REPORT
OF THE SGH WARSAW SCHOOL OF ECONOMICS AND THE ECONOMIC FORUM 2024

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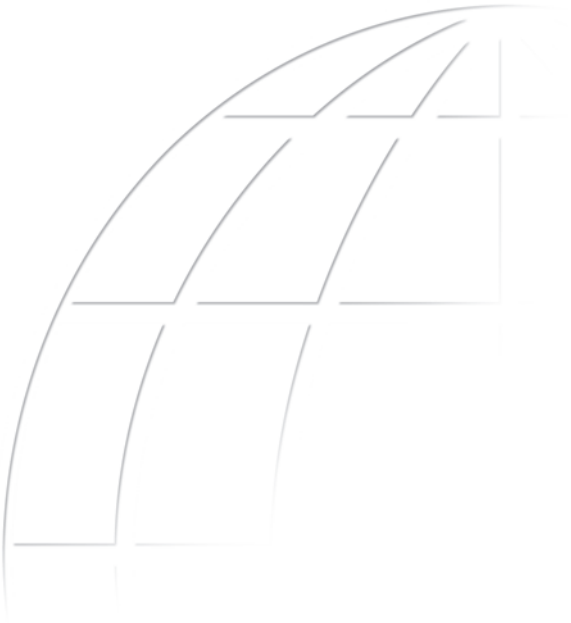

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PREFACE

We warmly invite you to read the seventh edition of the *Report of SGH Warsaw School of Economics and the Economic Forum 2024*, published annually since 2018. This *Report* provides a comprehensive summary of key economic and social processes taking place in Poland and the countries of Central and Eastern Europe (CEE). This year's *Report* covers 11 chapters prepared by experts from SGH Warsaw School of Economics, and a special supplement from the European Investment Bank (EIB).

The most important topics addressed in this edition include the development trajectories of CEE economies, green energy transition, changes in the global security induced by the war in Ukraine, social and economic inequalities, and their impact on economic development, as well as healthcare and related measures taken by authorities in the context of the labour market. The economic analysis and recommendations presented in the *Report* cover processes and phenomena occurring throughout the region, therefore the opening chapter on the development trajectories of CEE countries holds particular significance. It presents the evolution of the CEE economies from 2004 to 2023, with a special focus on their institutional comparative advantages. The regional context is also referred to in the *Report's* closing chapter, the supplement by EIB, which analyses investment in the CEE region.

The *Report of SGH Warsaw School of Economics and the Economic Forum 2024* provides answers to many pressing questions we all face. Considering the radical climate change climate change, can we afford not to invest in green economy? How much will artificial intelligence support development? How does the war in Ukraine, along with the resulting supply chain disruptions, financial market disturbances, and changes in international trade, affect the economic reality?

We believe that this publication, prepared by SGH Warsaw School of Economics and the Economic Forum, will be perceived as a reliable source of comprehensive analyses and recommendations, as well as a collection of information on the processes occurring both in Poland and the entire CEE region. The topics of the *Report* correspond to debates, presentations, and panel discussions held in Karpacz, which

involve representatives from academia, public administration, business, and non-governmental organizations.

For obvious reasons, the economic and social analysis presented in the *Report* covers only selected issues – it is not possible to analyse all the problems and threats experienced by our region in several hundred pages. However, we hope that the findings from the SGH experts' research will be interesting and helpful in strategic decision making. The *Report*, which is a result of a long standing cooperation between SGH Warsaw School of Economics and the Foundation Institute for Eastern Studies, is intended for decision-makers, who can apply its findings in practice, as well as for the media and academia.

We wish you an enjoyable read!

SGH Professor Piotr Wachowiak, PhD
Rector of SGH Warsaw School of Economics
Zygmunt Berdychowski
Chairman of the Programme Board of the Economic Forum

INTRODUCTION

It is with great pleasure that we present you the seventh edition of the *Report of SGH Warsaw School of Economics and the Economic Forum 2024* prepared for this year's Economic Forum in Karpacz.

Studies presented in the *Report* aim to enable business leaders, central and local administration representatives, and non-governmental organizations to make more effective decisions in times of significant social and economic challenges, caused by the war in Ukraine, migration pressures, climate change, and the development of modern technologies, such as artificial intelligence (AI) and blockchain.

This year's *Report* consists of 12 chapters addressing the development trajectories of Central and Eastern European (CEE) countries, housing market in the context of the residents' life quality, impact of tax reforms on local government revenues, renewable energy sources, the role of blockchain technology in the economy and administration, overcoming investment barriers, foreign expansion of CEE enterprises, demographics and labour market, reconfiguration of global supply chains, economic situation in the region, economic and social inequalities, and other issues important for the CEE region.

In the first chapter, titled *Development trajectories in Central and Eastern European countries in 2004–2023 – sources of the institutional comparative advantage and their evolution in patchwork capitalism* SGH experts demonstrate that the economic growth in the 11 new EU Member States from Central and Eastern Europe (CEE-11) was, on average, more than twice as fast as the overall EU growth from 2004 to 2023. The CEE-11 countries, embodying a patchwork model of capitalism, achieved the highest economic growth rates compared to countries representing four other models of capitalism coexisting in the EU (Continental, Mediterranean, Nordic, and Anglo-Saxon). Among the CEE-11 countries, Poland had the fastest economic growth rate from 2004 to 2023 (3.8%). The authors note that the economic growth in the CEE-11 countries proved to be the most resilient to the two recent asymmetric, negative exogenous shocks: the COVID-19 pandemic and the war in Ukraine. Consequently, after 20 years

of EU membership, the CEE-11 countries closed as much as 29 pp. of development gap relative to the EU average in terms of GDP per capita (at PPP).

The authors of the next chapter, titled *Housing gap and the quality of life of households in Central and Eastern Europe*, examined the housing market in the CEE, focusing on the housing gap, defined as the percentage of households with incomes too low to buy or rent suitable housing (satisfying minimum housing needs) at market prices and simultaneously too high to obtain state-subsidized housing. Our experts found that the smallest housing gap is in Slovenia (13%) and Estonia (17%), the smallest and richest countries in the region, while the highest is in the largest countries – Poland (35%), Romania, and Bulgaria (both 36%) – which are also among the poorest countries in the EU in terms of nominal income per capita, as well as Latvia, where the housing gap in 2022 was 37%.

In the third chapter, titled *Impact of tax reforms on the local government revenues in Central and Eastern European countries in the context of their effect on socioeconomic development in the region*, the authors present data showing that the most fiscally decentralized countries, in terms of the size of local sub-sector revenues relative to GDP, are Poland and Czechia, where this ratio in 2015–2022 averaged 13.9% and 12.5%, respectively. In four CEE countries, local sector tax revenues averaged over 20% of total tax revenues. The highest shares were in Czechia (27.9%) and Latvia (26.2%). In Hungary, tax revenues did not even reach 10%. The authors note that in most CEE countries, tax revenues did not even account for 5% of GDP. The highest ratio of local sub-sector tax revenues to GDP was in two countries – Czechia and Latvia (5.6% on average), while Hungary had the lowest rate (2.0% on average).

In the chapter titled *Economic situation in Central and Eastern Europe* a team of authors from SGH point out that 2023 was a period of economic downturn and volatility in the business sentiment in the CEE countries. The manufacturing industry continued its downward trend, which began a year earlier, and construction in most regional economies was in decline. Only in Poland and Romania could we see some signs of an upturn in the building sector. Still, in every CEE country, except Hungary and Estonia, the investment growth rate in 2023 was higher than the EU-27 average, and in almost every case, except Hungary and Bulgaria, average annual investment growth was higher in 2023 than in 2022. The authors highlight that business sentiment surveys from the first months of 2024 indicate an upcoming economic growth in the region.

The authors of the chapter titled *Reconfiguration of global supply chains – the role of enterprises from Central and Eastern Europe* believe that CEE enterprises can find an advantageous place in the reconfigured global supply chains. They can also play a significant role in supply chains aimed at rebuilding Ukraine's economy. The CEE region

can be a kind of reconfiguration hub for circular supply chains. However, this requires regulatory, formal, and financial support for enterprises, especially SMEs.

Significance of renewable energy sources for shaping contemporary energy security of Central and Eastern European countries is the title of the next chapter, where the authors argue that the share of RES in the CEE economies' electricity mix increased from 0% or close to 0% in 2004 to as high as 48% in 2022 (in Lithuania). The lowest share of RES in the CEE electricity mix in 2022 was in Slovakia and Slovenia (about 3%), while the EU's electricity mix increased from 2% to 24% during this period.

In the next chapter, titled *State in the blockchain network*, an interesting observation is made that countries with the most experience in implementing blockchain technology in the largest number of public processes are: USA (12), the Netherlands (9), Estonia (8), Romania (8), Austria (7), Switzerland (7), and Australia (7). The authors identified 54 public processes in which at least one of the 78 surveyed countries (including the EU) has taken steps to implement blockchain.

In the article titled *Overcoming investment barriers by companies in Central and Eastern European Countries*, the authors indicate that the biggest investment barriers faced by enterprises from Poland are uncertainty about the future (91.7% of responses) and energy costs (87.3% of responses). A country with a clearly dominant cluster of high barriers is Latvia (62.8%). A high share of enterprises in this cluster is also characteristic of Poland (46.5%) and Romania (42.9%). Countries with a dominant cluster of low barriers are Lithuania (40.9%) and Hungary (44.4%). This suggests that enterprises operating there experience the least investment obstacles compared to the analysed CEE economies.

The authors of the study *Economic development and economic and social inequalities* argue that in 2023, the most developed countries in the CEE region were Czechia and Slovenia (achieving 91% of the average EU GDP per capita, at PPP). The country with the lowest GDP per capita at PPP in the CEE was Bulgaria (64% of the EU average). The authors emphasize that labour costs in the CEE are still significantly lower than in Western Europe. In Bulgaria, Romania, Hungary, and Latvia, they do not exceed EUR 10 (per hour). In Poland, labour costs amount to EUR 10.3, while the average in the EU is EUR 22.9. Among the CEE countries, only Slovenia is close to the EU average (EUR 19.8).

In the next study, *Strategies of Central and Eastern European firms' foreign expansion and place-of-origin effect, cross-border e-commerce development, and pressure on innovation*, the authors present the view that the development of the Internet and new technologies creates great opportunities for international expansion for CEE firms, as it does not require physical presence in foreign markets. In 2022, cross-border e-commerce accounted for as much as 22% of global e-commerce. By 2030, its value will reach USD

6.12 trillion, while in 2022 it was only USD 0.948 trillion. In In the CEE countries the share of innovative firms operating on foreign markets in the total number of innovative enterprises according to Global Innovation Index 2023 was above 60% (in Poland it was 65%), and in two countries it exceeded 80% (81% in Estonia and 88% in Slovenia).

The authors of the study titled *Influence of demographic and socioeconomic factors on health in the context of labour market operation* argue that Poland stands out among other EU countries with its relatively low rate of work absenteeism due to health problems. However, the share of people reporting work-related health problems in the total number of employed people is the highest in Poland among the EU states. According to the authors, it is necessary to analyse the causes of high health risk among workers, in order to develop effective tools to protect their health.

In the final study, titled *Investment and innovation in Central and Eastern European firms – recent trends and the path ahead*, experts from the European Investment Bank (EIB) point out that investment gaps in the CEE region are still larger than in the EU: 78% of CEE firms declared an essentially adequate rate of investment in recent years (compared to 82% in the EU). At the same time, innovative activity in CEE is comparable to the EU average: over 40% of firms in this region have developed or introduced new products, processes, or services as part of their investment activities (39% in the EU). Two-thirds (65%) of CEE firms declare having used one or more advanced digital technologies, which places them slightly below the EU average (70%). Uncertainty about the future (86%) and availability of highly skilled staff (79%) are long-term investment barriers most commonly indicated by CEE firms.

Editorial Committee

DEVELOPMENT TRAJECTORIES IN CENTRAL AND EASTERN EUROPEAN COUNTRIES IN 2004–2023 – SOURCES OF THE INSTITUTIONAL COMPARATIVE ADVANTAGE AND THEIR EVOLUTION IN PATCHWORK CAPITALISM

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Abstract

The study provides a comparative analysis and assessment of development trajectories of the 11 new EU member states in Central and Eastern Europe (CEE-11) between 2004 and 2023, in the context of the most salient features of the model of patchwork capitalism that emerged in these countries, which determine the sources of their institutional comparative advantage. The analysis is conducted against the backdrop of the entire European Union (EU-28), with special reference to the four co-existing models of Western European capitalism there. It covers two basic dimensions of development: economic (growth, real convergence and macroeconomic equilibrium) and institutional (institutional architecture of the economy). Our research results indicate that patchwork capitalism enjoys an institutional comparative advantage in the short and medium term in relation to economic growth and real income convergence. At the same time, however, this model displays low resilience to adverse exogenous asymmetric shocks (e.g. the COVID-19 pandemic) and generates high economic and non-economic costs (e.g. high level of excess deaths) while protecting growth and employment. In the long term, the patchwork model exhibits an 'institutional shortsightedness syndrome' that puts it in a comparative disadvantage vis-a-vis other models of capitalism in the EU. The syndrome involved manifests itself in various ways, including a low capability to innovate and inability to alter the sources of hitherto comparative advantage, by moving away from the prevalent pattern of international

specialisation towards a knowledge-based and environmentally friendly circular economy, which would respond quickly, effectively and flexibly to the challenges of adverse asymmetric external shocks in a polycrisis environment. As a result, a rapid change in the present (semi-) peripheral status of the CEE-11 countries embodying the patchwork model, becomes a hardly realistic scenario, which would entail their getting stuck for long in the intermediate stages of global value chains.

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Ryszard Rapacki – Professor, former Head of the Department of Economics II at the SGH Warsaw School of Economics. His scientific interests comprise macroeconomics and new institutional economics, particularly the problems of economic growth and real convergence, as well as diverse forms of contemporary capitalism.

This paper presents a comparative analysis of development trajectories of 11 new EU member states from Central and Eastern Europe (CEE-11) in the years 2004–2023, in the context of the capitalism model employed in those countries which we refer to as the patchwork capitalism [Rapacki, 2019; Rapacki et al., 2019; Gardawski, Rapacki, 2021]. The analysis has been conducted against the backdrop of the entire European Union (EU-28)[1], highlighting the co-existing four models of Western European capitalism. The study elaborates on two fundamental dimensions of development: the economic dimension (growth and equilibrium) and the institutional dimension (institutional architecture of the economy). A key notion in our deliberations is the "institutional comparative advantage" which expands on the core claim of New Institutional Economics (NIE) [see e.g. Landes, 2005; Acemoglu, Robinson, 2014] that the quality of institutions strongly determines the economic performance of individual countries and their groups (*institutions matter*).

[1] In our study we also accounted for Great Britain, as this country had remained an EU member state for most of the analysed period (until 2020).

Institutional architecture (institutional governance) which constitutes the model of capitalism employed in a given country involves three main elements/dimensions. First, there are accepted social rules of conduct, i.e. codified laws (formal institutions) and the prevalent value models as well as norms followed by economic and social players (informal institutions). The second element is the attitude of players to the existing rules, i.e. the extent to which these agents approve of the formal institutions, or on the contrary – the degree to which they are engaged in striving for change. The third dimension of institutional architecture is the way the existing formal rules (laws) are being enforced, in particular by state authorities.

The concept of a comparative institutional advantage allows to clarify how institutions in various countries determine the revealed comparative advantage (RCA), i.e. the entrenched patterns of their competitiveness and international specialisation in industrial production and exports, and in a wider context – their economic performance and place in global value added chains [Rapacki at al., 2019, p. 38]. The very notion of a comparative institutional advantage is usually defined by referring to some "input" independent variables like: the shape of institutions constituting the entire architecture, their composition (structure) and character of interdependence (coherence, complementarity, or a lack of them), as well as the type of mechanisms coordinating the decisions and actions of economic agents [Hall, Soskice, 2001; Nölke, Vliegenthardt, 2009]. This term should be defined in dynamic categories – institutions which lie at the core of a country's comparative advantage must evolve along with its economic development, so that the use of resources may be optimised and the advantage maintained in the changing conditions.

The comparative institutional advantage may be also defined using "output" variables, i.e. the attained economic results. In this perspective, the advantage may be manifested in a high and steady economic growth rate which, on one hand, stimulates progress through real convergence, and on the other, in the case of CEE-11 countries, allows to transform their semi-peripheral EU status into a central economic position.

During the time period analysed in this paper, CEE-11 economies were affected by a series of asymmetric exogenous shocks, the most significant (chronologically) of which were: the process of EU accession, the global financial crisis initiated by a crash on the American property market in 2008 (its negative consequences could be observed as late as 2014), the COVID-19 pandemic and a recession it triggered, and finally the war in Ukraine. Simultaneously, long-term crisis occurrences of continuous and cumulative nature, frequently referred to as a *polycrisis* put pressure on institutional changes and economic policies conducted in the countries surveyed. [see Lawrence, Janzwood, Homer-Dixon, 2022].

The starting point of our analysis is an assessment of the economic growth rate and progress of the real convergence process in CEE-11 countries. Yet, we believe that the economic growth analysis itself, even when supported with an evaluation of various macroeconomic equilibrium dimensions (inflation, unemployment, balance of the public finance sector and current account balance), does not allow to determine how permanent and stable the observed CEE-11 development trajectories are, which is a prerequisite for further income convergence in relation to highly-developed EU economies, as well as to assess the risk of reversing the trend and the negative divergence scenario occurring.

This risk appears particularly prominent in the context of assessing the second institutional dimension of development trajectories in CEE-11 countries. Our assessment of the efficiency, productivity and coherence of institutions constituting the "patchwork capitalism" model that emerged in CEE countries is negative in many aspects (e.g. a fundamental weakness of the institutional framework, lack of entities interested in preserving the coherence and complementarity of the institutions involved, low barriers and costs to entry make the patchwork capitalism "an open-access system" and lead to uncontrolled import of entropy, "axiological heterogeneity" or problems in enforcing the existing rules of the game) [see Gardawski, Rapacki, 2021].

The above observations allow to identify a gripping research problem rooted in NIE literature and comparative studies over capitalism. There emerges a dilemma: how can a relatively good performance of CEE-11 countries in terms of economic growth and their authentic success in the process of real convergence be reconciled with a critical evaluation of the patchwork capitalism model employed in those countries, in the light of a widely shared claim of New Institutional Economics (NIE) that quality of institutions has a strong bearing on the economic performance, both in the long and short term.

In our text we have put forward a thesis that the patchwork capitalism model is characterised by a particular "institutional short-sightedness syndrome" which exhibits a preference for relatively easy-to-achieve, short term and medium term targets (quantitative changes) at the expense of long term goals (qualitative changes). One of the main purposes of this paper is to determine key criteria for assessing the sources of the comparative institutional advantage of an economy/a country, in a wider perspective – to establish a model of capitalism along with a relevant set of indicators allowing to verify to what extent these criteria have been met in a given country. The assessment of how much short term targets (maintaining the growth rate and employment level during the pandemic) were favoured at the expense of protecting human lives and health, as well as at the cost of entrenching macroeconomic disequilibrium and extending the time period needed to return to the inflation target

was the subject of analyses presented in previous editions of the Report [Próchniak, Lissowska, Maszczyk, Rapacki, Towalski, 2022; Maszczyk, Lissowska, Próchniak, Rapacki, Sulejewicz, 2023]. This study presents a far more complex approach to the issue of "institutional short-sightedness syndrome", focusing particularly on long-term goals such as: changing the (semi-) peripheral status of countries manifested in the patchwork model, understood as becoming permanently stuck at intermediate stages of global value chains, increasing the share of products carrying cutting-edge technologies in GDP and exports, as well as containing negative effects of demographic changes by employing reasonable migration policies, active job market strategies and boosting efficiency, thanks to reformed education and knowledge creation. These goals are absolutely crucial for CEE-11 countries to be able to avoid the middle-level development trap.

The structure of the paper is presented below. In the first part we conduct an analysis of the economic growth paths, real convergence and macroeconomic equilibrium in Poland and CEE-11 countries, as compared to other groups of countries in the EU representing various models of capitalism. The second part includes an analysis of the most significant institutional qualities of patchwork capitalism in CEE-11 countries divided into three categories: 1) the way of patchwork emergence, 2) the structure of its institutions, and 3) the way of its functioning. In this part we also attempt to identify change paths in the institutional architecture of the studied group of countries in the years 2004–2023, also in the perspective of asymmetric exogenous shocks, using the original method of coefficients and similarity hexagons (CEE-11 countries vs reference countries). The method identifies and applies carefully selected institutional indicators describing five key institutional areas (pillars of the economy's institutional architecture): a) competition on product markets, b) labour market and industrial relations, c) system of financial brokerage, d) system of social security, and e) system of knowledge creation. CEE countries have been contrasted against five "old" EU countries, representing four models of Western European capitalism (Great Britain, Germany, Sweden, Spain and/or Italy). In the second part, we also strived to present how selected elements of the institutional architecture of patchwork capitalism (in particular state institutions) responded to the recent negative exogenous shocks of the years 2020–2023. The third part is devoted to a comparative analysis of patchwork capitalism strengths and weaknesses as compared against the remaining four capitalism models in the EU, focusing on the sources and evolution of the comparative institutional advantage in the patchwork model. In this analysis we have employed a set of indicators which, in our opinion, allow to justify the thesis that patchwork capitalism suffers from an "institutional short-sightedness syndrome". These considerations lead to a summary including recommendations for future optimisation

of Poland's and other CEE-11 countries' development paths by changing the sources of their comparative institutional advantage leading to the enhanced international competitiveness of their economies.

