were strongly influenced by the 2022-2023 period of exceptionally high inflation rates in most countries. In fact, in 2022 the average inflation rate was 8.4% in the Eurozone and 9.2% the EU. The following year, the average rates were 5.4% in the Eurozone and 6.4% in the EU. Therefore, the assessed countries did not differ greatly from the average. Our specific assessment suggests that convergence is happening, although the period after 2020 and the disturbances caused by the pandemic, international conflicts and other crises, slowed down the process and caused some divergence. Best candidates for the integration into the EMU are therefore Denmark, Sweden, Bulgaria and Czechia, while the convergence process of Romania, Poland and Hungary needs more time and effort.

3.2 Real convergence and OCA criteria

In this section we present selected indicators related to the concept of real convergence and the OCA Theory. Usually, the real convergence is measured by changes in the GDP *per capita*, and other indicators based on possible assessments of the "catching-up" processes between different economies. Real convergence expresses the approximation of the levels of economic welfare, generally proxied by *per capita* GDP (Martín et all., 2001). Therefore, we

present the data for the seven non-EMU Member States of the Union for the most recent decade (Figure no. 5).

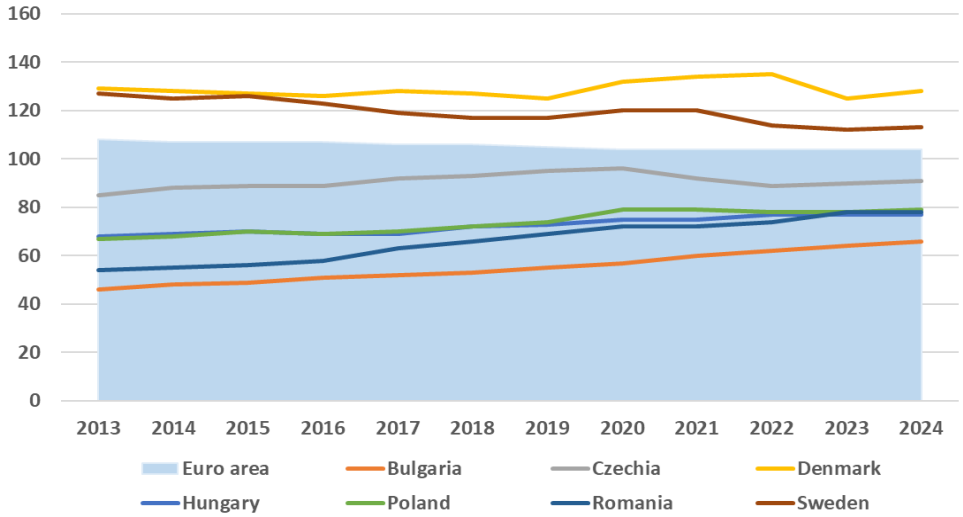

Figure no. 5 – GDP *per capita* in PPS for selected EU Member States and the Eurozone (2013-2024); EU27 = 100

Note: Volume indices of real expenditure per capita (in PPS_EU27_2020 = 100)

Source: Authors' work, based on Eurostat (2025e)

Figure no. 5 compares the data for the Eurozone and the seven non-EMU countries with the EU27 average, which equals 100. The Eurozone average was 8% higher than the EU average in 2013, but just 4% in the period after 2020. This means that the EU average and Eurozone average are converging. Denmark and Sweden are well above the Eurozone and EU average: Denmark 25-35% higher than the EU average and Sweden dropping from 27% to 13% in the observed period. The remaining five countries from Central and Eastern Europe have all experienced a clear convergence trend, although Czechia and Poland have experienced a slowdown after 2020. Czechia's GDP *per capita* is the closest to the EU average (91% in 2024), while Bulgaria is just at 66%, but improved by 20 percentage points in the observed decade. Hungary, Romania and Poland are quite even (77-79% of the Eurozone average), with Romania improving by 24 percentage points in the same 11-year period. Figure no. 6 compares initial levels of real GDP *per capita* with subsequent changes relative to the Eurozone average for all EU Member States.