Economic development trajectories of CEE-11 countries in the years 2004–2023

The conducted analysis of development trajectories in CEE-11 countries focuses mostly on the economic growth dynamics and the process of real income convergence. Additionally, we refer to the findings of the original assessment of the macroeconomic equilibrium in these countries presented in our last year's paper [Maszczyk et al., 2023].

Economic growth paths of CEE-11 countries

Economic growth paths in new EU member states from Central and Eastern Europe (CEE-11) in the years 2004–2023 have been illustrated by the data in Table 1. These data have been compared to average values for smaller groups of "old" EU member states representing four Western European capitalism models[2], as well as to the EU-28 average. It also allows to synthetically assess the process of real income convergence of CEE-11 countries, manifested in the patchwork model of capitalism, and compare it to the EU average and to the clusters corresponding to particular models of capitalism in the studied period. The table shows relevant indicators for the years 2020–2023 when the first economic consequences of the coronavirus pandemic and the war in Ukraine became apparent.

Table 1. Economic growth and real convergence in CEE-11 in the years 2004–2023

Country	Average annual GDP growth rate in fixed prices		GDP per capita (PSN, EU-28 = 100)**			
	2004–2019	2020–2023	2004–2023	2004	2019	2023
Poland	4.1	2.5	3.8	50.1	72.6	80.2
Bulgaria	3.1	2.3	2.9	34.2	52.8	64.1
Croatia	1.5	3.3	1.8	55.1	66.4	75.0***
Czechia	2.9	0.0	2.3	78.5	92.8	91.1

[2] Thus, a continental model of capitalism is represented by: Austria, Belgium, France, the Netherlands, Luxembourg and Germany, the Mediterranean model by: Greece, Spain, Portugal and Italy, the Nordic model by: Denmark, Finland and Sweden, the Anglo-Saxon model by: Ireland and Great Britain. The picture is completed by 11 countries of CEE representing patchwork capitalism.

Country	Average annual GDP growth rate in fixed prices		GDP per capita (PSN, EU-28 = 100)**			
	2004–2019	2020–2023	2004–2023	2004	2019	2023
Estonia	3.0	0.6	2.5	54.4	82.6	81.7
Lithuania	3.4	2.1	3.1	48.9	84.0	86.8
Latvia	2.7	1.4	2.4	46.1	68.9	71.0
Romania	3.8	2.0	3.5	33.8	69.3	78.2
Slovakia	3.8	1.1	3.2	57.0	70.2	73.1
Slovenia	2.2	1.9	2.2	85.4	88.4	91.6
Hungary	2.2	1.5	2.1	61.1	72.7	76.6
Models of capitalism						
Patchwork*	3.5	1.9	3.2	50.5	73.1	79.2
Continental*	1.4	0.5	1.2	117.8	116.1	112.8
Mediterranean*	0.5	0.9	0.6	102.3	90.1	90.7
Nordic*	1.7	1.4	1.7	123.4	117.9	117.9
Anglo-Saxon*	1.7	0.9	1.5	121.6	109.9	106.1
EU-28*	1.7	1.0	1.5	100.0	100.0	100.0

* Population-weighted average.
** Average for EU-28 in 2023 was calculated and reviewed by authors as compared to Eurostat source data for EU-27 including Great Britain.
*** Own estimates based on Eurostat data.

Source: Self-reported data based on Eurostat data [2024], Worldometer [2024] – population number in 2023, and IMF [2023] – GDP per capita in 2023; the missing records for Great Britain were complemented with the data from the Office for National Statistics, 2024 – economic growth rate in the years 2020–2023.

Analysis of these data supplemented with statistics coming from other sources allows to formulate the following conclusions.

1) Accession of CEE-11 countries to the EU (apart from Czechia and Slovenia) took place in the circumstances of unprecedented high discrepancies in economic development between the new member states and those constituting the "core" of EU. GDP per capita according to the purchasing power parity (PPP) in the group of CEE-11 in 2014 on average accounted for just 44% of the "old" EU countries (EU-15) average. To compare, in the years 1980–1985 when three countries from Southern Europe were joining the EU, this indicator amounted to 72% on average, ranging from 60% (in Portugal) to 76–80% (in Spain and Greece) [Rapacki, 2012].
2) Economic growth in CEE-11 countries in the entire period of 2004–2023 was on average over two times faster than in the whole of EU.
3) CEE-11 countries, representing the model of patchwork capitalism, had the highest growth rate as compared against the other four models of capitalism coexisting in the EU – the Continental, Mediterranean, Nordic and Anglo-Saxon. A particularly

large gap in the growth dynamics could be observed when contrasted against the Mediterranean model (7:1).

4) Despite its capacity to reach the relatively highest GDP growth rate, in the long term, the patchwork capitalism model was less efficient while dealing with some short-term and medium-term negative exogenous shocks. This is proven by the data collected in the period of the global financial crisis (2009–2014) when the average economic growth rate in CEE-11 countries was, with one exception of the Mediterranean model, lower than in the economies representing the other models of capitalism in the EU [Maszczyk et al., 2023]. Poland diverged from the general pattern, as it did not suffer from a recession in 2009 and even recorded the highest (except for Malta) average GDP growth rate in the EU.
5) On the other hand, economic growth in CEE-11 countries turned out to be the most resilient among all capitalism models in the EU to the last two asymmetric exogenous shocks in the form of the COVID-19 pandemic and war in Ukraine. The pandemic-driven recession of 2020 was the most shallow and the shortest in this group of economies, and their total average annual GDP growth rate in the subperiod of 2020–2023 was almost two times higher than the average of EU-28, and the highest when contrasted against the other models of capitalism.
6) Among CEE-11 countries it was Poland that achieved the highest economic growth in the studied period; only Romania, Slovakia and Lithuania recorded parallel results. In the entire EU only Ireland and Malta enjoyed a higher growth rate.
7) Consequently, CEE-11 countries experienced a fast process of income convergence, resulting in these economies catching up with as many as 29 p.p. of their development distance towards the EU average after 20 years of EU membership. They also outperformed, in terms of GDP per capita (according to PPP), two countries of the "old" EU – Greece and Portugal, making up for most of their development distance (almost 41 p.p. of 52 p.p. in 2004) to the entire group of Mediterranean countries[3].
8) In the years 2004–2023 the process of real convergence gained the fastest pace in Romania (44 p.p.) and Lithuania (38 p.p.), followed by Bulgaria and Poland (30 p.p.), with the slowest pace recorded in Slovenia (6 p.p.) and Czechia (13 p.p.). The pace of this process was strongly affected by the scale of migration in particular countries, especially by a high level of emigration and a slump in total popula-

[3] If only three countries representing the Mediterranean model which joined the EU in the '80 s of the 20th century had been included in the analysis (Greece, Spain and Portugal), the income gap of the countries employing the patchwork model would amount to a mere 5 p.p. in 2023 (own calculations based on Eurostat data).

tion numbers in the Baltic countries and Romania[4]. These factors caused the GDP growth rate per capita in these countries to reach significantly higher levels than the absolute GDP growth rate. Simultaneously, particularly after the COVID-19 pandemic outbreak in 2020, in some CEE-11 countries negative consequences of long-term negative demographic trends became dramatically apparent and were demonstrated in a rising surplus of the death toll over birth rate and a general slump in population numbers.

Macroeconomic equilibrium in the years 2004–2023

As follows from our previous analyses, the results of which were widely discussed in last year's edition of the Report [Maszczyk et al., 2023], rapid economic growth and the process of real income convergence in CEE-11 countries in the years 2004–2023 was accompanied by a considerable scale of the macroeconomic disequilibrium. It was particularly true of two out of four components of the general (dis) equilibrium indicator – the inflation rate and the current account balance.

In the first case, patchwork capitalism had the highest rate of inflation among all capitalism models in the EU, both throughout the entire period of 2004–2023, as well as in the years 2020–2023. High inflation (6.7% as compared to the average 4.2% for EU-28 in the years 2020–2022) [see Maszczyk et al., 2023] proved to be the economic price CEE-11 countries had to pay for a relatively effective protection of their employment levels and economic growth amidst the pandemic and the war in Ukraine. It should also be noted that certain signs of a change in the long-term trend could be observed in this group of countries in the time preceding the pandemic (2015–2019) – the inflation rate fell there to 1.2% annually and was lower than in the Anglo-Saxon model (1.4%), and only slightly higher than for EU-28 (1.1%).

The patchwork model showed also a high level of exogenous disequilibrium, in the years 2004–2019 the share of the current account deficit in GDP amounted on average to 3.4% annually; in the EU this index was slightly higher in the Anglo-Saxon model (–3.5%), and lower (–1.7%) in the Mediterranean model, while in the other models a surplus was observed [Maszczyk et al., 2023)]. A similar pattern was seen in the years 2020–2022 – CEE-11 countries had the second highest index of the current account deficit in the EU (–2,1% as compared to –3,0% in the Anglo-Saxon model and a surplus in the other clusters of member states).

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4 Only in the years 2010–2019 as many as 2 million people emigrated from Romania, and the country's population shrank by over 800 thousand (4%). In the same time period, due to emigration, the populations of Lithuania and Latvia decreased by about 8% each [Eurostat, 2021; Próchniak et al., 2022]. A negative balance was recorded also in Poland [Koyama, 2023].

Another quality of CEE-11 countries' development trajectory should be highlighted because it confirms the previously formulated conclusions. In terms of average annual indicators, for most of the study period, i.e. the years 2004–2019, rapid economic growth co-existed with high unemployment. Average unemployment rate reached then 8.4% and was one of the highest in the EU, exceeded only by Mediterranean countries (12.8%). Contrary to the inflation after 2008, this trend was reversed, and the patchwork model gradually improved its competitive position in the EU in terms of the macroeconomic disequilibrium index. In this context, the results achieved by CEE-11 countries during two negative exogenous shocks in the years 2020–2022 are worth a more careful consideration. Average annual unemployment rate (4.3%) was the lowest among all models of capitalism in the EU [Maszczyk et al., 2023].

What completes the picture is the fact that, in terms of the fourth component of the general macroeconomic equilibrium, i.e. the balance of the public finance sector, the patchwork model recorded a moderate scale of disequilibrium, positioning itself in a medium-range spot among all capitalism models in the EU. In the years 2004–2019 budget deficit amounted to 3.0% of GDP in CEE-11 countries and was on the verge of the acceptable Maastricht criteria. In the years 2020–2022 this deficit grew to 5.2%, which was similar to other EU member states [Maszczyk et al., 2023], as a result of these countries' governments fighting the COVID-19 pandemic and increasing economic costs of protecting job places.

Institutional development trajectories

The study of institutional development trajectories of CEE-11 countries included in this section consists of two parts. In the first one we present a general characteristic of the new socioeconomic order which emerged after 1989 – the patchwork capitalism – and outline its evolution paths in the years 2005–2023. The second part is an empirical study. We have conducted a comparative analysis of the similarity between the institutional architecture of patchwork capitalism and other capitalism models co-existing in the EU.

Most vital qualities of patchwork capitalism in CEE

As follows from theoretical analyses using the method of Weber's Ideal Types [Gardawski, Rapacki, 2021], and empirical studies run with the participation of this study's authors, the new socioeconomic order which emerged in CEE-11 countries after 1989 possesses some qualities close to the "Ideal Type" construct which

we named "patchwork capitalism" [Rapacki, 2019; Rapacki et al., 2019; Gardawski, Rapacki, 2021]. As far as the most vital constitutive qualities are concerned, this order is fundamentally different both from capitalism models in Western Europe, and from post-communist varieties of capitalism occurring in the other former communist bloc countries[5].

Below we outline in brief the most vital qualities of the patchwork capitalism in CEE countries. For greater clarity we have divided them into three large categories:

a) how patchwork capitalism emerged,
b) its institutional shape,
c) the functioning of a patchwork.

Emergence of patchwork capitalism

1) **Historical origins.** Patchwork capitalism in CEE countries is a product of a long duration [Braudel, 1999] or in other words – a path dependence [David, 1994]. As a consequence, today's institutional architecture of the system is a heterogeneous set of loosely connected elements inherited and/or transplanted from different socioeconomic orders which may be chronologically classified into three time layers: 1) feudal and capitalist institutional heritage, 2) legacy of socialism, 3) institutions imported during the period of transformation of 1989, transplanted from a few capitalism models co-existing today in Western Europe. A unique quality of patchwork capitalism is, among others, the fact that during the life span of one generation, institutional development trajectories in CEE countries were disrupted two times and changed direction by 180° – first in the period of 1945–1948 during the shift from capitalism to socialism, then after 1989, in the form of a political system transformation from socialism to capitalism [Gardawski, Rapacki, 2021].
2) **Reformatory elite.** The role of capitalism builders in CEE countries was performed by the elite reforming the economy (the transformation elite) which carried out an act of creative destruction: it demolished the institutional architecture of socialism, ousted the ruling *nomenclature* and implemented a programme of system transformation involving privatisation, restraining government intervention in the economy, deregulation and decentralisation of the economic power and administrative structures. The elite launched a mission of building foundations for

[5] It should be also borne in mind that patchwork capitalism, e.g. in Poland, significantly diverges, in terms of the structural qualities of its institutional architecture, from the stipulated in the Constitution of the Republic of Poland (Art. 20) model of an ordoliberal, social, free market economy. More on this model, see: Mączyńska and Pysz [2016].

a free market economy in its idealised, extremely liberal version. However, these elite members did not strive to become a new class of production means owners, which set them apart from reformatory elites in Russia and the Commonwealth of Independent States.

3) **Building capitalism without capitalists.** One of the key implications of the socialist implosion in CEE countries in 1989 was the fact that the process of creating a new socioeconomic order – capitalism – happened in the beginning without the presence of local capitalists, i.e. a class with a vital economic interest in establishing institutions lying at the core of this new order, ensuring their stability and protection by raising barriers to entry (and transactional costs) for new players and enforcing compliance with new rules of the game [Gardawski, Rapacki, 2021].
4) **The role of foreign capital.** The transformation elite decided neither to build capitalism "bottom-up", e.g. using the American model of Employee Stock Option Plan (ESOP), nor "top-down", e.g. by implementing an oligarchic model. Instead, capitalism in CEE countries was built "outside-in", or "from abroad" in other words, by using foreign capital [King, Szelenyi, 2005], including especially foreign direct investment (FDI), in line with the Washington Consensus recommendations. As a result, foreign capital constituted one of the key drivers in the process of establishing a new socioeconomic order (a dependent free market economy model) [Nölke, Vliegenthart, 2009], as well as a barrier preventing the emergence of a domestic class of oligarchs. Transnational corporations (TNC), which were the main channels of FDI inflow to CEE countries, faced very low barriers to entry, and more importantly, remained fully independent in shaping the internal institutional (corporate) governance in their CEE subsidiaries, which contributed to the development of the patchwork system. The inflow and the power of TNC clearly indicated the priorities of CEE countries which focused on ensuring privileged conditions for foreign capital and its accumulation, frequently at the expense of a widely understood social reproduction [Mrozowicki, Gardawski, Burski, Rapacki, 2023].
5) **EU membership.** On one hand, this factor led partly to institutional convergence and "standardisation" of socioeconomic orders in CEE countries, on the other, however, at least in the short and medium term, brought a kind of exogenous shock, temporarily increasing their institutional heterogeneity. Peculiarity of the EU accession process, resulting from CEE-11 countries' unique development trajectories, was their joining the EU (a singular occurrence in history) as outsiders to the capitalist world (being former socialist countries) which were only erecting institutional foundations of the new system.

Institutional architecture

Historical roots and ways of emergence of the patchwork capitalism after 1989 make its institutional architecture highly heterogeneous, with the most important qualities being:

1) **Fundamental weakness of the institutional framework**, i.e. of basic institutions setting rules of the game within the existing socioeconomic order.
2) **Incoherence and lack of complementarity of the institutional architecture**, as demonstrated by numerous loopholes and incompatibility of its structural elements.
3) **Co-existence of different, often diverse mechanisms of coordinating decisions/actions** taken by economic and social players in various areas of the institutional architecture[6] [Rapacki, 2019]. Consequently, although market mechanisms of coordination are predominant in the area of product market competition and financial brokerage, in the system of knowledge creation hierarchical coordination is the most common. For instance, the area of housing, as well as social security are dominated by personalised coordination mechanisms, based on family connections and cronyism [Czerniak, 2023].
4) **Incompatibility of formal and informal institutions and poor social roots of the former.** The consequence of CEE countries' strong dependence on earlier development paths (sturdiness of historically inherited informal institutions, including cultural patterns and social attitudes) on one hand, and on the other, massive imports of formal institutions mechanically brought to CEE countries from other Western capitalism models after 1989 is a significant incompatibility of formal and informal institutions and poor social internalisation of the former.
5) **Axiological heterogeneity.** Another quality of the patchwork institutional architecture, which boosts its heterogeneity even further, is the multitude and internal incoherence of the values observed by the society, particulary co-existence of contradictory values at the domestic level, their high dispersion and poor identification with free market principles [Lissowska, 2020; Rapacki, Maszczyk, Lissowska, Próchniak, Sulejewicz, 2024].
6) **Low barriers and (transactional) costs to entering** the patchwork order, which encourages incorporation of new organisations and institutions representing diverse, often clashing intrinsic logics. This quality makes patchwork capitalism, contrary to most other heterogeneous capitalism varieties, a "free access order" [Gardawski, Rapacki, 2021].

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6 We refer here to the relevant classifications presented by Hall and Soskice [2001], Amable [2003], Nölke and Vliegenthart [2009], and the concept of crony capitalism, originally created for the Phillipines case [Kang, 2002].

The way of functioning

Patchwork capitalism's origins and institutional structure results in a special way of its functioning, with some of the unique characteristics being:

1) tendency to go into a development drift,
2) increasing entropy import from highly developed countries [Gardawski, Rapacki, 2021],
3) high degree of state unreliability,
4) underdeveloped and chronically malfunctioning public services,
5) poor government support of social agents in crisis situations,
6) plenty of room for grassroots, spontaneous entrepreneurial activity [Mrozowicki i in., 2023].

Findings from the analysis of similarity coefficients of institutional architecture in CEE-11 countries as compared to EU reference countries in the years 2005–2023

Principally, the analysis conducted in this subsection involved five institutional areas identified by Bruno Amable [2003] in the research into capitalism models, [7]constituting the construction pillars of the institutional architecture of an economy: product market competition, industrial relations and the labour market, the financial brokerage system, social security system and knowledge creation system.

Within each of those areas we have compared CEE-11 countries to four capitalism models observed in Western Europe: the Anglo-Saxon model (represented by Great Britain), the Nordic model (Sweden), the Continental model (Germany) and the Mediterranean model (Italy or Spain, depending on data availability and how representative a given country is for the model).

The degree of resemblance was each time calculated based on six indicators. Three of them refer to institutional conditions in a given area (so called input variables), and the other three correspond to the findings obtained in this area (output variables which describe the effects of functioning of the institutional architecture).

In order to calculate resemblance, an original conception of coefficients and similarity hexagons was employed. The method of creating this apparatus was discussed in more detail in our former works [see e.g. Próchniak et al., 2016; Rapacki et al.,

7 Table for 2022, due to insufficient statistical coverage, particularly for Great Britain, outlines similarity analysis findings constrained to only four areas.

2019]. In the most general sense, the similarity coefficient equals 100 when the value of a given variable is the same in a CEE country and the reference country (full resemblance). Conversely, the value is 0 when the difference between a CEE country and the reference country exceeds three standard deviations of a given variable differentiation in the group of 15 studied economies (CEE-11 + four countries of Western Europe). If the difference is lower than three standard deviations, the similarity coefficient is calculated proportionally. Consequently, the higher the similarity coefficient, the greater the institutional affinity. It should be highlighted that the direction of deviation is irrelevant when calculating the similarity coefficient – it is only the absolute value of differences that is taken into account. Aggregated similarity coefficients for various areas and CEE-11 countries were calculated as arithmetic averages of the value of corresponding coefficients referring to six area indicators.