It is evident from Figure no. 6 that all new Member States started from 20 to 75 percentage points below the Eurozone average in 1999, but improved their real GDP *per capita* level in the next 24 years by approximately 10-50 percentage points. The figure clusters two groups of countries: "old" Member States in the lower right quadrant, and "new" Member States in the upper left quadrant. Countries not yet members of the Eurozone are represented by red dots, mostly in the new Member States cluster. Denmark and Sweden are obvious candidates for the EMU from the real convergence perspective, while the closest to them among the other non-EMU countries is Czechia, followed by Hungary. Bulgaria, the probable next joiner in 2026, is the farthest positioned, but with a quite strong convergence dynamic.

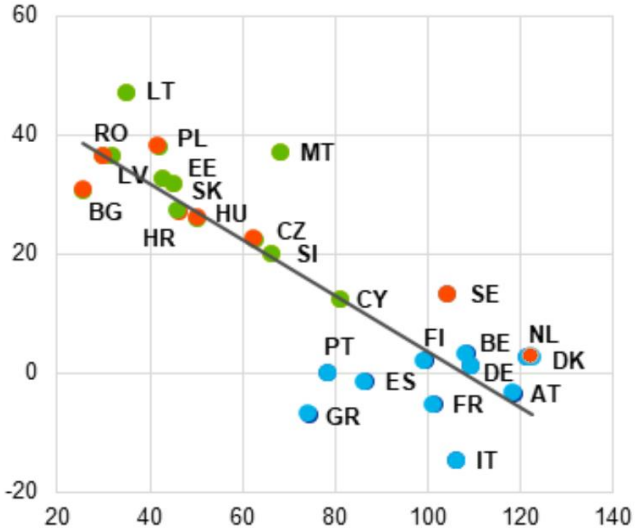

Figure no. 6 – Real GDP per capita – Initial level in 1999 compared with subsequent change relative to the Eurozone average (%)

Note: x-axis – level in 1999 (Index - Eurozone = 100); y-axis – change in level in percentage points (1999-2023); red dots indicate non-EMU countries; green dots indicate countries that joined the Eurozone after 2002; light blue dots indicate countries that joined the Eurozone before 2003. Ireland and Luxembourg are excluded.

Source: Convergence Report (2024); pp. 47

Other relevant indicators which can point out to the real convergence of non-EMU Member States include the share of trade in goods with the Eurozone, and the share of investment positions with the Eurozone. Czechia is a good candidate in case of those indicators, while Bulgaria and Sweden are in a weaker position. An indicator of financial integration is the share of euro-denominated loans to non-financial corporations (as a percentage of total loans), which is the highest in Czechia, Hungary and Romania (45-50%), while in Sweden the share is just 6-7% (Convergence Report, 2024). Eurostat data (2025f) shows that the EU average share of trade with the rest of the EU in 2024 was 61.7%. Among the non-EMU Member States, Bulgaria has the lowest share (57.3%), while Romania, Czechia and Hungary have the highest shares (ca. 72%). Somewhere in between, but still above the EU average, there are Sweden, Denmark and Poland (66-67%).

In the context of measuring real convergence, Hošoff et all. (2022) propose gross fixed capital formation at the level of EU states, as well as the governance quality indicators and the index of productive capacities. Governance quality is a crucial prerequisite for the viability and functionality of any (supra)national establishment and spans from the respect of human rights, the rule of law, political pluralism, legitimacy and transparency, access to knowledge and information, efficient public services, equity and sustainability, etc. So, Hošoff et all. (2022) combine multiple indicators in order to assess the overall level of governance quality of particular EU Member States (infringements, rule of law, financial irregularities, public procurement). The conclusion was that Hungary and Bulgaria, especially, and Romania, a bit

less, still need to invest more effort to converge with the rest, while Denmark and Sweden actually lead the way for the whole EU. Czechia and Poland score average levels.

The Index of productive capacities (PCI) is a composite index developed by the UNCTAD, which combines 42 indicators from different international sources. The PCI measures the levels of productive capacities along three pillars (productive resources; entrepreneurial capabilities; production linkages) and eight categories (natural capital, human capital, energy, institutions, private sector, structural change, transport, and information and communication technologies). Altogether they determine the capacity of a country to produce goods and services and enable it to grow and develop (UNCTAD, 2023). Figure no. 7 follows convergence trends of non-EMU Member States of the Union during a period of more than two decades.

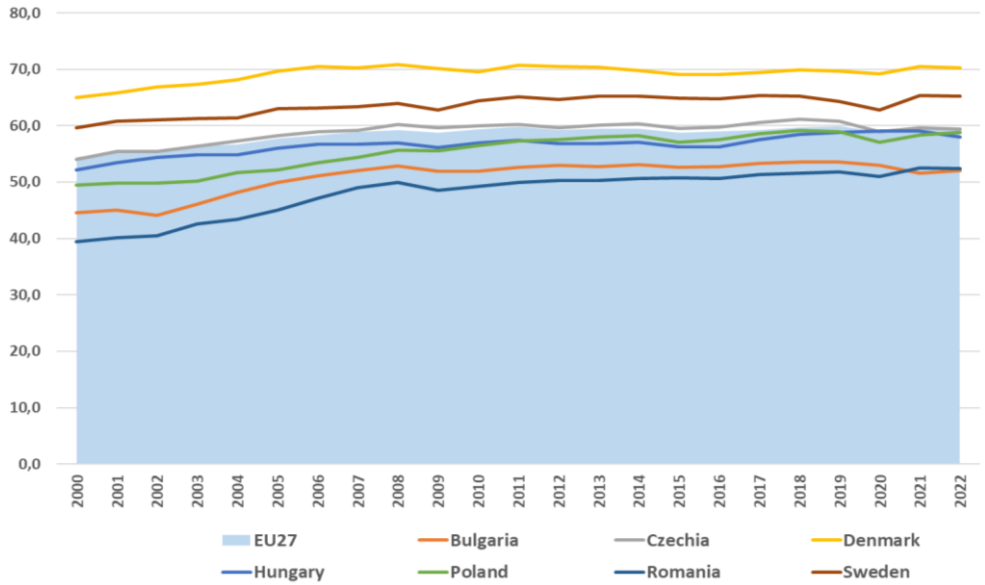

Figure no. 7 – Productive Capacities Index for non-EMU Member States of the EU (2000-2022)
Source: UNCTAD (2023)

Figure no. 7 compares the PCI indexes of seven EU Member States still not using the euro and the EU average score. Czechia, Hungary and Poland have significantly harmonized trends for PCI scores with the EU during the whole period (especially Czechia). Romania and Bulgaria still lag behind, although Romania's convergence trend is more clear, while Denmark and Sweden (together with the Netherlands and Germany) are continually keeping a lead with highest PCI scores.

Gross fixed capital formation (GCFC) represents the ratio of investment to GDP and it is measured as a percentage of GDP, or as the percentage change from the previous period. The GCFC is defined as acquisitions of produced assets (including purchases of used assets) reduced by disposals of fixed tangible or intangible assets. It excludes non-produced assets such as land and natural resources (OECD, n.d.; World Bank, 2025). As gross fixed capital and its formation are an important part of the process of increasing the GDP potential, it could

certainly bolster the assessment of real convergence (Hošoff et all., 2022), therefore we present trends of national GCFC's deviations from the Eurozone average in the period of 2015-2023 for the assessed non-EMU countries.