In the findings interpretation, we have assumed that if any CEE-11 country exhibits a simultaneous similarity to more than one Western European capitalism models (with the coefficient exceeding 50), it signifies the occurrence of a bi- or poly-centric similarity pattern and constitutes a premise of a given country possessing a patchwork capitalism model, in line with our earlier study [Rapacki, Czerniak, 2019; Rapacki et al., 2019].

Table 2 contains similarity coefficients of CEE-11 countries to reference countries for 2005[8]. For as many as seven of them the highest value of these coefficients was identified in relation to the countries representing the Mediterranean model (which also means that the average index for the entire group of CEE-11 was the highest in relation to Spain/Italy). However, for the remaining four countries the closest point of reference was the Continental model (Germany). It should be noted, though, that these coefficients stood at a relatively low level, not exceeding 70, with the exception of Slovenia. In the case of six countries (Croatia, Czechia, Estonia, Lithuania, Latvia and Slovenia) we saw a poly-centric similarity pattern, as the corresponding coefficients exceeded 50 in relation to three countries, i.e. Germany, Spain/Italy and Great Britain. Yet, in the other four countries (Bulgaria, Poland, Slovakia and Hungary) the institutional correlation pattern was bi-centric with the highest similarity coefficient to the Mediterranean model (three countries) and the Continental model (one country).

While studying similarity patterns for input and output variables separately it may be observed that for the former the highest similarity coefficients occurred in relation to Spain/Italy (five countries) and Germany (also five countries). The poly-centric distribution of similarity coefficients for the input side of the institutional architecture is also significant: apart from Romania, all CEE countries exhibit a simultaneous

8 The description of data used to create similarity coefficients may be found in Rapacki et al. [2019].

resemblance to at least two different capitalism models, with six countries sharing common characteristic with three models, and one (Slovenia) with all four systems.

Table 2. Similarity coefficients of CEE-11 countries to reference countries in 2005

	Germany		Spain/Italy		Sweden		Great Britain	
	input variables	output variables	input variables	output variables	input variables	output variables	input variables	output variables
Bulgaria	51.1		59.7		31.9		44.7	
	55.4	46.9	61.3	58.0	35.2	28.5	42.5	47.0
Croatia	63.0		63.8		41.1		51.3	
	67.5	58.5	64.6	63.1	45.2	37.0	51.8	50.9
Czechia	67.9		68.3		46.2		53.8	
	67.5	68.2	66.2	70.4	44.4	48.1	56.7	50.9
Estonia	61.1		55.6		48.0		59.9	
	60.5	61.6	48.9	62.4	49.6	46.3	62.8	57.0
Lithuania	64.0		60.8		43.2		54.7	
	69.2	58.8	59.4	62.2	49.5	36.9	60.9	48.6
Latvia	59.6		57.0		39.6		52.6	
	65.4	53.8	57.4	56.6	49.9	29.3	59.2	45.9
Poland	51.3		65.9		35.3		43.4	
	56.2	46.4	69.7	62.1	40.2	30.4	43.3	43.5
Romania	48.5		50.1		31.9		40.3	
	44.2	52.9	46.5	53.7	39.6	24.3	33.8	46.8
Slovakia	61.6		59.4		35.1		45.9	
	59.4	63.9	57.7	61.2	40.8	29.4	48.1	43.8
Slovenia	59.9		70.5		49.3		51.5	
	57.5	62.3	65.1	75.9	51.6	47.0	53.1	49.8
Hungary	58.4		65.6		41.0		49.9	
	59.8	56.9	69.0	62.1	47.2	34.8	51.5	48.3
Average	**58.8**		**61.5**		**40.2**		**49.8**	
	60.2	**57.3**	**60.5**	**62.5**	**44.8**	**35.6**	**51.2**	**48.4**

Notes: Dark grey colour was used to indicate the highest similarity coefficient in each CEE-11 country; light grey marks a simultaneous resemblance of a given country to other reference countries at the level of over 50; yellow marks the highest similarity coefficients for input and output variables.
Similarity coefficients involve five areas.

Source: Self-reported data.

When it comes to output variables, as many as 10 countries showed the highest resemblance to the Mediterranean model. It is worth noting that nine CEE-11 countries

demonstrated at the same time the characteristics of a bi-polar model, i.e. a simultaneous convergence of their performance with two different capitalism models (output similarity coefficient over 50). The regularity did not apply to Poland which in this respect strongly gravitated towards the Mediterranean model.

Table 3. Similarity coefficients of CEE-11 countries to reference countries in 2018/2019

	Germany		Spain/Italy		Sweden		Great Britain	
	input variables	output variables	input variables	output variables	input variables	output variables	input variables	output variables
Bulgaria	49.8		58.0		34.6		49.2	
	52.9	46.2	62.6	53.4	41.2	27.9	53.8	44.6
Croatia	55.9		60.5		36.7		45.0	
	58.9	52.8	64.2	56.7	39.8	33.6	49.1	40.9
Czechia	57.0		53.7		44.9		55.8	
	62.3	51.6	58.1	49.3	52.8	37.1	63.5	48.1
Estonia	63.0		63.8		50.7		56.0	
	60.1	65.8	62.0	65.6	46.5	54.9	53.6	58.3
Lithuania	55.3		58.7		48.4		53.2	
	59.7	51.0	56.7	60.7	54.2	42.5	61.0	45.5
Latvia	55.1		58.1		45.9		51.6	
	54.1	56.1	54.7	61.5	50.2	41.6	49.7	53.5
Poland	56.4		61.1		34.2		45.0	
	55.6	57.2	59.0	63.2	32.0	36.4	39.5	50.5
Romania	49.2		53.0		35.9		53.2	
	44.4	54.0	51.4	54.6	34.7	37.1	55.2	51.2
Slovakia	52.7		58.4		39.1		46.0	
	58.3	47.1	64.9	51.9	40.8	37.4	58.3	33.7
Slovenia	69.5		69.4		55.6		59.7	
	74.6	64.4	70.0	68.8	60.3	50.9	63.1	56.3
Hungary	58.5		56.6		38.4		52.4	
	58.6	58.4	61.2	52.0	41.7	35.1	56.3	48.5
Average	**56.6**		**59.2**		**42.2**		**51.6**	
	58.2	**54.8**	**60.5**	**57.9**	**44.9**	**39.5**	**54.8**	**48.3**

Notes: Dark grey colour was used to indicate the highest similarity coefficient in each CEE-11 country; light grey marks a simultaneous resemblance of a given country to other reference countries at the level of over 50; yellow marks the highest similarity coefficients for input and output variables.
Similarity coefficients involve five areas.

Source: Self-reported data.

Table 3 presents an analogical set of similarity coefficients for 2018/2019[9]. The institutional convergence pattern identified at the level of the entire group of CEE-11 countries in 2005 has undergone a fundamental change – it transformed from a bi-centric into a poly-centric one, in which the group displayed on average a simultaneous similarity (corresponding coefficients over 50) to three different capitalism models: the Mediterranean, Continental and Anglo-Saxon. It happened mostly due to an increased number of economies in which the similarity coefficient exceeded the level of 50 in relation to three or more reference countries (from 5 to 6). Moreover, the economies of Estonia and Slovenia in 2018/2019 showed a simultaneous resemblance to all four reference countries. In this light, the conclusion that the studied group of countries is increasingly saturated with patchwork model characteristics seems quite grounded.

At the level of input variables, the similarity pattern was increasingly more poly-centric, just like in the case of average values. Between 2005 and 2018/2019 the number of countries whose institutional architecture was similar (the level of corresponding coefficients over 50) to three different reference countries at the same time has increased from 6 to 8. A simultaneous resemblance to all four reference countries demonstrated by three CEE-11 economies is a new phenomenon. On the side of output variables, CEE-11 countries in 2018/2019 still showed the highest resemblance to the Mediterranean model, but their number decreased from 10 to 8. A slight decrease in the frequency of occurrence of the bi-polar similarity pattern should also be noted (from 9 to 8 countries). At the same time, some increase was observed in the number of countries whose economic performance positioned them close to at least three Western European capitalism models (from 3 to 5, including Poland), with Slovenia showing similarity to four models.

Table 4 includes similarity coefficients for 2022. It should be noted that due to Great Britain leaving the EU and some of the data used for the comparative analysis in the years 2005 and 2018/2019 becoming unavailable, the data set based on which similarity coefficients were calculated had changed[10]. Nevertheless, the method itself,

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9 The set of data used to create coefficients for 2018/2019 was described by Próchniak [2021].

10 Most important changes in variable sets between 2005 and 2022 are in two areas: product market competition and knowledge creation. In terms of competition on the product market two new variables were accounted for: digital competitiveness index created by the International Institute for Management Development (IMD) and the Herfindahl-Hirschman Index (HHI), measuring exports concentration according to the countries in trade partnerships, replacing two variables established by the World Economic Forum: the Global Competitiveness Index (GCI) and its component variable. In the area of knowledge creation, patent applications to the European Patent Office have been replaced by patent applications in general, filed by residents or non-residents, instead of the value of corporate revenues obtained thanks to implementing innovations (as a percentage of total corporate revenues) the value of revenue per one employee of the ICT sector is now used. It should be also noted that in order to ensure a multifaceted data analysis we have additionally compared similarity coefficients from Table 4 with the values of these coefficients of 2019, calculated based on the vari-

as well as the way of selecting variables for assessing the degree of institutional (dis) similarity of CEE-11 countries to the countries representing four Western European models of capitalism in the EU, have not basically changed.

Analysis of Table 4 contents leads us to believe that the poly-centric similarity pattern in CEE-11 countries has been perpetuated and reinforced. The number of countries displaying a simultaneous institutional affinity to all four capitalism models in the EU has grown to three (Estonia. Latvia and Slovenia). Additionally, three countries (Czechia, Lithuania and Hungary) have gravitated institutionally towards three different models. Against this backdrop, Poland and Romania have stood out, and their similarity coefficients exceeded 50 only in relation to the countries representing the Mediterranean model. Importantly, an analogical pattern applied in these two countries both to the input and output variables.

Assessing the changes in the perspective of two decades (2004–2023), it can be observed that the qualities of the patchwork capitalism model emerging in CEE-11 countries have intensified. In 2019 a simultaneous resemblance to all four models was seen in two countries (Estonia and Slovenia), and similarity to three models – in four countries. In 2005 six countries were simultaneously similar to three Western European capitalism models, but none were resembling four of them. In the period of the study, a relative similarity of CEE-11 countries to the Anglo-Saxon model could be also seen. This trend has been observed mostly on the input side of the institutional architecture – in five CEE-11 countries (Czechia, Estonia, Lithuania, Latvia and Slovenia) this model constituted the closest point of reference for their formal institutions.

Table 4. Similarity coefficients of CEE-11 countries to reference countries in 2022

	Germany		Spain/Italy		Sweden		Great Britain	
	input variables	output variables	input variables	output variables	input variables	output variables	input variables	output variables
Bulgaria	52.0		64.1		42.6		49.1	
	50.8	53.2	61.9	66.3	43.0	42.2	52.5	45.6
Croatia	53.4		59.5		40.1		47.2	
	46.9	59.9	51.7	67.2	32.8	47.4	46.9	47.5
Czechia	52.0		54.9		47.6		55.4	
	61.9	42.0	59.8	49.9	49.0	46.3	65.1	45.7
Estonia	65.4		59.4		59.2		63.9	
	68.1	62.7	53.6	65.3	63.1	55.3	72.3	55.4

ables employed in 2022 analysis (due to the article size limitations they have not been elaborated on in the paper) and this fact has not significantly affected the formulated conclusions.

cont. Table 4

	Germany		Spain/Italy		Sweden		Great Britain	
	input variables	output variables	input variables	output variables	input variables	output variables	input variables	output variables
Lithuania	59.6		63.5		49.2		55.0	
	64.3	55.0	59.6	67.3	53.5	44.9	66.4	43.6
Latvia	58.1		59.4		50.5		56.2	
	59.1	57.0	53.1	65.7	52.6	48.5	63.5	48.9
Poland	49.9		64.0		32.4		41.6	
	50.5	49.3	57.1	70.8	23.8	40.9	38.1	45.1
Romania	46.7		59.8		40.1		43.6	
	42.8	50.6	56.6	63.0	37.9	42.2	40.4	46.8
Slovakia	53.3		59.5		42.0		45.6	
	60.1	46.5	63.7	55.4	43.4	40.6	56.2	35.0
Slovenia	63.2		66.5		54.8		60.3	
	68.6	57.7	60.1	72.9	56.7	52.9	69.2	51.3
Hungary	59.0		62.0		49.4		54.2	
	64.5	53.4	64.3	59.6	50.9	47.9	61.2	47.2
Average	**55.7**		**61.1**		**46.2**		**52.0**	
	58.0	**53.4**	**58.3**	**63.9**	**46.1**	**46.3**	**57.4**	**46.6**

Notes: Dark grey colour was used to indicate the highest similarity coefficient in each CEE-11 country; light grey marks a simultaneous resemblance of a given country to other reference countries at the level of over 50; yellow marks the highest similarity coefficients for input and output variables.
Similarity coefficients involve four areas (without the labour market).

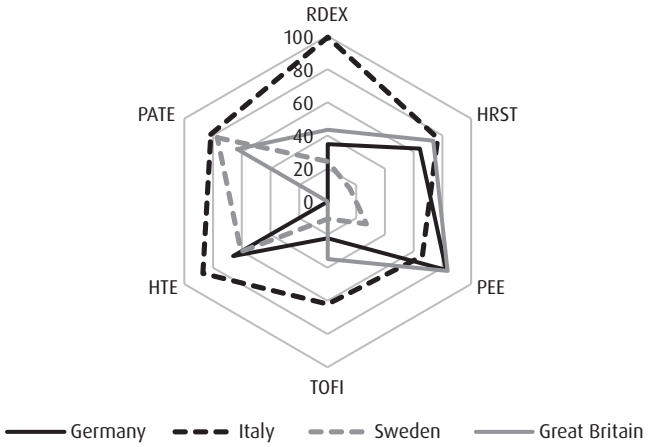
Source: Self-reported data.

While performing an assessment of the institutional architecture of CEE-11 countries in 2022 versus the countries representing other models of capitalism in the EU, we also conducted an in-depth study of similarity coefficients for Poland in four areas. i.e. the knowledge creation system, product market competition, financial brokerage and the social security system. Findings of this analysis are presented below in a graphic form of similarity hexagons (Figures 1–4).

In the area of knowledge creation Poland was definitely institutionally the closest to the Mediterranean model (Figure 1). Similarity coefficients to other reference countries fell significantly below the threshold level of 50. This similarity pattern may be recognised as relatively permanent because it was also identified in this area in 2018. Its relevance to Poland is also confirmed by the fact that both in terms of input and output variables the closest point of reference on the similarity map was Italy. An analogical, mono-centric distribution of similarity coefficients could be also observed in six other CEE-11 countries. In other countries of this group (Czechia, Estonia, Slo-

venia and Hungary) a poly-centric similarity profile to three different reference countries was observable.

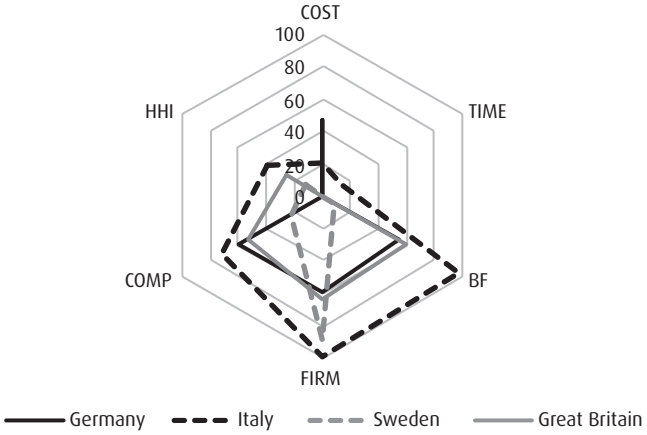
Figure 1. Comparison of Poland to reference countries in the area of knowledge creation in 2022



Notes:
RDEX – expenditure on research and development (% of GDP).
HRST – people employed in the science and technology sector (% of the professionally active population).
PEE – public expenditure on education (% of GDP).
TOFI – turnover of companies in the information and communications sector (thousands of EUR per employee).
HTE – exports of high-tech products (% of goods exports).
PATE – number of patent applications from residents and non-residents (per one million residents).
Source: Self-reported data.

A closer look at the similarity hexagon for Poland in the field of product market competition (Figure 2) leads to two conclusions. First, a definitely mono-centric similarity pattern and the highest institutional resemblance to Spain are apparent. Secondly, the polygon representing Spain is asymmetric and visibly tilted to the right. It signifies the fact that institutional similarity to the Mediterranean model occurred mostly for output variables. For input variables it was not so strong (although stronger than in the case of other reference countries). A similar pattern, i.e. the closest resemblance to the Mediterranean model can be seen also in nine other CEE-11 countries, with only three of them (Czechia, Slovakia and Hungary) demonstrating also the mono-centric pattern. In the remaining seven cases similarity coefficients in the analysed area exceeded 50 in relation to two (Bulgaria and Romania), three (Croatia) or even four reference countries (Estonia, Lithuania, Latvia and Slovenia).

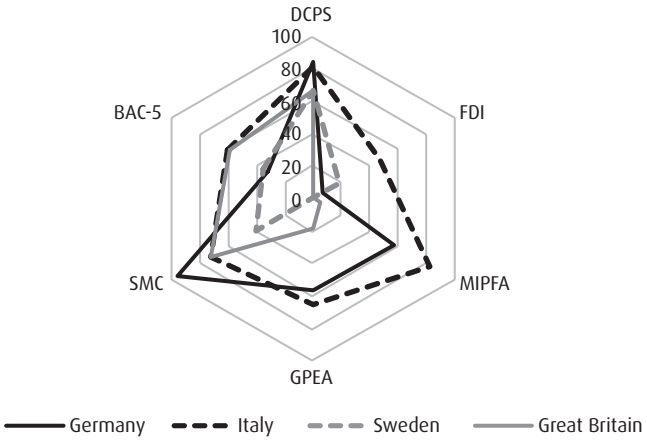
Figure 2. Comparison of Poland to reference countries in the area of product market competition in 2022



Notes:
COST – cost of procedures necessary to start business operations (% of income per capita).
TIME – time needed to start business operations (days).
BF – index of business operations freedom.
FIRM – number of enterprises in industrial production, construction and services (per one million residents).
COMP – index of digital competitiveness.
HHI – Herfindahl-Hirschman Index measuring the concentration of exports on the markets of countries in trade partnerships.

Source: Self-reported data.

Figure 3. Comparison of Poland to reference countries in the area of financial brokerage in 2022



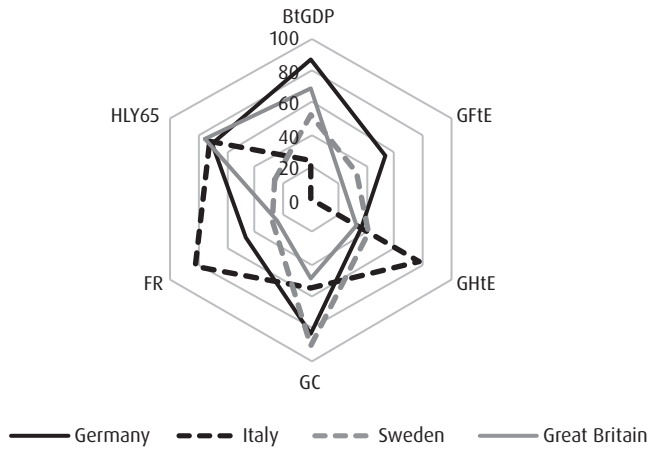
Notes:
DCPS – domestic credit for the private sector (% of GDP).
FDI – foreign direct investment (difference between net inflows and net outflows (% of GDP).
MIPFA – sum of assets of mutual funds, insurance companies and pension funds (% of GDP).
GPEA – gross capital assets (shares and other securities (% of GDP).
SMC – share market capitalisation (% of GDP).
BAC-5 – assets of five biggest banks (% of assets of all banks).

Source: Self-reported data.

The shape of the next similarity hexagon for Poland, describing the area of financial brokerage (Figure 3), proves the existence of a bi-centric similarity model in this area. Institutional architecture of our country in this area was marked on one hand by a relatively high (almost 70) degree of institutional affinity with Spain (the similarity coefficient here was the highest both for input and output variables), but on the other, by quite a visible gravitation towards Germany (similarity coefficient exceeding 55). It is a continuation of the trend of 2019. An analogical bi-centric similarity model was prevalent in almost all CEE-11 countries, with the exception of Croatia and Czechia (similarity to Spain exclusively).