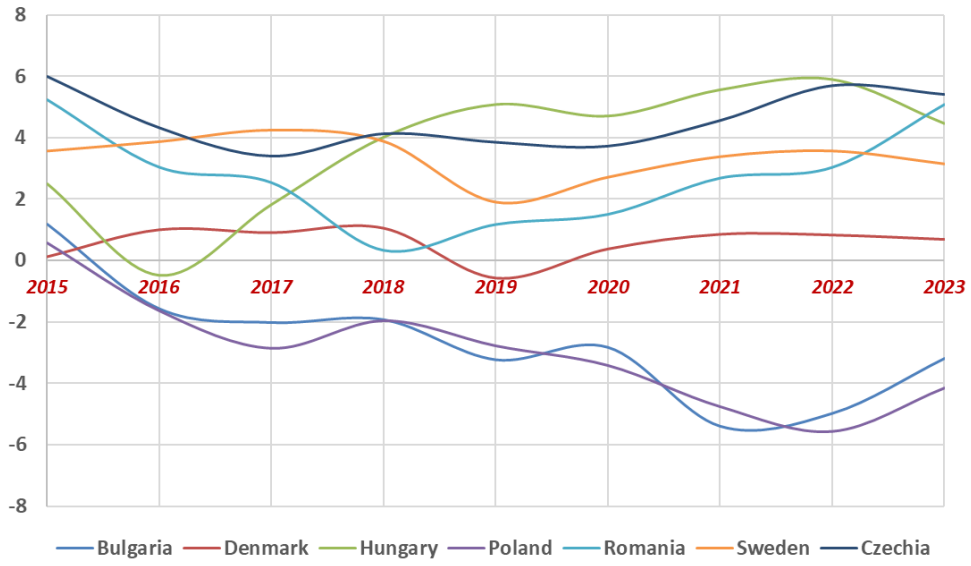

Figure no. 8 – Deviations of Gross fixed capital formation (as % of GDP) for non-EMU Member States of the EU from the Euro-zone GFCF average (2015-2023)
Source: Authors' work, based on World Bank (2025)

Figure no. 8 presents the trend lines of deviation values of Gross fixed capital formation, as a percentage of GDP for non-EMU Member States of the EU, from the Euro-zone average values in the most recent nine available years. Denmark has the most harmonized trend with the Euro-zone during the whole period, while Sweden had a similar trend, but with 2.3 – 3.4 percentage points higher indices. Poland and Bulgaria had the most diverging trends, until 2022 and 2021 respectively, suggesting convergence could restart in the next years. On the other hand, Czechia, Hungary and Romania experienced positive trends, suggesting convergence, especially stable in the case of Czechia. Hungary had a setback in 2016, while Romania's convergence slowed-down until 2018 but recovered afterwards.

We finish this section with one of the main OCA Theory criterion – the importance of synchronized business cycles. Many sources tried to assess the level of synchronization among Euro-zone countries. Cyclical convergence relates to the characteristics of the business cycles and it is fully achieved when business cycles of integrated economies are concordant and of the same amplitude (Creel, 2018). According to several research (Alesina et all., 2017; Gogas, 2013; Frankel and Rose, 1998), business cycles among EU/Euro-zone countries became more synchronized, especially after the introduction of the euro. Although, Beck (2021) suggests that, despite a deeper EMU integration, GDP cycles across EU Member States have grown less synchronized, especially after 2008. Core-periphery GDP growth correlations fell, and the EU-factor's variance share dips, while a shift in economic composition (with services having weaker inter-sectoral ties) transmits fewer common shocks.

As an alternative to the traditional correlation coefficient of output gaps, business cycle coherence can be analysed through a combination of synchronicity and similarity measures (Mink et all., 2012; de Haan et all., 2024). Synchronicity points out to the signs of output gaps, while similarity identifies the differences in amplitudes of business cycles. For instance, correlation analysis suggests that the output gaps of countries in Central and Eastern Europe and the Euro-zone are quite similar, which would be beneficial for acceding countries. De Haan et all. (2024) estimate that the business cycles of some countries (i.e. Romania and Hungary) are not well synchronized with the Euro-zone. Walko (2022) presents correlations of output gaps and correlations of annual changes in real GDP with the Euro-zone aggregate for the period 2001-2020. Figure no. 9 excerpts data for non-EMU countries.

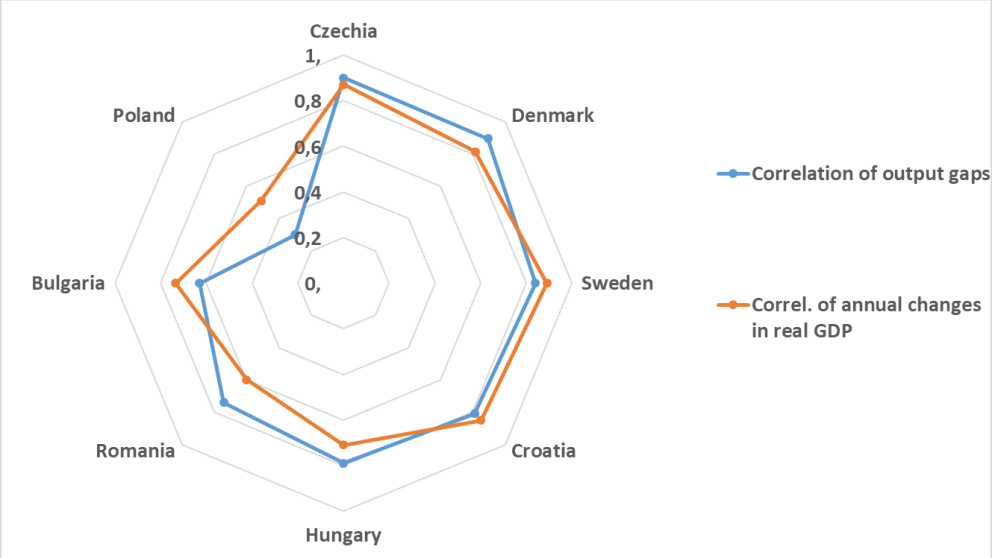

Figure no. 9 – Correlation of output gaps (a) and correlation of annual changes in real GDP (b) with the Euro-zone aggregate, for the period 2001-2020 for non-EMU countries
Source: Authors' work, based on Walko (2022)

Figure no. 9 shows that higher and significant correlation values were estimated for Czechia, Denmark and Sweden for both estimated variables (0.8 – 0.9). The data for Croatia was included as a comparison, as in the assessed period this country was still outside the Euro-zone. However, the correlation values are significant (0.8 – 0.85), especially for the annual changes in real GDP. The correlation values for Hungary, Romania and Bulgaria are more modest (between 0.6 and 0.8), while Poland scores low correlation values (0.3 and 0.5, approximately). Poland is actually the EU Member State with the least correlated business cycles with the Euro-zone. Interestingly, Euro-zone countries with more modest business cycle synchronisation are Ireland, Malta, Greece, Lithuania and Latvia, much less synchronized than Czechia, Denmark and Sweden (Walko, 2022). Comparing them with all Euro-zone countries, these three EMU candidates are more synchronized than most countries already using the euro. On the other hand, Poland has still to converge quite a lot, while for

Romania, Hungary and Bulgaria it is necessary to assess more extensively their convergence context, as business cycle correlations are not giving a clear answer.

The analysis of real convergence shows that Sweden and Denmark, as already established and advanced economies, achieve most criteria for integration. However, they both are postponing their decision to initiate a possible transition to the common currency. Other five non-EMU Member States from Central and Eastern Europe show different perspectives. Regardless of the obvious catching-up processes toward more economically advanced Member States, Poland has not managed to achieve proper real convergence. Giving up from their national currency (złoty) at this stage could prompt asymmetric shocks and a decline in competitive advantage (Mucha-Leszko and Kakol, 2021). Although Romanian public is optimistic about the future introduction of the euro, the country lags behind in productivity, GDP per capita and economic structure, besides having increasing problems with fiscal imbalances and inflation (Schipor and Duhnea, 2022).