The picture of similarity coefficients distribution obtained for Poland in the considered area should be placed against a wider context, i.e. results of the entire CEE-11 group of countries. It then becomes apparent that the remaining countries of the group were dominated by a poly-centric similarity pattern, characteristic of the patchwork model – in all of these countries corresponding coefficients exceeded 50 for three different reference countries. Interestingly, in as many as seven of them the highest value was recorded in relation to Great Britain.

Figure 4. Comparison of Poland to reference countries in the area of social security in 2022



Notes:
BtGDP – transfers (% of GDP).
GFtE – public expenditure on families (% of public spending).
GHtE – public expenditure on healthcare (% of public spending).
GC – Gini Coefficient.
FR – fertility coefficient.
HLY65 – healthy life expectancy for people at 65 years of age (years).
Source: Self-reported data.

Slightly different conclusions may be drawn from the analysis of the similarity hexagon in the area of social security in Poland in 2022 (Figure 4). First, institutional architecture of our country in this area showed the highest convergence with the Continental capitalism model. A similar picture was obtained also in 2019, although with different relative discrepancies in the value of similarity coefficients to four various capitalism models in the EU. Secondly, the distribution of those coefficients, just like for the area of financial brokerage, was bi-centric, due to the fact that the social security system in Poland demonstrated simultaneously quite significant qualities (coefficient above 50) of institutional convergence with the Mediterranean model. Thirdly, the bi-centric similarity model was even stronger in this case than for the area of financial brokerage, as the separately recorded input and output variables indicated the greatest institutional affinity with different reference countries: for input variables it was Germany, for output variables – Italy.

At the end of this part of analysis based on the use of similarity hexagons it should be stressed that the obtained similarity coefficients' distribution of particular areas in Poland in 2022 (including the changes in the years 2018–2022) cannot be deemed representative for the entire group of CEE-11 countries. It has turned out that in most of them, more than in Poland (both at the level of particular areas and average indicators), a poly-centric similarity pattern of their institutional architecture to several different Western European capitalism models was dominant, with a tendency to further persist after 2005 (see Table 2–4).

Sources of the comparative institutional advantage of the patchwork model and their evolution

In this part of the study we carry out an empirical verification of the hypothesis of patchwork capitalism's "institutional short-sightedness" in CEE-11 countries, by conducting a comparative assessment of selected indicators demonstrating how this model responds to development challenges in the short and medium term and what results it is able to achieve as contrasted against four other Western European capitalism models. The original assumption of our reasoning in this part is the belief that a country's or a capitalism model's comparative institutional advantage should be evaluated through the lens of its capability of delivering on the short, medium and long term targets. Thus, for the purposes of this paper we have adopted the following assessment criteria:

I. Short and medium term criteria:
   1) ability to generate fast economic growth and achieve real convergence (efficiency);

2) ability to combine fast economic growth with economic stability (macroeconomic equilibrium);
3) ability to ensure even income sharing (equitability);
4) resilience to negative, asymmetric exogenous shocks, including agility and pace of adjusting to shocks as well as costs of those adjustments (e.g. sacrifice ratios in the time of the pandemic);

II. Long term criteria:
1) ability to adapt to the changing development conditions, particularly tackling the increasing polycrisis (demographics, immigration, ecology, climate change, etc.); most of all this criterion allows to assess the **"responsiveness"** of a country or capitalism model to the occurring threats (*ex post*);
2) ability to initiate change in the development model, including change in the existing international specialisation model, and to improve competitiveness (among others by boosting innovation capabilities), avoiding a middle-level development trap by shifting from a (semi) periphery to the centre; this criterion helps assess the ability of the institutional system to **"anticipate"** development opportunities (*ex ante*);
3) ability of the system to learn and self-correct (institutional memory).

The assessment of a comparative institutional advantage of patchwork capitalism in the light of the first two short and medium term criteria was performed in the first part of this study. It has found out that countries employing this model have a proclivity to generate the highest in the EU economic growth rate, which in the years 2004–2023 translated into fast progress on the path of real convergence in relation to the EU average and other capitalism models in the EU. Economic growth in the patchwork model was however accompanied by a relatively high scale of macroeconomic disequilibrium. The data we have collected prove that the best total results in the area of growth and equilibrium in the years 2004–2019 were achieved by the countries representing the Nordic capitalism model, where rapid economic growth co-existed with only a slight scale of macroeconomic disequilibrium. A comparatively fast (or even faster than in CEE-11 countries) GDP growth was recorded in that time also in countries with the patchwork and Anglo-Saxon capitalism models, yet their rapid growth was accompanied by a high scale of disequilibrium. The worst performance could be observed in Mediterranean countries, with their economic growth rates falling behind the EU-28 average, and simultaneously three out of four equilibrium variables at below the entire EU average [Próchniak et al., 2022].

Assessment of patchwork capitalism in the light of the two remaining short and medium term criteria is far more ambiguous. Both the ability of this model to ensure even income sharing and its resilience to negative, asymmetric, exogenous shocks

(including its agility, speed of adjustment to shocks and costs of these adjustments) versus the other capitalism models co-existing in the EU can only be rated very moderately [Maszczyk et al., 2023]. In particular it pertains to the macroeconomic response of CEE-11 countries to two recent negative, exogenous shocks, i.e. the COVID-19 pandemic and war in Ukraine (data of 2020–2022). These countries managed to protect their economic growth and employment levels, but they paid a high economic price for it, suffering from the highest inflation and public finance deficit in the entire EU. The best performance in this respect could be seen in Nordic countries which maintained their economic growth in the "double shock" environment and did not experience any macroeconomic disequilibrium. The worst situation, on the other hand, was observed in the countries representing the Mediterranean capitalism model.

The above findings should be, particularly in the long term perspective, analysed jointly with non-economic costs of the pandemic, i.e. a high health sacrifice ratio (the relation between a relative level of excess mortality and changes in the GDP growth rate in the years 2020–2022), which put CEE-11 countries on a disadvantage as compared to the Nordic, Anglo-Saxon and Continental capitalism models [Próchniak et al., 2022]. This ratio, calculated separately for 2020 and the two-year period of 2020–2021, appeared the lowest in Nordic countries. In the entire period of the pandemic the worst performance could be observed in the countries employing the Mediterranean model of capitalism, closely followed by CEE-11 countries. Poland performed worse than the EU-28 average, but better than the patchwork model average.

To conclude this part of the study, it should be stated that, in the light of the above mentioned short and medium term criteria, our general assessment of patchwork capitalism and its ability to generate comparative institutional advantage remains – particularly as compared to the Mediterranean model – moderately positive.

This assessment is much lower when applied to long term criteria. For this purpose we have selected 11 indicators characterising the input and output side of an economy's institutional architecture. Ability to accommodate the changing conditions of development, i.e. the responsiveness of a patchwork capitalism model, has been assessed based on the analysis of the World Bank's synthetic measure of government effectiveness[11] and position of CEE-11 countries in the Global Competitiveness Index (GCI) ordered by the World Economic Forum (Table 7). The ability to initiate development model change was assessed based on four indicators used by the European

[11] The measure of government effectiveness created by the World Bank is a weighted average of seven indices reflecting the opinions of experts, entrepreneurs and households concerning various aspects of functioning of state institutions. Most frequently assessed factors are: the quality of public services and public administration as well as their independence of political influence, the quality of developed and implemented policies and public infrastructure (transport, sanitary, IT).

Commission to prepare the European Innovation Scoreboard (EIS) which shows the share of outlays on research and development (R&D) in GDP, both jointly and split between the public and corporate sector, as well as the share of direct spending and fiscal support in total public sector expenditure (Table 5 and 6). The output side, being the outcomes of actions taken by institutions constituting the patchwork capitalism model, providing premises of change in the existing model of international specialisation and improved competitiveness by increased innovation capability, was assessed using five indicators taken from EIS. These indicators reflect on the following aspects: 1) relative (versus the value of GDP) number of patents submitted to the European Patent Office (EPO), 2) number of new technologies in the field of environment protection in relation to all technologies developed in a given country (Table 8), 3) share of goods carrying cutting-edge technologies in exports, 4) share of goods carrying most advanced and intermediate technologies in exports (Table 9, as well as 5) relation of knowledge-based service exports to total service exports (Table 10). We intended to present these indicators for three selected years in the period of 2005–2023 (2005, 2019 and 2023), but it was not always possible due to an incomplete statistical coverage for 2005. Therefore, in the analysis we used the newest and the oldest available data (most often for 2016) pertaining to particular indicators.

Table 5. Total outlays on R&D in GDP and the share of corporate sector spending on R&D in GDP in selected years of the period 2005–2023

Country	Share of spending on R+D in GDP (%)			Share of corporate spending on R+D in GDP (%)		
	2005	2019	2022	2016	2019	2023
Poland	0.56	1.32	1.46	0.44	0.67	0.91
Bulgaria	0.44	0.83	0.77	0.52	0.52	0.51
Croatia	0.85	1.08	1.43	0.37	0.41	0.58
Czechia	1.16	1.93	1.96	1.08	1.11	1.25
Estonia	0.92	1.62	1.78	0.62	0.60	0.98
Lithuania	0.75	0.99	1.02	0.32	0.33	0.54
Latvia	0.53	0.64	0.75	0.24	0.14	0.23
Romania	0.41	0.48	0.46	0.16	0.29	0.29
Slovakia	0.49	0.82	0.98	0.32	0.48	0.52
Slovenia	1.42	2.04	2.11	1.83	1.39	1.57
Hungary	0.92	1.47	1.39	1.14	1.14	1.24
Models of capitalism						
Patchwork*	0.65	1.17	1.24	0.54	0.65	0.79
Continental*	2.19	2.72	2.73	1.71	1.79	1.83

cont. Table 5

Country	Share of spending on R+D in GDP (%)			Share of corporate spending on R+D in GDP (%)		
	2005	2019	2022	2016	2019	2023
Mediterranean*	1.00	1.36	1.41	0.70	0.74	0.86
Nordic*	3.09	3.12	3.15	2.03	2.10	2.14
Anglo-Saxon*	1.53	2.56	2.63	1.24	1.23	1.22
EU-28*	1.52	2.06	2.11	1.17	1.23	1.31

* Population weighted average.

Source: Self-reported data based on EIS [2024] and Eurostat [2024]; the missing records for Great Britain were complemented with the World Bank data.

As follows from the data set out in Table 5, both the index of total outlays on R&D in GDP in the years 2005–2022 and the analogical indicator for the corporate sector in the period of 2016–2023 put the patchwork model in an unfavourable position against other models of capitalism in the EU. CEE-11 countries, since the beginning of their EU membership, have significantly lagged behind EU-15 countries in terms of their financing of research and development activities, also versus Mediterranean countries (albeit by a slim margin). The trend staying unchanged for almost 20 years indicates a permanent and structural nature of the international specialisation pattern present in patchwork capitalism, characterised by a low innovation propensity and low probability of improving this orientation in the near future.

The situation of Poland in this context does not appear very encouraging – in terms of the level of both assessed indicators it ranked third or fourth among CEE-11 countries, and one of the last among EU-28 economies.

To conclude this part of analysis, it should be noted that despite the persisting disproportions of the level of financing research and development activities in the patchwork model, in comparison with the other models of capitalism in the EU, these outlays kept rising systematically throughout the entire period studied, which shortened somewhat the institutional and development distance between CEE-11 countries and the "old" EU economies at the end of the studied period (particularly in terms of relative levels of outlays on R&D in the corporate sector), although this gap remains still considerable.

A similar pattern was also observed for the relative level of direct public sector spending on R&D and degree of support to the corporate sector offered in this respect by the government in the form of tax relieves in relation to GDP (Table 6). These indicators made CEE-11 countries stand out negatively from the EU "core" states in the entire studied period.

The proportion of GDP earmarked for R&D in the public sector in the first group of countries was almost two times lower that in the Nordic countries, and also lower

than the corresponding indices in other models of capitalism co-existing in the EU. In terms of relative public sector spending on R&D, Poland usually ranked in the middle of CEE-11 countries and in the bottom half of the EU-28 ranking, with a respective GDP proportion in our country exceeding the average for the patchwork model, yet remaining below average among EU-28 economies.

Table 6. The share of direct public sector spending on R&D in GDP and the level of support to the corporate sector in the field of R&D through the tax system in the years 2016–2023

Country	Direct public sector spending on R+D in relation to GDP (%)			Government support to the corporate sector in the sphere of R+D through the tax system (% GDP)		
	2016	2019	2023	2016	2019	2023
Poland	0.51	0.36	0.53	0.04	0.11	0.15
Bulgaria	0.27	0.21	0.26	0.01	0.01	0.01
Croatia	0.40	0.44	0.66	0.26	0.00	0.11
Czechia	0.87	0.65	0.74	0.16	0.11	0.12
Estonia	0.79	0.66	0.75	0.08	0.03	0.06
Lithuania	0.72	0.57	0.56	0.02	0.03	0.04
Latvia	0.45	0.37	0.47	0.00	0.01	0.01
Romania	0.22	0.21	0.18	0.02	0.04	0.02
Slovakia	0.55	0.40	0.41	0.02	0.02	0.06
Slovenia	0.54	0.47	0.55	0.34	0.16	0.19
Hungary	0.35	0.35	0.40	0.32	0.16	0.23
Capitalism models						
Patchwork*	0.47	0.37	0.46	0.09	0.08	0.11
Continental*	0.84	0.83	0.88	0.22	0.22	0.24
Mediterranean*	0.56	0.53	0.60	0.07	0.10	0.14
Nordic*	0.99	0.97	0.96	0.09	0.09	0.11
Anglo-Saxon*	0.53	0.50	0.51	0.19	0.37	0.44
EU-28*	0.66	0.62	0.68	0.15	0.18	0.21

* Population weighted average

Source: Self-reported data based on EIS [2024].

A similar picture was recorded in the analysis of the government's fiscal support to the research and development activity of companies. In the case of this index, the highest average value versus GDP is found in the Anglo-Saxon model, the patchwork model is placed in the last position of the ranking, along with the Nordic model. This seemingly stunning statistical effect is most certainly due to a distinct concept of R&D support by the state in Sweden, Finland and Denmark. However, it should be

interpreted in a wider context of total spending on research and development projects in those countries, which accounts on average for 3.15% of GDP. At the end of the studied period, Poland occupied the third position among CEE-11 countries, which shows a great improvement on the earlier position held in 2016. Yet, in Poland, the question of effectiveness of such support to research and development by the state's fiscal policy should be addressed, particularly in terms of irregularities disclosed in the operations of the National Centre for Research and Development (NCBiR).

Last but not least, it should be pointed out that between 2016 and 2023 the average value of both indicators in CEE-11 almost did not change or grew slightly, which stood in contrast with the upward trend generally observed in the entire EU.

Table 7. Government effectiveness and country position in the Global Competitiveness Index (GCI) in selected years of the period 2005–2023

Country	Government effectiveness*			Country position in Global Competitiveness Index		
	2005	2019	2022	2005	2019	2023
Poland	0.45	0.51	0.26	43	38	43
Bulgaria	0.13	0.17	–0.27	61	48	57
Croatia	0.46	0.46	0.58	64	60	50
Czechia	0.91	0.92	1.09	29	33	18
Estonia	0.94	1.14	1.34	26	35	26
Lithuania	0.76	1.01	0.99	34	29	32
Latvia	0.53	1.07	0.69	39	40	51
Romania	–0.29	–0.22	0.00	67	49	48
Slovakia	0.88	0.55	0.38	36	53	53
Slovenia	0.89	1.04	1.07	30	37	42
Hungary	0.75	0.45	0.53	35	47	46
Capitalism models						
Patchwork**	0.40	0.43	0.37	47	43	43
Continental**	1.62	1.44	1.28	10	22	24
Mediterranean**	0.95	0.68	0.67	35	42	40
Nordic**	2.01	1.80	1.73	5	10	7
Anglo-Saxon**	1.76	1.44	1.26	10	22	27
EU-28**	1.22	1.06	0.96	24	30	31

* Variable between –2.5 (the worst result) and 2.5 (the best result).
** Population weighted average.

Source: Self-reported data based on the World Bank [2024] and the World Economic Forum [2023] data.

Analysis of government effectiveness and economic competitiveness indices in CEE-11 countries (Table 7) gives no reason for optimism. Average value of the government effectiveness index in the patchwork model in the years 2005–2023 was over two times lower than the average for EU-28 and considerably lower than indicators for the other capitalism models in the EU, particularly that of the Nordic model (1:5 ratio). These results seem to empirically confirm the validity of the thesis, often cited in scientific literature, that CEE countries are historically incapable of building a strong and effectively functioning state [Wallerstein, 1974; Szücs, 1983; Sowa, 2011]. In this context, Poland's very poor score is appalling, in terms of the comparative institutional advantage it positioned itself in the third lowest place among EU countries, leaving behind only Bulgaria and Romania.

CEE-11 countries, despite a slight improvement between 2005 and 2023, usually took the last places among member states of EU-28 in the ranking of international competitiveness prepared by the World Economic Forum, visibly losing to the Western European capitalism models of the "old" EU. It was the Nordic countries that came at the top of the ranking in the entire studied period. Table 7 demonstrates another important trend of a gradual fall in the competitive position of the entire EU and the other Western European capitalism models in the global economy.

Table 8. Relation of the submitted patent applications to the GDP value according to PPP and the share of new technologies in environment protection versus all developed technologies in the years 2016–2023

Country	Relation of the submitted patent applications (EPO) to GDP value according to PSN			Share of new technologies in environment protection versus all developed technologies (% of the number)		
	2016	2019	2023	2016	2019	2023
Poland	0.55	0.74	0.48	14.49	14.44	6.46
Bulgaria	0.65	0.59	0.51	18.43	22.02	12.84
Croatia	0.68	0.44	0.57	15.05	9.82	5.03
Czechia	0.96	1.01	0.72	11.61	10.02	12.30
Estonia	0.70	0.98	1.33	23.75	17.61	7.76
Lithuania	0.84	0.42	0.55	12.67	15.54	9.91
Latvia	1.02	0.85	0.73	13.37	10.17	7.66
Romania	0.23	0.26	0.14	15.81	6.37	8.64
Slovakia	0.42	0.55	0.51	17.93	16.43	12.68
Slovenia	2.85	1.78	1.58	8.98	10.56	9.05
Hungary	1.40	1.46	1.09	12.04	10.60	7.70

cont. Table 8

Country	Relation of the submitted patent applications (EPO) to GDP value according to PSN			Share of new technologies in environment protection versus all developed technologies (% of the number)		
	2016	2019	2023	2016	2019	2023
Capitalism models						
Patchwork*	0.68	0.73	0.55	14.63	12.44	8.51
Continental*	5.57	5.33	4.57	14.49	13.24	13.06
Mediterranean*	1.66	1.75	1.61	13.61	11.41	10.04
Nordic*	8.92	8.11	7.72	16.35	15.65	15.42
Anglo-Saxon*	3.14	3.09	2.88	12.87	11.99	11.18
EU-28*	3.39	3.31	2.94	14.11	12.52	11.23

* Population weighted average.

Source: Self-reported data based on EIS [2024].

Assessment of output variables showing the results achieved by patchwork capitalism countries should begin from the comparative analysis of the indices expressing their ability to innovate and potential ability to tackle environmental challenges (Table 8). If a measure of the effects of research and development activity, demonstrating an economy's ability to innovate, is the number of the submitted patents per unit of GDP value (bn EUR), it becomes clear that there was a gulf of difference between the patchwork model and the other models of capitalism in the EU in the years 2016–2023, also the Mediterranean model which did not record a particularly high patent activity and innovativeness at an international scale. Poland looks particularly unfavourable in this ranking, taking the last but one position among CEE-11 countries and leaving behind only Romania.

A similar situation, albeit not so dramatic, is found in the patchwork model's competitive position in terms of the relative number of new technologies employed for environment protection, related to generating, storing and saving energy, crucial to the fourth industrial revolution and to profound changes in climate conditions affecting all countries of the globe. Although the share of such technologies in the entire number of technologies developed in CEE-11 countries in 2016 and 2019 was comparable to analogical indices in other EU countries, in 2023 the situation changed completely – their share fell by about 4 p.p., which pushed the patchwork model down the analysed classification to the last position in the EU. Poland, just like with patent activity, in 2023 ranked last but one in the classification of CEE-11 countries, after 2016 slipping by four positions and overtaking only Croatia.

Table 9. Share of cutting-edge and intermediate technologies in exports in the years 2016–2023

Country	Relation of exports of goods carrying cutting-edge technologies to all exports (%)			Relation of exports of goods carrying cutting-edge and intermediate technologies to all exports (w %)		
	2016	2019	2022	2016	2019	2023
Poland	8.50	8.68	9.14	49.44	48.60	49.93
Bulgaria	5.14	6.32	5.48	30.70	34.33	35.11
Croatia	9.67	8.11	6.85	37.98	39.07	33.67
Czechia	15.05	18.95	19.19	64.08	67.09	67.89
Estonia	15.60	11.08	10.79	40.92	38.24	36.45
Lithuania	7.84	8.21	7.79	34.06	36.40	35.80
Latvia	10.03	9.94	8.70	33.52	35.61	30.19
Romania	8.28	9.12	8.89	52.07	57.18	56.01
Slovakia	9.75	9.08	7.44	66.56	67.82	70.55
Slovenia	5.71	6.50	6.70	56.00	57.30	63.58
Hungary	15.90	16.26	14.77	69.09	65.96	65.50
Capitalism models						
Patchwork*	9.76	10.39	10.18	51.74	52.94	53.39
Continental*	17.67	17.93	15.86	60.55	60.97	59.80
Mediterranean*	6.27	6.69	7.69	46.49	46.06	47.49
Nordic*	10.94	9.91	10.38	50.22	50.31	52.41
Anglo-Saxon*	21.05	21.27	23.42	54.62	53.63	47.09
EU-28*	13.35	13.71	13.51	53.84	54.02	53.23

* Population weighted average

Source: Self-reported data based on EIS [2024] and Eurostat [2024]; missing records for Great Britain were complemented with the data from the World Bank.

Indices reflecting the structure of exports of goods in CEE-11 countries (Table 9) show a brighter picture. It should be highlighted that the share of products being carriers of cutting-edge and intermediate technologies in the exports of goods was high, at over 50% in the years 2016–2023. Such a high share itself may be a premise of CEE-11 countries facing a threat of getting stuck in a middle-level growth trap, which can be proven by these economies specialising in the exports of goods carrying mostly intermediate technologies. The conclusion may, however, be a bit premature, as the relatively high, over 10%, share of exports of goods carrying cutting-edge technologies in the entire exports of CEE-11 countries in the years 2019–2023 seems to imply. In this respect, the patchwork model countries achieved results comparable with the Nordic model and prevailed in competition with the Mediterranean model,

however were defeated while competing with the Anglo-Saxon and Continental models. Unfortunately, Poland, despite a slight improvement in the analysed index in the years 2016–2022, lagged behind CEE-11 leaders (Czechia, Hungary and Estonia), ranking fourth in this group.

Table 10. Share of exports of knowledge-based services in all service exports in the years 2016–2023

Country	Relation of exports of knowledge-based services to all service exports (%)		
	2016	2019	2023
Poland	38.90	41.26	49.10
Bulgaria	37.62	41.02	56.61
Croatia	20.33	20.13	24.35
Czechia	42.67	42.96	54.25
Estonia	45.33	49.91	65.47
Lithuania	18.66	20.13	31.76
Latvia	47.02	51.36	55.56
Romania	44.45	44.21	52.94
Slovakia	35.35	38.37	46.27
Slovenia	34.80	35.44	42.56
Hungary	48.54	51.14	55.53
Capitalism models			
Patchwork*	39.83	41.53	50.09
Continental*	68.98	69.04	74.99
Mediterranean*	43.29	42.68	55.50
Nordic*	76.26	72.91	81.68
Anglo-Saxon*	72.53	81.69	87.87
EU-28*	57.25	58.73	67.23

* Population weighted average.

Source: Self-reported data based on EIS [2024].

Definitely a less favourable situation of CEE-11 countries could be observed in the exports of knowledge-based services in the years 2016–2023 (Table 10). The average level of the index reflecting the share of "knowledge-consuming" services in total service exports of the countries representing the patchwork model kept falling systematically below the analogical proportion in other capitalism models in the EU. Poland's results in this respect were slightly below the average of the entire CEE-11 group, placing it in the seventh position.

To recap, key conclusions from the conducted empirical analysis provide a solid support in favour of the previously postulated hypothesis of patchwork capitalism suffering from "institutional short-sightedness". They also indicate a low ability of the model to adapt to long term challenges and changing development circumstances – particularly to tackling numerous symptoms of the escalating polycrisis (e.g. environmental threats). Simultaneously, patchwork capitalism has appeared, as of yet, incapable of initiating change to the existing development model and the international specialisation pattern, as well as unable to permanently improve its competitiveness (e.g. by boosting innovativeness), thus unable to change its economic and geopolitical status and shift from a (semi) periphery to the centre of the EU.

The obtained findings shed new empirical light on patchwork capitalism's most vital sources of comparative institutional advantage, which – on the output side of its institutional architecture – is demonstrated in the ability to achieve some short and medium term goals, including particularly rapid economic growth and real convergence. These inferences also help address the question why CEE-11 countries cannot handle the above mentioned long term, short term and medium term challenges (e.g. economic and non-economic costs of fighting the pandemic). We believe that it is chiefly due to three structural qualities of this capitalism model: 1) weakness (low effectiveness – see Table 7) of state institutions, 2) the resulting vast room for spontaneous, bottom-up entrepreneurship, and 3) open nature of this socioeconomic order allowing for a dynamic and uncontrolled by governments inflow of foreign capital and transnational corporations.

Summary and recommendations

The above proposed assessment of economic and institutional development trajectories of CEE countries allows us to formulate some recommendations concerning the best course of action to change these trajectories in the future. It is recommended to change the sources of these countries' comparative institutional advantage by abandoning the existing model of economic development and international specialisation towards the circular economy, an environmentally-friendly model based on knowledge, able to produce an agile response to the challenges posed by negative, asymmetric and exogenous shocks in a polycrisis environment. Meeting those goals should make it possible to avoid the middle-level income trap, continue along the path of real income convergence, and as a consequence – help change the existing status of CEE-11 countries and move from a semi-periphery to the EU centre.

This transformation – owing to its very nature – may happen mostly in the medium and long term. In this time-line our priority should be to minimise the infusion of patchwork qualities in the socioeconomic orders existing in Poland and CEE-11 countries by relevant restructuring of formal institutions and their entire architecture. At the same time, a long term strategy of economic development should be created, aimed at changing the pattern of international competitiveness of those economies towards a greater role of innovation and specialisation in manufacturing, with a high share of value added. In order to attain those strategic goals the following actions should be taken:

1) Institutions:
   - revising the existing institutional architecture for coherence and complementarity of the formal institutions it comprises;
   - creating and implementing a restructuring programme of formal institutions, aimed at ensuring growth by boosting the coherence and complementarity of the entire institutional architecture as well as enhancing its framework;
   - developing a mechanism ensuring unconditional enforcement of the existing formal institutions (rules of the game);
   - designing and implementing a system of constitutional checks and balances preventing free interpretations of legal norms by politicians and eliminating "institutional voluntarism";
   - introducing institutional barriers to restrain "premium seeking" and state appropriation by politicians;
   - conducting a complex reform of the healthcare system which will allow to considerably increase the access to healthcare and raise the quality of medical services, at the same time boosting the system's resilience to unpredictable pandemic shocks;
   - implementing institutional solutions to make capital inflows from abroad more "civil" and subject them to assessment in terms of domestic economy's strategic development goals (thus eliminating another weakness of the patchwork capitalism – the "open access order");
   - introducing a scrutiny of entropy inflows from abroad (involving e.g. free imports of toxic waste);
2) Strategy of economic development:
   - creating and implementing a plan of redefining the goals of the economy's development and changing its structure towards a larger share of highly processed goods and services, with high proportion of technological advancements and value added;
   - increasing the pro-developmental role of the government, particularly in the area of R&D;

- limiting the scale of state unreliability, in particular as a provider of public and socially desirable goods (e.g. healthcare or education);
- implementing tax solutions aimed at permanently boosting the saving propensity and raising investment rates, being the premises of accelerated economic growth.

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HOUSING GAP AND THE QUALITY OF LIFE OF HOUSEHOLDS IN CENTRAL AND EASTERN EUROPE

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Abstract

The objective of this research is to evaluate the quality of life in 11 Central and Eastern Europe an (CEE) countries by assessing housing affordability. To achieve this goal, the study presents the findings of a novel method for measuring the housing gap, which represents the proportion of households with incomes that are insufficient to purchase or rent a dwelling that meets their needs but are too high to qualify for public housing support. The analysis was conducted over the period of 2017–2022, focusing on the fundamental aspects of the sociogeographical structure of households in the housing gap. The results were compared with life quality indicators, as well as examined in the context of the housing policies implemented by the CEE governments. Based on these findings, the study formulated recommendations for evolving housing policies to reduce the housing gap and, consequently, to improve the quality of life in the CEE region.

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The concept of quality of life is multidimensional and interdisciplinary, reflecting at the same time the multifaceted existence of individuals and the degree to which their needs are met. The WHO [2012] defines quality of life as "individuals' perceptions of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns." As a result, the quality of life is determined by the degree to which needs are met in various aspects of life, such as family life, health, neighbours and friends, household activities, professional work, financial issues or housing conditions [Campbell, 1976; Kałamucka, 2023]. It should be emphasised that the quality of life also refers to the area in which individuals live – in both the macro and micro spheres. That is why it is so important to provide every household with access to housing adequate to their needs and financial capabilities [Bryx, 2021]. This is especially true in post-socialist countries, where the housing conditions of the population are on average much worse than those in Western Europe [Mandič, 2010], which may significantly affect a lower quality of life in the region of Central and Eastern Europe (CEE).

In this study, we focus on the latter aspect of the quality of life in eleven CEE countries.[1] To this end, we present the results of the application of an innovative method of measuring the housing gap[2] for these countries in the years 2017–2022. We compare the results with the life quality indicators as well as with the analysis of housing policy implemented in recent years by the governments of each CEE country. On the basis of these findings, we formulate recommendations on the direction of evolution

1 Bulgaria, Croatia, Czechia, Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia, Hungary.

2 The housing gap calculations presented in this study were carried out as part of the grant project No. 2021/43/D/HS4/01649 funded by the National Science Centre.

of housing policy in the region, which is to lead to the reduction in the housing gap and, consequently, to the improvement of the quality of life of households in CEE.

Housing gap in the CEE countries

The concept of available housing appears in the physical context, i.e. housing shortage and the financial context, i.e. property prices and rental fees [Bryx, 2021; Marona, Tomasik, 2023]. However, Meen and Whitehead [2020] write that in a capitalist economy, housing can never be generally unaffordable, because then no one would buy it. A loss of demand would lead to the disappearance of the market or, more likely, to a decline in prices. Therefore, the issue of housing availability is a problem resulting not so much from average values as from the scope of distribution, i.e. the analysis of what part of households do not have access to housing with the size appropriate to the number of household members and the price that does not cause an excessive burden on the budget with spendings on loan repayment or rent. In this connection, in the study, we present an analysis of the housing gap in the CEE countries in 2017–2022. According to our general definition, the housing gap is a percentage of households with incomes too low to buy or rent an adequate (i.e. meeting the minimum housing needs) dwelling at a market price, and at the same time too high to obtain a dwelling subsidised by the state.

Housing gap measurement methods

The size of the housing gap defined in this way is a derivative of many factors, including, above all, the demographic structure of households, the amount of their disposable income, housing prices, the amount of rental rates, the costs of maintaining real property, the physical and financial availability of state-subsidised housing as well as the conditions for granting mortgage loans. Therefore, the calculations should be carried out in several stages, based on various statistical databases.

The first stage is the classification of households and the indication of minimum requirements for the usable area of property. For the purposes of this study, we have distinguished eleven types of households, differentiated by the number of adults and the number of children in them. To calculate the minimum size of a dwelling that a household needs, we used the European definition of overcrowding of a dwelling.[3]

[3] A detailed description of the calculation of minimum housing needs can be found on the Eurostat website [2021].

The second stage is to determine the minimum level of disposable income, enabling the purchase on credit or rental at the market price of a residential property of a minimum size satisfying the needs of the household. To determine the average level of housing prices in the CEE countries in 2017–2022, we used data provided by the European Central Bank (ECB), the European Commission, consulting firm Deloitte and the central banks and statistical offices of each country.[4] Due to the need to harmonise price levels over time, we assumed that they changed in line with the house price index (HPI) provided by Eurostat. Then, using the method developed by Czerniak, Czaplicki, Mokrogulski and Niedziółka [2022], based on the average prices and minimum housing needs, we calculated the minimum disposable income that a household of a certain type must have in order to take out a mortgage loan in a given year to buy an apartment of a specific size and average price. We also used macroprudential policy criteria from the ECB, the International Monetary Fund and national financial supervisors, as well as data on average rates on new mortgages denominated in local currency from the ECB and national central banks.

In order to estimate the cost of using commercial rental flats according to the number of rooms in each of the CEE countries, we used the European Survey on Household Budgets and Living Conditions (EU-SILC). Assuming that a household should not spend more than 40% of its disposable income on the property maintenance (otherwise we consider it a household overburdened with housing costs), we have established the minimum amounts of income needed to rent a flat with a proper number of rooms in a given country.

In the third stage, we compared the indicators previously calculated at the national level with microdata (i.e. on individual households) from the representative EU-SILC survey – we divided the household population in each of the CEE countries into seven groups as described in Table 1.

As part of the above classification, the housing gap includes households from groups B, C and D, i.e. those that cannot afford to buy or rent a flat which meets the minimum housing needs of the household and cannot not receive aid from the state, family or employers (group C) or receive insufficient physical or financial aid (group D), as well as those who have an average income that in theory allows them to buy an flat to suit their needs, but for various reasons live in properties that are too small or with too high operating costs (group B).

[4] A detailed description of the sources of housing prices and the methods of their aggregation and extrapolation can be found in publication by Czerniak and Kroszka [2024].

Table 1. Characteristics of individual groups of households

	They use overcrowded premises and/or the costs of maintaining the property exceed 40% of the income	They have adequate income to meet their housing needs on the commercial market (purchase or rent)	They use a flat with a rent lower than the market rate
A	NO		NO
B	**YES**	**YES**	**NO**
C	**YES**	**NO**	**NO**
D	**YES**	**NO**	**YES**
E	NO	NO	YES
F		YES	YES
G	Others, including missing data		

Notes: Groups included in the housing gap are marked in bold, and categories whose values were not relevant as to assigning households to a specific category are marked grey.

Source: Self-reported data.

Size of the housing gap in the CEE countries in 2017–2022

The size of housing gap in CEE varies strongly (Table 2). The smallest housing gap is in Slovenia (13%) and Estonia (17%), the smallest and richest countries in the region. Both these factors are crucial to understanding the small value of the housing gap. Firstly, not numerous population automatically reduces the absolute scale of income inequality, and thus also the financial availability of housing. Smaller real property markets are characterised by a greater degree of homogeneity, i.e. less variation in prices on a national scale and less diversity of access to mortgage loans. Secondly, the average price level in small countries is more closely linked to the average price level in neighbouring countries, especially if there can be free movement of goods and people between countries and they belong to the same currency area. This is the case of both Slovenia, which benefits from the proximity of Italian regions with relatively low levels of real property prices, and Estonia, which is adjacent to Latvia, which is cheapest among the Baltic countries. Thirdly, a high level of per capita income, combined with access to relatively cheap euro-denominated mortgages, increases chances of households to buy a dwelling to suit their needs.

The largest countries in the region have the highest housing gaps – Poland (35%), Romania and Bulgaria (36% each), which are also among the poorest in the EU in terms of nominal income per capita. The only exception to this rule is Latvia, where the housing gap in 2022 was as high as 37%. It was due to the overlap of several factors – large socioeconomic inequalities between Riga and other regions of the country (reflected in the high share of households belonging to category B), location between

richer countries with higher housing prices on average, as well as a rapid decline in the number of inhabitants [Chmielewski, 2023].[5]

Table 2. Housing gap by CEE country in 2022 (%)

Specification	A	B	C	D	E	F	G	Housing gap (B + C + D)
Slovenia	71	7	4	2	3	13	0	13
Estonia	69	8	6	3	5	9	0	17
Czechia	73	8	11	1	3	4	0	20
Hungary	75	5	13	2	2	3	0	20
Lithuania	71	13	7	1	2	6	0	21
Slovakia	72	11	15	1	0	1	0	27
Croatia	65	14	13	1	2	5	0	29
Poland	56	5	24	6	3	3	3	35
Romania	62	10	24	2	1	1	0	36
Bulgaria	53	31	4	1	0	11	0	36
Latvia	54	22	11	3	2	6	2	37

Source: Self-reported data.

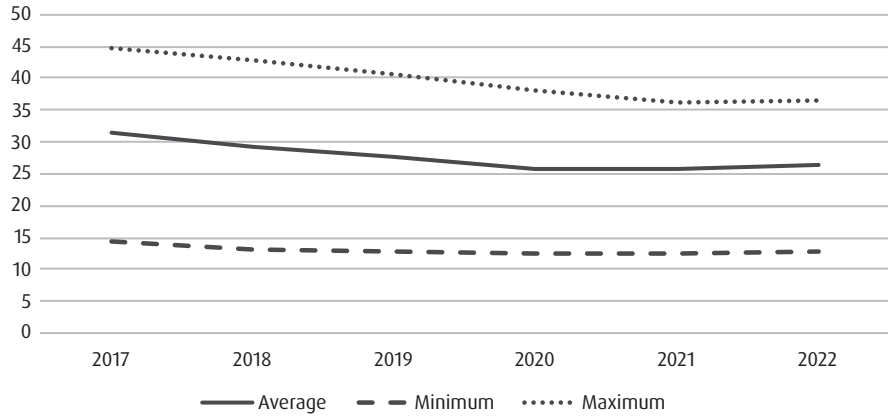
And the highest percentage of households classified as group B in the entire region (31%) in 2022 was in Bulgaria, which was due to the high socioeconomic stratification of this country, including even the capital agglomeration itself [Balgaranov, 2021]. Importantly, the vast majority of households in this group were overburdened with the costs of use, and at the same time – at least in theory – had incomes allowing them to buy a residential property. These were mainly single-person households, elderly people living in houses located in rural areas. Theoretically, these people could purchase residential real property to fit their needs and financial capabilities, but this type of real property was unavailable in the regions where they lived, and the culturally based attachment to the property used prevented them from moving away.

The presented study indicates that the housing gap is characterised by a relatively low variability over time (Figure 1). In the CEE region, it remained stable during the 2020–2022 real property boom at an average of 26–27%, and showed a slight downward trend in 2017–2019. The data on individual groups of households were slightly more variable. During the period of monetary and credit policy easing in 2020–2021, in most CEE countries, there was a decrease in the percentage of households living

[5] At the end of 2022, the population was 1883 million inhabitants, while at the end of 2019 it was 1997 million people [Eurostat, 2024].

in overcrowded or excessively expensive properties, which could not afford to buy a flat fit for their needs (group C), and an increase in the share of those who could afford such a flat, but for various reasons decided to stay in a property inadequate to their needs (group B). In 2022, with the tightening of monetary policy, the situation was reversed and the population of households in group C increased significantly at the expense of the size of group B.

Figure 1. Average, minimum and maximum housing gap in the CEE countries in 2017–2022 (%)



Source: Self-reported data.

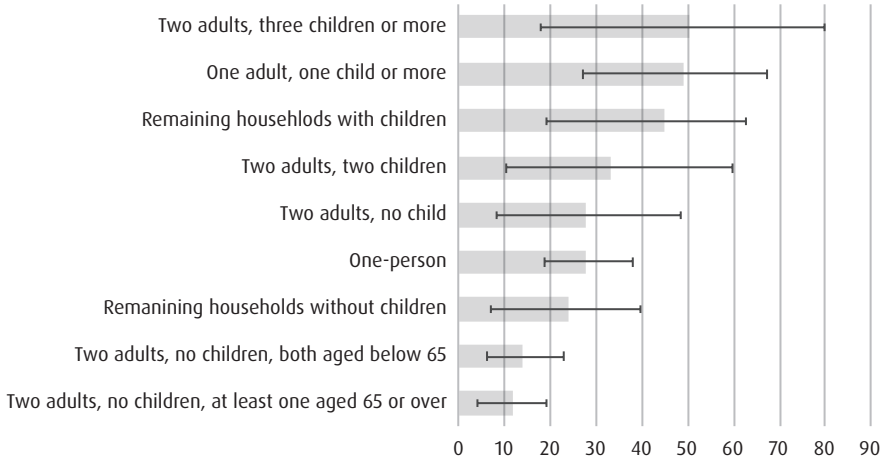
The study also includes the analysis of housing gap in each CEE country broken down into the basic socioeconomic characteristics of households. In terms of the household composition, the distribution of the housing gap was very similar in all countries analysed (Figure 2). The highest housing gap characterised households with two parents and at least three children (the average gap in 2022 was 50%), as well as households of single parents (49%). The values of the housing gap for single-person households and the smallest nuclear units, i.e. consisting of two adults and one child (28% each) were close to the national average in each country. On the other hand, two-person households without children (13%) were in the best housing situation.[6]

In all countries of the region, there were similar patterns of differentiation of the housing gap by the level of household income. The highest rates were recorded in 2022 for households in the 1st quintile of the income distribution (45% on average). This indicates that virtually all CEE countries failed to provide adequate social housing for households at risk of economic exclusion due to economic reasons. Much more

6 The results confirm the conclusions of previous research conducted for Poland [Bryx, Łobejko, Rudzka, 2021].

surprising are the results for the other four quintiles, where the average housing gap is virtually identical (23–20–23–23%). This signals that basing the parameters of public aid solely on the absolute (and not relative to the number of household members) income criteria may cause ineffectiveness of the housing policy.