4. DISCUSSION AND CONCLUSION

The launch of the monetary integration among EU Member States intensified the process of economic integration and enabled convergence. Although the level of GDP *per capita* gradually converged, several shocks accentuated existing imbalances and unresolved issues in the macroeconomic (especially fiscal) area (Coutinho and Turrini, 2020; Hošoff *et all.*, 2022; Bordignon et all., 2024). The Euro-crisis (2009-2013) led to economic divergence, especially in "peripheral" Member States, while the more recent "COVID-crisis" was more a symmetrical type of shock, so the convergence resumed, especially because of faster responses and more solidarity among Member States. However, inequality rose in both cases (Miron *et all.*, 2022; Bordignon *et all.*, 2024).

Rosati (2017) points out that the Eurozone countries do differ structurally, but the divergence may be smaller than suggested, primarily because asymmetric shocks in specific Member States reflect specific fiscal policies and impacts of financial and debt crises. According to Ficek (2024), fiscal elements need to be reinforced before a deeper integration. His analysis suggests that the monetary and fiscally most integrated EU countries are Ireland, Luxembourg and Malta, while the best candidates for Euro-zone integration are Denmark, Bulgaria, Sweden and a bit less – Czechia. Besides Greece, Italy and Spain, which use the euro for more than two decades, the least monetary and fiscally integrated countries are Romania, Hungary and Poland. Their accession to the Euro-zone should not be accelerated and forced (in order to avoid Greek-type of crisis scenario). This is why the "smart" use of cohesion and structural funds is essential to boost economic and social cohesion in the EU, as they aim to reduce disparities in the Union (Kandžija and Cvečić, 2010; Alcidi, 2019; Andor, 2019). Nevertheless, institutional heterogeneity in the Union (for example in the context of labour market) must be taken into account as one-size-fits-all reforms may not induce convergence in specific clusters of Member States (Obadić *et all.*, 2022).

Several crises during the recent two decades in Europe have shown that large capital flows to lower-income countries can only contribute to sustainable real convergence and generate productivity growth if resources are efficiently allocated in the economy. Although sustainable convergence is mainly a national responsibility, specific efforts should be complemented by structural reforms at the EU level as well (i.e. deepening the Single Market, Banking Union, Capital Markets Union, the European Semester, targeted InvestEU and EIB

lending, etc.) (European Central Bank, 2015). This notion goes in line with several research which suggest that the real convergence process slows down in periods of crises (Bordignon et all., 2024) and as a response to policies which are implemented in particular countries, also influenced by societal antagonism to changes and less ambitious institutional and structural reforms. However, aligning specific policies, for example budget deficits across countries or post-pandemic green and digital transitions, can reduce business cycle synchronization, a crucial optimal currency prerequisite. Nevertheless, this may be the outcome of pro-cyclical fiscal behaviour or a lack of discipline (Chedi, 2024; Correia and Martins, 2019). Basically, to enable sustainable convergence, three main prerequisites must be achieved (European Central Bank, 2015; Diaz del Hoyo *et all.*, 2017):

- macroeconomic stability should be maintained
- affected economies must increase their degree of economic flexibility
- conditions for total factor productivity growth must be improved (increased proportion of highly skilled workers; improved quality of capital through the adoption of innovation and technology; institutional frameworks which support innovation).

Hošoff *et all.* (2022) imply that, although there is absolute convergence in GDP *per capita* among the EU27 countries, the effects are differentiated, especially with a widening gap in living standards and diverging trends on the regional (sub-national) level. Bulboaca (2023) determined that the real economic convergence at the national level was at least three times stronger than at the regional level. Although the greatest increase in regional differences in GDP *per capita* levels occurred in Ireland, significant divergence was also identified in Poland, Romania, Hungary and Bulgaria. Unfulfilled real convergence in the EMU, especially in the pre-crisis period (before 2009), was mainly a combination of: (a) not supportive institutional conditions for business innovation and productivity growth in some Member States; (b) structural rigidities and a lack of effective competition; (c) low real interest rates which exacerbated credits and fuelled demand beyond real future expected incomes (European Central Bank, 2015). This is what certainly happened in Southern EU countries (such as Greece and Portugal), which have systematically underperformed relatively to the Eurozone average and apparently have been caught in a *lower income trap* (Alcidi, 2019; García Solanes *et all*, 2024). Therefore, EU and the lagging countries (and regions) should invest more efforts into combining EU financial transfers (Cohesion and Structural Funds, Recovery and Resilience Facility…) and better governance, further market integration (Single Market – especially financial and services market integration, CMU…), fiscal and macroeconomic coordination, as well as more targeted investments in human and physical capital (especially in order to boost competitiveness and total factor productivity). Addressing divergence pressures on multiple fronts could induce growth and convergence, especially in "peripheral" areas, while safeguarding overall stability and functionality of a deeply integrated Economic and Monetary Union.