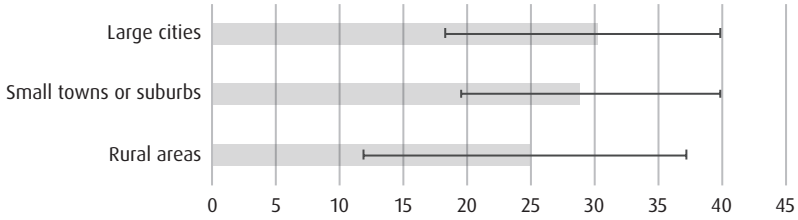
Figure 2. Housing gap in the CEE countries in 2022 by household type (average, min-max, %)



Source: Self-reported data.

In 2022, the highest housing gap (Figure 3) was recorded in the group of households using properties located in large cities (30% on average), and the lowest in the case of those located in rural areas (25% on average). It was due to a much greater availability of land for development and much lower demographic pressure in rural areas, especially in less attractive regions of the country, such as the eastern part of Slovenia, the mountainous areas of Romania or the area of the Baltic states bordering Belarus and Russia.

Figure 3. Housing gap in the CEE countries in 2022 by degree of urbanisation (average, min-max, %)



Source: Self-reported data.

Impact of housing availability on the quality of life of households

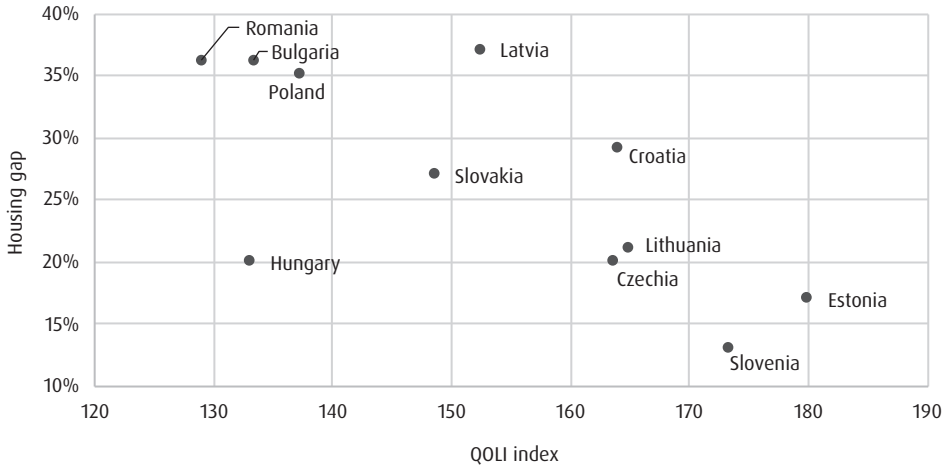
Studies on the quality of life belong to the most common studies in the field of social sciences, and thus – they are characterised by a multitude of definitions and methodological approaches. In general, however, it can be assumed that the quality of life is inextricably linked to the satisfaction of life needs. In the literature defining the concept of quality of life, two opposing approaches can be encountered, i.e. the Scandinavian approach, focusing on objective living conditions and the American, focusing on the subjective well-being of individuals [Illić, 2010]. Rabenda-Bajkowska [1979] distinguishes between objective and subjective perception of the quality of life – the former refers to external (objective) conditions of life, important from the perspective of human needs, while the latter is related to subjective states corresponding to the belief in the degree of satisfaction of these needs. The quality of life is most often treated as a dependent variable, determined by social, economic, environmental, psychological, cultural, demographic and legal and political factors. Since there are differences between subjective and objective assessments of quality of life, standardised measures of quality of life are necessary.

In comparative international studies, one of the popular measures of quality of life is the quality of life index (QOLI) [Numbeo, 2024a], which is based on a methodology combining subjective and objective quality of life and covers areas such as security, family, migration, working conditions and GDP per capita, poverty and unemployment. This index, among the eight factors analysed, deals with the ratio of the price of real property in relation to income and the cost of living ratio. The top five of the ranking in 2024 includes respectively: Luxembourg, the Netherlands, Iceland, Denmark and Finland, and among the CEE countries analysed in 2024, the highest rated were: Estonia (10th place in the world ranking out of 85 analysed countries), Slovenia (16th) and Lithuania (19th), and the lowest Poland, Bulgaria, Hungary and Romania, occupying places from 42nd to 45th respectively. These data indicate the existence of a relatively high correlation between the quality of life and the size of the housing gap (Figure 4).

The existence of a cause-and-effect relationship between the quality of life and the housing gap is supported by empirical research [Dewilde, 2022; Girardi, Rubbo, Broday, Arnold, Picinin, 2024]. It shows that the main determinant of the quality of life of households is the income situation that creates the framework for the level and structure of expenditure [Chmielewska, Zegar, 2018]. The authors emphasise that the assessment of the quality of life accounts primarily for the issues related to food, housing conditions, housing equipment, access to modern communication technologies, children's education, participation in culture, leisure as well as the position on the

labour market and the use of social assistance, services or the health care system. The study of life quality indicators should not forget also about such issues as air quality, safety indicators and multifaceted climate change. The level of guarantee of environmentally sound and safe living conditions is an important value for which many flat buyers would be able to pay extra [Zhou, Song, Tan, 2021].

Figure 4. Life Quality Index and the size of the housing gap in the CEE countries



Source: Self-reported data based on own calculations and data from the Numbeo platform [2024b].

As a result, poor accommodation and its modest furnishing reduce the quality of life. Conversely, good housing that meets the criteria of its users is usually a source of satisfaction and a positive assessment of the quality of life. It is worth noting that the very question about the well-being of household members can give a misleading idea of the quality of life. In countries with a high share of owner-occupied flats, such as those in CEE [Mandič, 2010], the majority of respondents declare that they like their place of residence and that it has a positive impact on their well-being. However, this satisfaction results from the fact that the respondents live in places that they have chosen themselves. As a result, dwellings – regardless of their actual quality – become simulacras [Baudrillard, 2014]. From a psychological point of view, questioning one's own life decisions and their long-term consequences, manifested in criticism of the property owned, would be an unnatural action [Holska, 2016].

For this reason, the study of the relation between the housing gap and the quality of life should also take into account objective measures of the quality of life associated with housing (Table 3). Firstly, the CEE countries with the highest housing gap (Latvia, Romania, Bulgaria, Poland, Croatia, Slovakia) also have the highest rates of

housing overcrowding. At the same time, the lower the housing gap, the higher the ratio of oversized dwellings to the number of household members. Secondly, in Slovenia, Czechia, Estonia and Hungary, which have the lowest housing gap ratio, the percentage of households having problems with covering the costs of heating flats or houses is the lowest among the CEE countries surveyed. The exceptions are two countries with a high housing gap – Poland and Latvia, where only 4.9% and 6.6% of households, respectively, have problems with providing adequate heating of occupied properties. Thirdly, countries with the lowest housing gap also have the lowest proportion of population without a bath, shower or toilet in their homes. Slovenia, Estonia, Czechia, Lithuania and Poland have the lowest number of households in arrears with mortgage, rent or utility payments. Attention should also be paid to the correlation between the quality of life and the housing gap, as it translates into the quality of life both directly (energy bills) and due to technical and health conditions (emissivity of the building).

Table 3. Housing gap and measures of living conditions in the CEE countries in 2023 (%)

	Housing overcrowding rate	Percentage of households that cannot afford to heat their homes	Percentage of population without a bath, shower or toilet in their homes**	Percentage of population in payment arrears***	Housing gap*
Slovenia	10.3	3.6	0.1	7.3	13
Estonia	17.0	4.1	2.9	5.8	17
Czechia	15.9	6.1	0.1	2.9	20
Hungary	17.0*	4.7	1.5	10.3*	20
Lithuania	24.6*	17.5*	6.4	6.0*	21
Slovakia	30.5	8.1	0.7	8.8	27
Croatia	32.7	7.0*	0.7	15.7*	29
Poland	35.8	4.9*	1.3	6.0*	35
Romania	40.5*	15.2*	21.2	18.4*	36
Bulgaria	34.9	20.7	7.0	18.8	36
Latvia	40.9	6.6	7.0	7.9	37

* Data for 2022.
** Data for 2020.
*** Repayment of loan, rent or utility bills.

Source: Self-reported data based on own calculations and data published on the Bellona website [2024].

Characteristics of the tools used in the housing policy in CEE and EU to reduce the housing gap

Challenges related to the low availability of housing are priorities of the housing policy in CEE countries. However, there is no one common way of conducting it. According to the "patchwork" model of capitalism dominant in the region [Rapacki, Czerniak, 2020], each country develops an individual set of solutions. From the administrative point of view, the most commonly used tool is to assign housing to a specific ministry, usually dealing with infrastructure development. Only in Czechia have cross-ministerial teams been established, consisting of representatives of various ministries involved in the coordination of individual housing policy activities, combining infrastructure programmes with social and environmental programmes.

Table 4. Selected policies supporting financial availability of housing in the CEE countries in 2021

	Subsidy or loan guarantee	Credit reliefs or moratoria	Tax reliefs	Housing allowances	Subsidies for housing construction*
Slovenia	–	–	+	+	+
Estonia	+	–	+	+	–
Czechia	+	+	+	+	+
Hungary	+	+	+	+	–
Lithuania	+	+	+	+	–
Slovakia	+	+	+	+	+
Croatia	+	–	+	+	+
Poland	+	+	+	+	+
Romania	+	–	–	–	–
Bulgaria	+	–	– **	+	–
Latvia	+	–	+	+	–

* Applies to affordable housing other than social and municipal housing.
** In 2022, new tax instruments were introduced – tax reliefs for buyers of first flats and property tax reliefs for flat owners.

Source: Self-reported data based on OECD.

The comparison presented in Table 4 shows that in most CEE countries, housing policy consists in facilitating the purchase of a flat by subsidising housing loans in order to reduce their effective interest rates. The second most popular are housing allowances for low-income households, usually set and financed at the local level, as well as tax reliefs, intended especially for individual housing. Subsidies for housing construction other than municipal and social housing are used less frequently (only in

5 out of 11 analysed countries), as well as support for households overburdened with housing loan installments through a system of reliefs or moratoria (the so-called credit holidays). However, there are no strong correlations between the amount of housing gap and the housing policy tools used. Slightly fewer tools are available in Bulgaria and Romania, which, however, may be due to the relatively least developed housing loan market in both cases and the lower degree of commodification of residential property than in other countries in the region [Czerniak, 2024].

The last few years have brought intensified activities in the field of housing policy aimed at improving the availability of housing in the CEE countries, although this does not mean a particular focus on measures taken for households in the housing gap. However, it is worth following this evolution on the example of a few selected countries, ranked according to the size of housing gap.

Slovenia

In Slovenia, which has the lowest housing gap among the countries in the region, the housing policy pursued under the National Housing Programme for 2015–2025 does not provide for taking special measures for people in the housing gap. It is aimed at the development of construction for renting, especially in response to the needs of young people [UN, 2015]. It was not until 2024 that this programme was expanded to include some support for the construction of affordable flats for renting. The financing of the programme is provided by the National Public Housing Fund [Housing 2030, 2024], which both conducts its own investments and offers loans to municipalities and local and regional public funds investing in housing construction. Part of the funds also comes from the National Recovery Plan [Republic of Slovenia, 2023].

Czechia

Czechia has one of the most multidimensional instruments for meeting the housing needs of its citizens, including housing loan subsidies and tax reliefs on the demand side as well as a comprehensive set of programmes supporting the construction and renovation of the housing stock on the supply side. Despite its complexity, the system is not a sufficient answer to the problems of households in the housing gap. The main form of support is tax incentives giving rise to the deduction of mortgage interest from the income tax base.

In 2020, there was another significant change in the Czech housing policy – the tax on the purchase of real estate, which had previously amounted to 4% of the property value, was abolished. As a result, a new incentive to buy houses was created.

However, the programme does not meet the needs of people in the housing gap, and even – as the OECD report [2021] points out – may be counterproductive, increasing demand for housing among higher-income households that could afford it even without additional support. Tax reliefs cannot be used by low-income households that do not enjoy adequate creditworthiness, let alone savings that would allow them to buy real property for cash.

In an effort to support the private rental market, the Rental Housing Development Programme was launched. It consists in granting loans to support the construction or renovation of rental flats for groups of people who may have difficulties entering the housing market (e.g. seniors, youth, people with disabilities). Municipalities, businesses and individuals were also previously able to receive loans of this type, but there was little interest in them: two applications were submitted in 2019 and one in 2020.

There are also two forms of housing allowances in Czechia. Some are available to tenants and private owners of flats who use them for their own needs (*príspevek na bydlení*). If the documented costs of the flat exceed 30% of the household's disposable income (35% in Prague), the household is entitled to receive a cash transfer, the value of which is calculated on the basis of current rents, energy prices and service charges. The second type of allowance (*doplatek na bydlení*) is granted to households with the lowest incomes, regardless of the cost of housing [OECD, 2021].

Lithuania

In Lithuania, the housing gap is mainly made up of households aged 20–29, which have the greatest difficulty in meeting their housing needs due to insufficient housing supply and a shallow rental market. In response to this problem, two programmes have been set up to support young families in buying their first home [OECD, 2023a]. Both programmes are aimed at households supported by people under the age of 36.

The first one (*parama bustui isigyti*) focuses on support in obtaining a mortgage. The amount of the subsidy is determined in relation to the value of the loan and the size and type of household (larger households may receive a higher subsidy, ranging from 15% to 30% of the housing loan amount).

The second programme was introduced in 2018 by the Act on Financial Incentives for Young Families to Acquire Their First Home (*finansine paskata pirmaji busta isigyjancioms jaunoms seimoms*). It aims to help young families buy their first home outside the main cities (eligible regions are determined by the maximum average price) and thus contribute to improving territorial cohesion. Therefore, the introduction of income criteria and the requirement that the purchased house must be used as the main residence have been abandoned. Eligible households receive a subsidy,

which can be used to cover part of the mortgage repayment or own contribution. The amount of the subsidy depends on the size of the household and ranges from 15% of the total loan value for families without children to 30% for households with three or more children [OECD, 2023a].

Poland

In Poland, the existing programmes supporting households in purchasing flats have had a strong pro-demand impact and a limited impact on solving the housing problems of people in the housing gap. The so-called housing package adopted in 2020 was aimed at increasing the supply of available housing. In addition to grant support for the social development and municipal housing construction industry, rent subsidies for flat tenants were also introduced. In addition to pro-supply measures, a family housing loan was introduced in 2021, and since 1 July 2023 a new instrument has been in effect to directly support households in the purchase of flats ("Safe 2% Loan").

The "Safe 2% Loan" supported people up to 45 years of age in the purchase of a residential property on the primary or secondary market as well as in the construction of a single-family house. No income restrictions have been introduced in terms of the area or price of 1 m2 of the purchased property, but only limits on the amount of support and own contribution. The announcement of the launch of the "Safe 2% Loan" resulted in a sudden increase in market demand, which, with reduced supply, resulted in an increase in housing prices in the largest cities [Szelągowska, 2023].

The successor to the "Safe 2% Loan", the "Housing Loan #naStart" is to[7] ensure better adjustment of state housing aid to the needs of the population [Government Legislation Centre, 2024]. In addition to clarifying the rules for granting loans for the purchase of real property (including income limits, metric area limits, higher amounts of subsidies for larger households); it is also planned to introduce a consumer loan to finance participation in social rental housing and housing contributions to housing cooperatives. The new instrument is still primarily aimed at supporting the purchase of a flat, but the possibility of crediting cash deposits enabling the use of affordable housing is a novelty and at the same time an opportunity to actually support households in the housing gap.

7 At the time the material was going to press, the government was still working on the preparation of this programme.

Latvia

The solution developed in Latvia with the use of funds from the National Recovery Plan is noteworthy. In 2022, Latvia established the Housing Affordability Fund to finance preferential, long-term loans for developers building affordable flats for rent. The programme sets out in advance the maximum rent amounts for each of the flats offered and the conditions for applying for rent [OECD, 2023b]. Earlier, in 2020, the housing loan guarantee programme was extended to include greater support for large families and people entering the labour market. What is more, large families can apply for a loan again after the next family extension. A support programme for renovations for owners of many flats was also introduced – in mid-2021, each flat owner can apply for a loan to cover the costs of construction and improvement of multi-family buildings and their immediate surroundings, including improving the efficiency of single-family houses.

European Union

In the context of the housing gap and the related quality of life of households in the CEE region the solutions implemented at the transnational level are also very important. In our opinion, what is most important in this case is the guidelines introduced under the directive, according to which by 2050 all residential buildings are to reduce their CO^2 emissions to 0 kWh of primary energy per 1 square meter per year [Forum Energii, 2020]. This type of policy will have a twofold impact on the housing gap and the quality of life. Firstly, the need to provide access to more energy-efficient buildings will affect construction costs, which will mean a potential increase in housing prices and thus reduce their financial availability. Secondly, the reduction of primary energy consumption will translate into lower operating costs, which may contribute to the reduction of the housing gap related to the excessive burden of households on the costs of using housing. Due to the reduction in the energy intensity of buildings, the average amount of utility bills paid by households in the EU should be reduced by up to 50% [ECF, 2022].

According to research conducted in the CEE countries [Kurmayer, 2023], Romania (56%), Bulgaria (56%), and Hungary (51%) will benefit the most from thermal modernisation. For comparison, Poland will gain 39% in terms of energy during renovation activities, which is due to the relatively low share of single-family houses and a relatively energy-efficient housing resources, which is associated with a lower percentage of housing built before 2000 than in other countries.

Summary and recommendations

The housing policies of the CEE countries, although largely eclectic, are in most cases aimed at supporting buyers of flats and preferential taxation of the construction of single-family houses. As a result, they support households in getting out of the housing gap only to a small extent.

Even in those countries where there are special support programmes to meet the housing needs of people with lower incomes, large families or young households, their effectiveness is very limited, and sometimes – as in Poland or Czechia – they are counterproductive. It is the result of the preference given in housing policy to the purchase of own flat as an optimal, long-term solution to the housing problem of a household, which translates into an increase in real property prices and, consequently, a further reduction in the availability of housing for people who, for various reasons, are not eligible for the government support. What is more, due to the use of commercial bank financing to increase the efficiency of public spending, households which do not have creditworthiness are excluded from aid programmes, e.g. due to precarious forms of employment, bad credit history, economic emigration or lack of savings.

On the basis of analysis, we did not observe a relationship between the housing policy tools used and the size of the housing gap and, more broadly, the quality of life in the CEE countries. The housing situation of the population in the region is much more dependent on historical events, including the housing resources inherited from socialism, population structure and demographic trends as well as the wealth of the society, the level of GDP and the development of the financial sector. It means that the housing policy is characterised by a low scale of interference in the housing sector, which may be the result of the dominant paradigm of housing policy, according to which free-market mechanisms are able to meet the housing needs of the population to the fullest extent.

However, going to the level of analysis of individual solutions used in the field of housing policy, we are able to indicate several positive actions that, in our opinion, should be developed in all countries of the region. Firstly, it is worth using EU funds for preferential and long-term lending of affordable construction for renting, including social rental housing. Secondly, the use of international financing for subsidies and loan subsidies for residential renovations should be increased, with a particular focus on single-family houses aimed at improving energy efficiency. Thirdly, the housing allowance system should be developed to reduce the burden on household budgets of the costs of using real property, especially in relations to the groups particularly at risk of falling into the housing gap. Fourthly, the loan subsidy programmes should be limited only to energy-efficient individual housing and those households which, for

financial reasons, are not able to purchase a suitable flat without state aid, and due to their size or other characteristics (e.g. age, people with disabilities), the commercial rental offer is not tailored to their needs. Without such a restriction, support programmes generate excessive pressure on price increases, which at least partially offsets the benefits of subsidies.

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IMPACT OF TAX REFORMS ON THE LOCAL GOVERNMENT REVENUES IN CENTRAL AND EASTERN EUROPEAN COUNTRIES IN THE CONTEXT OF THEIR EFFECT ON SOCIOECONOMIC DEVELOPMENT IN THE REGION

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Abstract

The study presents a quantitative and qualitative comparative analysis of local government tax revenues in selected countries of Central and Eastern Europe (CEE) in the years 2015–2022. It examines their structure, amounts and nature of trends observed in the indicated period, with particular emphasis on regional similarities and differences between selected countries. The analysis results in the formulation of recommendations on the principles of shaping the catalogue of sources of own revenues of local government units (LGUs) in the context of ensuring the stability of revenues and their appropriate level, allowing the administrators to support the socioeconomic development of regions and local communities. The analyses were expanded in relation to Poland and Estonia with individual data on a micro scale, which allowed to extend the study to the issue of the degree of differentiation between municipalities, accounting for their geographical location or type. The study describes the results of statistical analyses conducted at the level of both countries and individual local government units. The proposed measures managed to capture similarities in the tax policy and financial situation of local government units as well as the dynamics of changes in recent years.

In conclusion, recommendations were formulated with regard to zoning in real estate tax, its unification (regardless of the type of real estate), implementation of the concept of the municipal PIT, a wider use of lump-sum taxes, change in the rules of calculation of the share of local government units in state taxes and increase in the competences of local government units in the area of local government taxes.

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One of the roles of local government is shaping socioeconomic development at the regional and local levels. From the perspective of everyday life and welfare of the citizens it is significant that the volume of resources redistributed and allocated by local government units is growing. According to the doctrine, local government units should be financed mainly from their own tax revenues, treated as an important instrument of fiscal decentralisation [Poniatowicz, Dziemianowicz, 2016]. The system of local government finance should be designed in a way which provides sufficient funds for performing all the tasks of the municipality unit. However, stable financing must also be ensured for general, nation-wide tasks, performed by the central sector institutions [Malinowska-Misiąg, Misiąg, 2021].

There are different political and legal systems applied in the countries of the European Union (EU). Also, the degree of fiscal independence of local government units is diversified, and local units are also internally diverse. European states have different rates of fiscal decentralisation, and various regulations determining individual tax systems.

This study provides qualitative and quantitative comparative analysis of tax revenues of municipalities in selected countries of Central and Eastern Europe (CEE) in the years 2015–2022. We present both its legal dimension (reforms and changes in taxes received by government budgets) and financial aspect (revenue potential as a factor determining the possibility of financing public tasks, directly affecting the welfare and life quality of citizens). The aim of the study is to:

1) evaluate systemic changes in municipal tax revenues in the 2015–2022 period in the Visegrad Group states and Baltic states;
2) establish the impact of these changes on the finance of local governments;
3) identify possibilities and formulate recommendations about local government units' own revenue sources in the context of their support for socioeconomic development.

Conclusions from the research is based on data from international institutions (Eurostat, European Commission, OECD) and national institutions (mostly statistical offices and ministries of finance). The proposed indicators allow not only to quantify socioeconomic determinants, but also to make a comparative analysis between states and establish the pace of changes in individual countries. An exploratory analysis of research material, broadened by statistical similarity measures and statistical data, required multidimensional aggregation at the local level, made in the time and space dimension, taking into account individual types of municipalities. Results of the analyses are presented in tables and figures, including maps that are useful for drawing conclusions thanks to municipality geolocation and division of local units into quartile groups.

An added value in the context of the current state of knowledge is primarily the analysis of two selected countries (Poland and Estonia) broadened by micro-scale (unitary) data. Thus, the rate of differentiation between municipalities can be analysed, as well as the direction and pace of changes, taking into account their type and geographical location. A statistical analysis of distribution of measures allocated for each municipality better reflects their general fiscal and financial situation, and makes it possible to grab the dynamics of changes that could be incorrectly quantified in the entire-country scale due to deviating values.

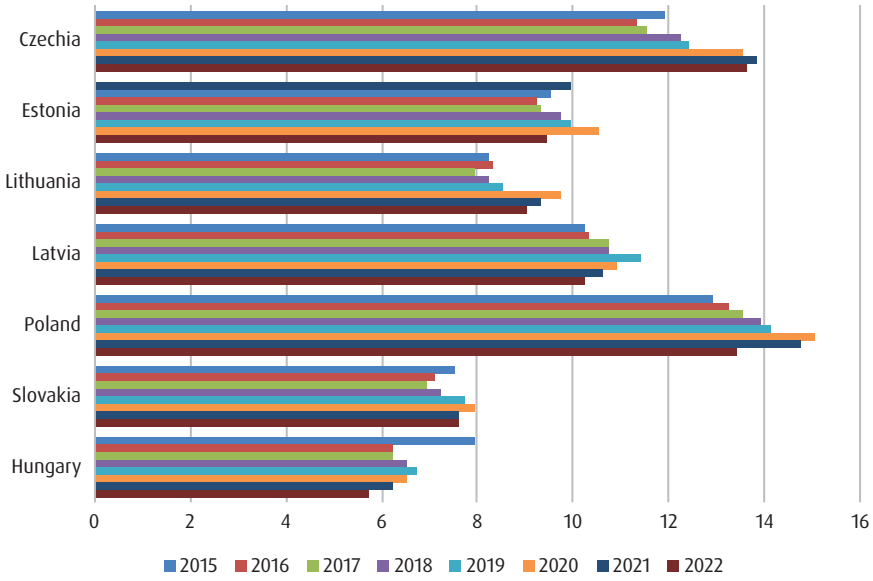
Local government in CEE countries

CEE countries have different rates of fiscal decentralisation. The most decentralised countries in terms of local sub-sector revenues in relation to GDP are Poland and Czechia, where the rate in 2015–2022 was on average 13.9% and 12.5%, respectively (Figure 1). This rate has been changing in time depending on the economic situation, affecting the size of both local revenues and GDP, as well as on other factors that influence financing sources of local governments. Some of them last for a short time, such as increased transfers from the central sector during the pandemic, others modify relations between various entities of state and local government sub-sector (general government) in a much longer time perspective. Such long-term factors include most of all system reforms and changes in the financing system, such as those relating to taxes, their legal structure and division of tax revenues between the state and local government budgets.

Changes stemming from systemic determinants can also be analysed on the basis of measures showing relations between the revenues of local sub-sector and revenues of other sub-sectors, or the general (both state and local) government sector as a whole. While in most CEE countries the share of local revenues in the revenues of the general sector of state and local government remained on a relatively stable level (except the year 2020) or was growing, in Hungary it fell from 16.4% in 2015 to 13.3% in 2022 (Table 1). The relation of local sub-sector revenues to central sub-sector revenues in Hungary dropped in that time from 24.0% to 17.2%.

While analysing the sub-sector indicators, it should be borne in mind that they refer not only to local government units, but also, depending on legal and system conditions of individual countries, also to entities such as utility companies, cultural institutions or other entities depending (in various ways) on local authorities. Although in some countries such broadly defined non-budgetary management is very extensive, local government units remain the basic part of the local sub-sector.

Figure 1. Revenues of the local government sub-sector in relation to GDP in the CEE countries in 2015–2022 (%)



Source: Self-reported data based on Eurostat [2024a, 2024b].

Table 1. Share of local sub-sector revenues in the revenues of the general state and local government sector in CEE countries in 2015–2022 (%)

Specification	2015	2016	2017	2018	2019	2020	2021	2022
Czechia	28.9	28.0	28.5	29.4	30.0	32.5	33.3	32.8
Estonia	24.0	23.7	23.9	25.1	25.2	26.6	25.0	24.1
Lithuania	23.6	24.1	23.6	23.8	24.1	26.8	25.7	25.3
Latvia	27.5	27.5	28.2	27.7	30.1	28.8	28.4	28.1
Poland	32.9	34.0	33.9	33.8	34.4	36.4	34.9	33.2
Slovakia	17.5	17.8	18.0	18.7	19.5	20.0	18.9	18.9
Hungary	16.4	13.9	14.1	14.8	15.2	14.9	14.9	13.3

Source: Self-reported data based on Eurostat [2024a].

The local government system in CEE countries can comprise one level (Baltic states), two levels (Czechia, Slovakia, Hungary), or three levels (Poland). The quantities of units comprising these systems also vary between countries. The most extensive is the Czech system, consisting of 14 regions (*krai*) and 6258 municipalities (*obce*). The basic local government units are municipalities, which are very fragmented. In

2021 in Czechia there were on average 1710 inhabitants per one municipality, which is the least among OECD countries, where the average population is over 10 thousand people (slightly less than 6 thousand in the EU). The situation is similar in Slovakia, although the number of municipalities there is much lower.

In Poland the local government was reactivated in 1990, when gminas (municipalities) were established as units performing public tasks on their own behalf and responsibility. After the second stage of the system reform in 1999, two other levels were introduced in the local government system: poviats (districts) and voivodships (provinces). Currently the Polish local government system covers 16 voivodships, 314 poviats, and 2477 gminas, including urban gminas (including cities with rights of a poviat), rural-urban, and rural gminas which are the most numerous.

In Hungary the local government was also reactivated in early 1990s, when a two-level system was designed, consisting of municipalities and regions. 3175 municipalities were established, often with very limited financial potential [Kubas, 2023, p. 3]. After 2010 a re-centralisation process began, which has led to a substantial reduction of competences of local government units. The Hungarian municipal government is very fragmented. The number of municipalities has changed substantially, and currently 75% of them have less than 2 thousand inhabitants [OECD/UCLG, 2022].

The Baltic states have relatively few municipality units. In Lithuania local government consists of 60 municipalities. Initially, there were nearly ten times more, but as a result of subsequent mergers, large units were formed, with an average population exceeding 46.5 thousand people. In Latvia, structural reforms have led to a reduction in the number of municipalities and fewer levels of local government. Currently, local government comprises 43 local units: municipalities (*novadi*) and state cities (*valstspilsēta*) with the same competences and sources of funding, although cities have additional functions related to maintaining and developing communication systems and transport infrastructure of national importance.

In Estonia, prior to the administrative reform of 2017, half of the local government units had fewer than 2,000 residents, and 80% were inhabited by fewer than 5,000 people. Consequently, local government units struggled with correct performance of their obligations. The reform aimed to increase the capacity of local government units to provide high-quality public services and ensure more balanced regional development. The reform assumed that the minimum number of residents for a municipality was 5,000, with a recommended number of 11,000, with possible exceptions. After the administrative reform, the number of municipalities fell from 213 to 79, and the number of small units (with fewer than 5,000 residents) dropped from 169 to 17 [Ministry of Finance of Estonia, 2021, p. 8].

Table 2. Basic information about local government in the analysed countries

Specification	Types of local government units	Number of units	Average municipality population (thousand people)	Average municipality area (km^2)
Czechia	municipalities and regions	6258	1710	13
Estonia	municipalities	79	16,836	574
Lithuania	municipalities	60	46,806	1088
Latvia	municipalities	43	43,791	1502
Poland	gminas, poviats, voivodships	2477	15,407	126
Slovakia	municipalities and regions	2927	1859	17
Hungary	municipalities and regions	3155	3078	29

Source: Self-reported data based on OECD [2023a].

In the CEE countries, local government units carry out both their own tasks and (commissioned) tasks delegated by the government administration. Municipal competences include activities of local significance, primarily tasks related to education, healthcare, social welfare, local public transport, utilities, environmental protection, and culture. Tasks related to education hold particular importance, as in most countries they account for the largest share of municipal expenditures. These are usually own tasks of municipalities, although in Lithuania, preschool, primary, and secondary education are partly own tasks and partly delegated ones. In Hungary, educational tasks were under municipal competence, but following the centralization reform, local authorities no longer manage primary education [Rajca, 2019, pp. 18–19]. Changes reducing the level of decentralization can also be observed in Czechia. Although the reforms and structural changes carried out in this country in recent years were primarily aimed at increasing decentralization, in 2015 a process of re-centralization took place. Some municipal responsibilities were transferred from smaller units to larger ones and to the central government due to social reform. The manner in which funds from the central budget are allocated significantly limits the autonomy of Czech municipalities and their ability to shape local policies [OECD/UCLG, 2022].

Significance and structure of local government tax revenues

An analysis of the experiences of selected CEE countries regarding local government tax revenues indicates that they are quite diverse (Table 3). On one hand, these revenues come from taxes over which local authorities have some degree of tax authority (primarily the right to set tax rates). On the other hand, there are also

shared taxes, allocated between the central government's budget and the budgets of local authorities. Theoretically, local taxes (primarily property tax) are the best guarantee of financial independence of local government units. This would be true if they were characterized by high fiscal efficiency. However, in most countries, the amount of own revenue obtained in this way is disproportionate to the expenditure needs of local government. Hence, the necessity of equalisation mechanisms to supplement their financial resources while maintaining a connection with the economic potential of individual units [Wójtowicz, 2021]. The question of shared taxes, which are imposed and collected by higher-level authorities and then partially transferred to local government budgets, is also widely discussed. In most cases, local governments participate in the revenues from income taxes (PIT and CIT), less frequently in revenues from consumption/sales taxes (VAT). These taxes can be shared proportionally to the local government unit's contribution to revenue generation (*individual proportionality*) [Blöchliger, Petzold, 2009] or can serve as an equalisation tool – with more revenue going to units with lower revenue potential [Dougherty, Harding, Reschovsky, 2019].

Table 3. Types of taxes funding local government budgets in selected CEE countries

Specification	Taxes shared between the state budget and local government budgets	Local government taxes
Czechia	PIT, CIT, VAT, gambling tax, lottery and gaming machine tax	property tax (land tax, building and premises tax), dog tax, motor vehicle entry tax for selected cities, water supply or sewerage connection tax
Estonia	PIT	land tax, advertising tax, tax on roads and streets closure, motor vehicle tax, animal tax, entertainment tax
Lithuania	PIT, pollution tax, carbohydrate extraction tax, natural resources extraction tax	property tax, state land lease tax
Latvia	PIT, solidarity tax, natural resource tax, lottery and gambling tax	property tax
Poland	PIT, CIT	property tax, agricultural tax, forestry tax, motor vehicle tax, civil law transaction tax, inheritance and donation tax, lump-sum income tax paid in the form of tax card
Slovakia	gaming tax	PIT, property tax (land tax, building tax, premises tax), dog tax, accommodation tax (tourist tax), tax on non-profit gaming machines, vending machine tax, tax for entry and parking of motor vehicles in historical city areas, public space usage tax
Hungary		property tax, local business activity tax, pollution tax

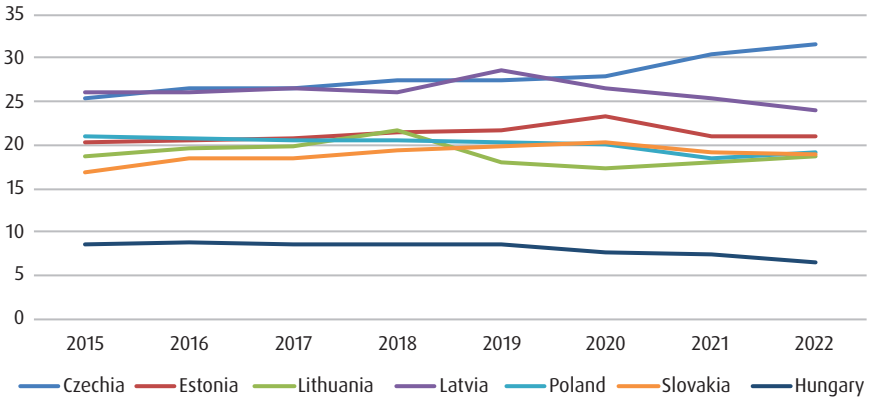
Source: Self-reported data based on the data from European Commission [2024] and information from websites of the Estonian Ministry of Finance [2024], Polish Ministry of Finance [2024a], and State Revenue Service in Latvia [2024].

The system of revenue sharing between different levels of government affects the level of revenue autonomy of local government units [see, e.g., OECD, 2021, p. 83]. Fiscal significance of this revenue source will depend not only on the size of the shares and the way they are determined, but also on the legal structure of these taxes [Pest, 2014] and macroeconomic conditions.

To assess the significance of local government tax revenues in the examined countries, three indicators were selected: the share of local sub-sector tax revenues in total tax revenues (Figure 2), the share of local sub-sector tax revenues in total local sub-sector revenues (Table 4), and the share of local sub-sector tax revenues in GDP (Figure 3).

The data on the size of local sub-sector tax revenues show that in four countries, they averaged over 20% of total tax revenues during the studied period. The group of countries with the highest share included Czechia (an average share of 27.9%) and Latvia (an average share of 26.2%). In recent years, an increase in this indicator was noted only in Czechia and Lithuania. In the case of Hungary, tax revenues did not even reach 10%.

Figure 2. Share of local sub-sector tax revenues (corrected) in total tax revenues in selected CEE countries in 2015–2022 (%)



Source: Self-reported data based on Eurostat [2024a], Ministry of Finance of Slovakia [2024b], Official Statistics Portal of Lithuania [2024] and Statistics Estonia [2024].

Considering the second indicator, only in a few cases did it average close to or more than 50%, which is the case for Latvia (almost 53%), Slovakia (49%), and Estonia (47.3%). A group of countries can also be identified where the analysed ratio averaged above 40% but below 45%. These were Czechia (44.5%) and Lithuania (41.6%). In Poland and Hungary, this ratio was the lowest, at 31.2% and 31.0%, respectively.

In most cases, tax revenues did not even reach 5% of GDP in the analysed period. The highest ratio of local sub-sector tax revenues to GDP was found for two countries –

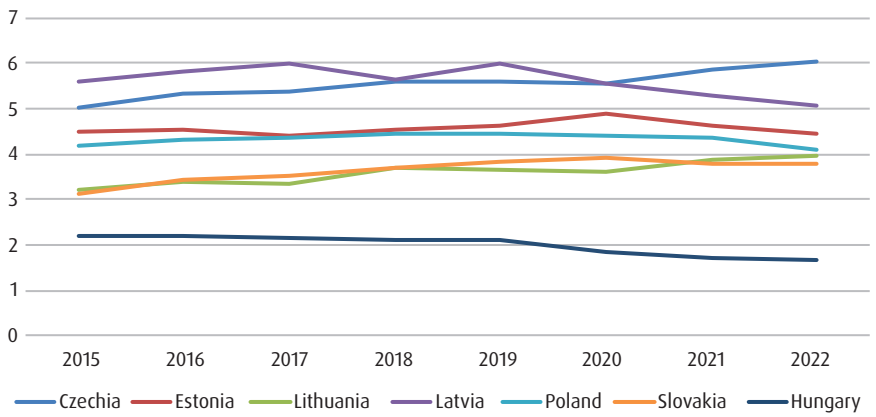
Czechia and Latvia (where the average share was 5.6% of GDP). In Hungary, this ratio was the lowest, averaging 2%.

Table 4. Share of local sub-sector tax revenues (corrected) in of the total local sub-sector revenues in selected CEE countries in 2015–2022 (%)

Specification	2015	2016	2017	2018	2019	2020	2021	2022
Czechia	42.2	47.2	46.8	46.0	45.0	41.2	42.5	44.6
Estonia	47.0	49.0	47.7	46.8	47.0	46.6	46.7	47.8
Lithuania	38.9	40.7	42.4	44.9	42.9	37.2	41.6	44.1
Latvia	54.4	56.3	56.0	52.8	52.6	50.7	49.7	49.6
Poland	32.4	32.5	32.1	32.1	31.4	29.3	29.5	30.5
Slovakia	41.8	48.5	51.1	51.1	50.3	49.5	50.0	49.8
Hungary	27.8	35.6	34.5	32.8	31.6	28.7	27.8	29.2

Source: Self-reported data based on Eurostat [2024a], Ministry of Finance of Slovakia [2024b], Official Statistics Portal of Lithuania [2024] and Statistics Estonia [2024].