Perhaps the main conclusion of the research is that an efficient integration into the EMU requires not only the capacity to fulfil nominal convergence criteria, but also to follow closely the progress related to the concept of real convergence, including more diligent analysis of the criteria put forward by the Optimal Currency Area theories. The absence of that could result in a peripheral and non-flexible economy unable to eliminate (asymmetric) shocks affecting it. Focusing just on short-term goals of nominal criteria fulfilment may complicate a sustainable real convergence progress (as evidenced by Greece). Therefore, it is crucial to reach a stable economic and financial situation in candidate countries, as well as to help them

develop resilience to various shocks, as the concept put forward by many economists is that an optimal currency area needs to foster integration and convergence among Member States (Creel, 2018). Since 1999, the EU as a whole has shown sigma and beta convergence driven mostly by the rapid catch-up of Central and Eastern Member States. On the other hand, the original 12 Eurozone countries have seen virtually no real *per capita* convergence after the euro was introduced (European Central Bank, 2015).

García Solanes *et all.* (2024) find that the primary factors that explain the differences between convergence processes and stationary states are labour productivity, physical and human capital, investment and trade openness. This, suggest Hafner and Jager (2013), may influence EMU's vulnerability to asymmetric shocks due to differences in economic structures and potentially high degrees of industrial specialisation (regardless of increased shares of intra-EU trade). That is why Beck (2021) points out to the importance of necessary service-sector integration and a rebuilding of EU-wide sectoral linkages to restore business cycle synchronicity (as the European economy now depends much more on the services sector rather than manufacturing industries). Liccheta and Mattozzi (2023) focus on necessary investments and reforms in order to neutralize structural economic weaknesses and improve productivity growth, which they highlight as main drivers of income convergence. Another aspect is the capacity of risk-sharing through financial markets, as a well capitalised banking sector and a functional capital market should lead to economic resilience (Berti and Meyermans, 2017).

The logical notion would be that the European Economic and Monetary Union needs more resilience in order to foster convergence and allow particular economies to cushion negative impacts of asymmetric shocks and to lower risk premia (Wieser *et all.*, 2024). Furthermore, they suggest that countries adopting the euro from Central and Eastern Europe have seen swifter disinflation, lower long-term borrowing costs and reduced sovereign-bond yield spreads vis-à-vis Germany than non-EMU countries from the same region, primarily because the integration into the Euro-zone induces fiscal discipline and deeper financial integration. This is what Todorov (2024) argues while suggesting that shocks in Bulgaria and the Euro-zone are similar, as an outcome of a binding monetary regime (*currency board*) which partially transmitted the ECB policy effects to Bulgaria, while for other uncertainties the discretion policies were motivated by clear rules, coupled with flexible and dynamic instruments necessary to stabilize the economy. Although, the absence of public support, especially in the case of contested fiscal positions and un-correlated business cycles could translate into significant economic costs comparable to the loss of monetary policy independence (Schipor, 2020). Therefore, policy responses have to be well coordinated and agile in the face of external and unanticipated events, as suggested by Haynes and Alemna (2023). Fiscal discipline, efficient product and labour markets, innovation and smart governance are engines of continuous catch-up processes, as convergence doesn't happen automatically. It is rather a continuous economic and policy adjustment process, as well as a multidimensional process, encompassing nominal, real, social, cyclical, and a convergence towards resilient economic structures.

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