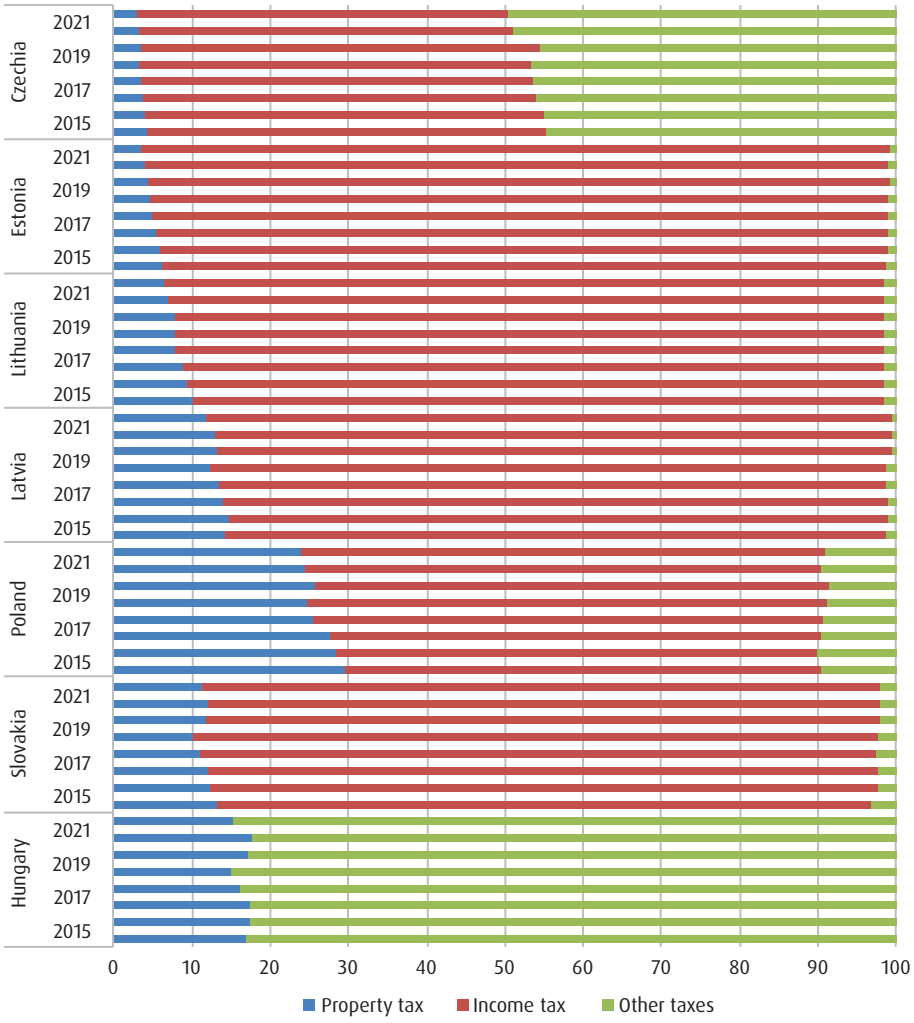
Figure 3. Share of local sub-sector tax revenues (corrected) in GDP in selected CEE countries in 2015–2022 (%)



Source: Self-reported data based on Eurostat [2024a], Ministry of Finance of Slovakia [2024b], Official Statistics Portal of Lithuania [2024] and Statistics Estonia [2024].

Interesting conclusions also emerge from the analysis of the structure of local government tax revenues (Figure 4). In most countries, local government tax revenues come from income tax, property tax, and other taxes. This group includes countries like Estonia, Lithuania, Latvia, Poland, and Slovakia, where major sources of local government tax revenues are income taxation and property taxation, with a small supplement from other taxes.

Figure 4. Structure of local sub-sector tax revenues (corrected) by tax groups in selected CEE countries in 2015–2022



* Individual categories cover: D29A and D59A (as Property taxes), D51 (as Income taxes), sum D2_D5_D91 less D29A, D59A, and D51 (as Other taxes). Eurostat data were additionally corrected. The following modifications were made: for Estonia, Lithuania, and Slovakia, PIT revenues were added, which are a source of revenue of the local sub-sector, based on information from a statistical office or ministry of finance of the relevant country. This increased total tax revenues in relation to the value indicated for a given category, compared to Eurostat data.

Source: Self-reported data based on Eurostat [2024a], corrected by the data from the Ministry of Finance of Slovakia [2024b], Official Statistics Portal of Lithuania [2024], Statistics Estonia [2024], National Statistical System of Latvia [2024] and Statistical Office of Hungary [Központi Statisztikai Hivatal, 2024].

In Estonia, Lithuania, and Slovakia, revenues from property taxation are complemented by revenues from taxation of goods and services (in Estonia, revenues from

advertising tax, motor vehicle tax, and entertainment tax; in Lithuania, revenues from pollution tax and natural resources tax; in Slovakia, revenues from special local taxes on goods and services, including accommodation tax, motor vehicle tax, and entertainment tax). In Poland, these include revenues from motor vehicle tax, civil law transaction tax, and inheritance and donation tax. On the other hand, Czechia also has significant revenues from goods and services tax (including municipalities' participation of in VAT). Another group includes Hungary, where local government tax revenues come from two types of taxes, primarily from the taxation of goods and services (local business tax and municipal tourist tax). It is worth noting that fiscal significance of property tax – one of the most important local taxes – varies between countries. In most of them, except for Poland and Hungary, it does not prevail in local government tax revenues.

Directions of changes in taxes constituting local government revenues

Changes introduced to the tax systems in CEE countries have affected the financial stability of local government units to varying degrees.

In Czechia, municipal tax revenues consist of property tax revenues, VAT revenues (24.92%), and PIT and CIT revenues (24.92%) [Dvořák, 2017]. Additional revenues are received by the largest cities, i.e., Prague, Plzeň, Ostrava, and Brno, as they are entitled to a share in the gross national tax revenue, the amount of which depends on various factors characterizing their additional expenditure needs, including the number of residents or the number of children and students [Sedmihradská, 2008].

A fundamental trend in PIT changes was the reduction of tax burdens, motivated on the one hand by stimulus objectives (e.g., introduction of tax incentives for insurance within the so-called third pillar in 2017) and on the other by social reasons (reduction of labour taxation in 2021 to boost demand after the pandemic-induced slowdown) [OECD, 2023b]. An essential solution to increase tax revenues was the introduction of tightening measures in 2019, implementing the provisions of the EU ATAD directive into the Czech law. These included, in particular, the general anti-tax avoidance rule, tax on unrealized gains, new rules for taxation of so-called controlled foreign corporations, and regulations regarding so-called hybrid mismatches. In 2020, Czechia became the only EU country to introduce so-called general VAT reverse charge mechanism, applicable to all transactions with goods and services exceeding the value of EUR 17,500. Alongside tightening measures, many temporary VAT rate reductions were introduced during the study period, motivated by the needs arising from the COVID-19 pandemic [Ministry of Finance of the Czech Republic, 2024]. In **Estonia**,

the major source of local revenue is PIT. Since 2014, revenues from this source have been reclassified as cross-sectoral transfers to local government budgets. Concurrently, PIT burdens have been reduced (flat tax) by lowering tax rates (since 2015, they have been at 20%) and increasing the tax allowance (from EUR 1,848 in 2015 to EUR 7,848 in 2023). The annual tax allowance decreases as total income increases. Estonian municipalities receive a share of PIT amounting to about 12% of personal income [Ministry of Finance of Estonia, 2024].

Property tax covers only land. Tax rate is set by the local government and has so far ranged from 0.1% to 2.5% of the land value [Felis et al., 2023a; Mazurek-Chwiejczak, 2015]. However, from 2024, the upper rate is 1%; the lower limit is supposed to mitigate the effects of the valuation update. A protective mechanism has also been established, ensuring that the tax does not increase by more than 10% per year compared to the previous year until the amount of the land tax based on the land's taxable value and the tax rate is reached.

In **Lithuania**, PIT is also a shared tax classified as a transfer. Until 2018, a single rate applied to income from employment (and equivalent sources) was 15%. In 2019, a progressive PIT was introduced, with a lower rate (20%) and a higher rate (27%). In 2020, the highest rate was raised to 32%, while the lower rate remained unchanged. The size of tax revenue is also affected by the tax allowance (EUR 520 per month in 2022). The central authorities set the rules for equalisation mechanisms to ensure the financial security of worse performing local government units. Since 2016, a municipality receives a percentage share of PIT based on the forecasted municipal PIT revenue per capita compared to the average forecasted PIT per capita of all municipalities. In 2018, the municipalities' share of PIT was 82.16%, of which 78.45% was a fixed share, and 3.71% was variable [Ministry of Finance of Lithuania, 2024].

A shared tax is also the tax on pollution (physical, chemical, or biological) that negatively impacts humans and the environment. Local budgets receive a fixed 70% share of the total revenue from this source.

The most important local Lithuanian tax is property tax, which formally consists of two taxes: land tax and real estate tax. Since 2013, the annual rate set by municipal councils has ranged from 0.01% to 4% of the land's market value. Property tax applies to real estate owned by individuals valued at over EUR 150,000 (previously EUR 220,000). Tax allowance is higher, e.g., for families with three or more children and families with a disabled child – EUR 200,000 (previously EUR 286,000). The tax rates are: 0.5%, 1%, and 2%, depending on the property's market value [Felis et al., 2023a; Miceikienė, Skauronė, Krikštolaitis, 2021; Skauronė, Montvydaitė, 2019].

In **Latvia**, the most important shared tax is PIT. The tax is progressive, depending on income: up to EUR 20,004 income, the rate is 20%; for income from EUR 20,004

to EUR 78,100 it is 23%; and for income above EUR 78,100 it is 31%. Revenues from this source are allocated to both local and state budgets, with the local share being three times higher (75% vs. 25%). Since 2021, PIT revenues have been divided in this proportion. Previously, local government units received 80% [Ministry of Finance of Latvia, 2024].

Local governments also participate in the revenues from the solidarity tax, which is paid by employees, employers, and sole traders. The tax applies to income exceeding the maximum amount subject to mandatory contributions for state social insurance. In 2018, this was EUR 55,000 per year, in 2019–2021 it was EUR 62,800 per year, and since 2022 – EUR 78,100 per year. Since 2021, the tax rate has been 25% (in 2019 and 2020, it was 25.5%).

Other shared taxes include the natural resources tax and the lottery and gambling tax. Part of the revenue from these taxes allocated to municipalities must be used exclusively for environmental protection purposes. Since 2020, an amendment to the law on lotteries and gambling fees and taxes has changed the distribution of funds between the central and local budgets (the state's share increased from 75% to 90%, reducing the municipalities' share from 25% to 10%).

In Latvia, since 2010, there has been a single property tax, which covers land, buildings or parts of buildings, and engineering structures intended for business activities. The tax base is the cadastral value of the property. In the case of rural land (until 2025), the tax base is a special value determined by the state administration for tax calculation purposes. The tax rate (s) are set by the local municipality, even though it is collected at the central level [Felis et al., 2023a].

In **Poland**, an important source of budget revenues for local government units are shares in PIT and CIT. In the years 2015–2022, significant systemic changes were made to these income taxes, such as [Felis, Malinowska-Misiąg, Otczyk, 2023]:

- lowering the PIT rate in the first tax bracket: from 18% to 17% in October 2019, and then from 17% to 12% in 2022;
- exempting persons under the age 26 who have not exceeded a specified income limit from PIT in August 2019;
- increasing the tax allowance from PLN 8,000 to PLN 30,000 for all taxpayers subject to general taxation principles and increasing the tax threshold (above which the tax rate is 32%) to PLN 120,000 from January 2022;
- reducing the CIT rate for small taxpayers from 19% to 15% from 2017, and then from 15% to 9% from 2019;
- introducing Estonian CIT from 2021;
- introducing many investment incentives in CIT and PIT, including incentives for R&D (in 2016) and robotisation (in 2022);

- eliminating the tax card (since 2022, this form of taxation is only available on a continuation basis).

Due to the changes, an additional source of local government revenue (development subsidy) was designated, effective from October 2021. At the same time, the way of establishing municipalities' shares in income taxes was modified, where the share of the due income tax of legal and natural persons allocated to a municipality will be the weighted average of the three years preceding the base year determined on the basis of tax return data for those years, not just the last year preceding the base year. Additionally, attention should be drawn to changes in the mechanism for determining the general subsidy. An additional requirement was introduced to include planned revenues from municipalities' shares in income taxes (not just for the year preceding the base year), with the possibility of increasing the subsidy when the determined amount is lower than the reference amount [Dz.U 2021 [*Polish Journal of Laws*], item 1927].

In **Slovakia**, PIT is a significant source of local government units' revenue, entirely allocated for their needs. Municipalities receive 70% of PIT, while the state retains 30% [OECD, 2023b]. Key sources of own revenues for municipalities include local taxes, with property tax and tax on gaming machines being the most significant [Dvořák, 2017]. Between 2015 and 2023, the Slovak PIT underwent two processes: tightening inspired by EU directives and transformation towards progressive rates [Ministry of Finance of Slovakia, 2024a]. As a result of reforms implemented in 2020–2021, the Slovak PIT became a tax with two rates and a relatively high tax allowance. At the same time, many modern pro-investment solutions were introduced, particularly R&D and IP-Box reliefs [PwC, 2023]. Municipalities can charge not only property tax but also a local business tax, with considerable autonomy to independently decide on its key structural elements (tax base, rates, and preferences) [Etel, 2019].

In **Hungary**, property tax is paid by owners and calculated based on area, useful floor area, or adjusted market value [Hoffman, 2019]. Local authorities have the power to waive its collection and have broad rights to shape its scope. Municipalities can create a catalogue of applicable reliefs and diversify tax rate depending on the purpose and location of specific properties [Etel, 2019].

Hungarian entrepreneurs are obliged to pay a local business tax, determined by local government units, with the condition that the tax rate cannot exceed 2%. The tax base is revenue reduced by several items, including costs of raw material and materials supplied by third parties, selected passive payments, and some paid taxes [Ministry of Finance of Hungary, 2024]. Between 2016 and 2023, numerous changes in the local business tax were implemented, significantly impacting local government finances, such as:

- the possibility for municipalities to grant reliefs for companies conducting R&D;

- the possibility for municipalities to grant reliefs to companies making investments on their territory (in the form of a tax deduction or tax base reduction) equal to the entire, part, or multiple of the expenditure;
- the requirement for taxpayers to settle the tax electronically.

Impact of tax changes on the economic and financial potential of local governments in Czechia, Estonia, Poland, and Slovakia

The starting point for analysing and assessing the financial situation of local governments in selected CEE countries is a review of their financing principles, which helps explain at least some of the observed relationships.

Statutory sources of municipal financing in Czechia include property income, revenue from activities, including administrative ones, grants provided at the central and regional levels, as well as tax revenues (both own and shared). Transfer revenues account for about one-fifth of total municipal revenues. A large part of these funds are restricted grants for financing delegated tasks. Municipal expenditures are primarily current costs, with more than half absorbed by purchases, including energy, water, and services, as well as non-investment grants transferred to non-budgetary entities.

In Estonia, tasks performed by local governments are financed from own and transfer revenues. Municipalities receive revenue from taxes, provided services, and grants. An important source of transfer revenue are restricted block grants, allocated for, among other things, financing teachers' salaries and maintaining local roads.

According to the Constitution of the Republic of Poland, local government revenues consist of their own revenues, general subsidy, and restricted grants from the state budget. Shares in the revenues from shared taxes (PIT and CIT) are classified as own revenues, which actually they are not. General subsidy is transferred to local governments without indicating its purpose. It consists of several parts, characterized by different algorithms for both determining the total amount of transfers and dividing this amount among individual local government units. The largest part of the general subsidy is allocated for education.

In Slovakia, since 2014, revenues from the personal income tax have been classified as transfers. Restricted grants for municipalities are paid, among other things, from the state budget to cover the costs of delegated state administration tasks. The state budget may also finance other tasks in the form of earmarked grants, such as cultural heritage protection. Municipalities can also receive restricted grants from regional budgets or other municipalities' budgets [Románová, Červená, 2017].

Budget indicators applied to assess the financial situation of local governments included:[1]

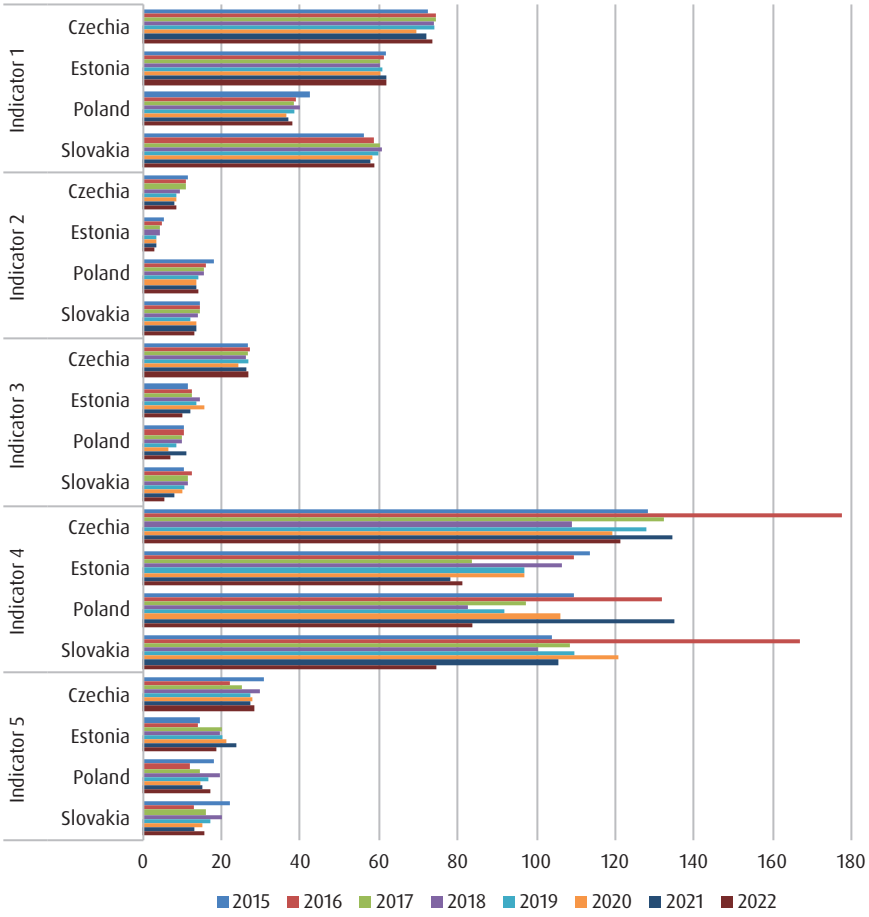
1) total tax revenues / current revenues (indicator 1),
2) local tax revenues / current revenues (indicator 2),
3) operating surplus / current revenues (indicator 3),
4) (operating surplus + property income) / capital expenditures (indicator 4),
5) capital expenditures / total expenditures (indicator 5).

Among the proposed indicators, particular attention should be paid to the operating surplus (the difference between current revenues and current expenditures) and tax revenues, as important components of current revenues, which significantly determine the way of financing public tasks. The value of most indicators for municipalities in the analysed countries is relatively stable. The crisis (COVID-19) did not bypass the CEE economies but affected them to different extents. Hence, the varying scale of changes in indicators, including the measure referring to financial independence (indicator 2), in the construction of which variables most sensitive to crisis phenomena and processes were included. These variables include, primarily, shared taxes, local taxes and fees, income from municipal property, and local government expenses (both current and capital). A worrying phenomenon is the change in the value of indicators that include the operating surplus – a regular decline in the value of indicator 3 and a highly fluctuating indicator 4. Operating surplus is crucial because it plays a key role in the municipalities' investment policy. The highest share of capital expenditures in total expenditures is recorded by Czech municipalities, which also have the highest ratio of operating surplus to current revenues.

There are significant differences between the analysed countries in both the rate of taxation and the structure of revenues from individual budgetary items. Figure 5 shows that, apart from indicator 2, the highest indicators were found for municipalities in Czechia. In Slovak municipalities, some indicators also confirmed favourable relationships between the potential of the local economic base, revenue volumes, and changes in tax systems. Particular mechanisms ensuring stability of municipal government units' own revenues are found in these two countries of the Visegrad Group. In Czechia, the tool for linking municipal revenues stronger to the real needs of residents and enterprises is the allocation of a significant part of revenues not only from PIT but also from CIT and VAT (almost 25% from each). Slovakia found a different solution to this problem by making PIT an entirely local government tax. However, neither CIT nor VAT is a shared tax there.

[1] To calculate the indicators in this part of the study, aggregate values of individual budget categories for all municipalities in total were applied.

Figure 5. Selected indicators of municipal government budget management in some CEE countries in the years 2015–2022 (%)



Source: Self-reported data based on the data of Czech Statistical Office [2024a, 2024b], Ministry of Finance of Slovakia [2024b], Statistics Estonia [2024] and Ministry of Finance of Poland [2024a, 2024b].

An analysis of the remaining countries, namely Estonia and Poland, shows that their situation is similar – almost all indicators were lower than in Czechia and Slovakia. In Estonian municipalities, PIT plays a key role, with revenues shared between the state budget and local budgets. In the structure of municipal revenues, local taxes, primarily the property tax, are not as significant. In Poland, transfer revenues (grants and general subsidy) prevail, which is not favourable for local governments' financial independence and autonomy. Let us also note the efficiency of local taxes, among which only the property tax is significant – considering the wide catalogue of all local taxes. Fiscal efficiency of the property tax, however, is not high compared to income

taxes. A comparison of indicators 1 and 2 for both countries indicates certain dependencies. In Polish municipalities, the values of both indicators significantly decreased over eight years, while in Estonian municipalities, they remained stable. For municipalities in both countries, a key element determining the value of indicator 1 is the share in PIT revenues (and also CIT in Poland). The importance of this revenue category has changed over time due to factors such as rules and proportions in which tax revenues were divided, the design of these taxes, and economic conditions. The socio-economic programme called the Polish Deal, implemented in recent years in Poland, has reduced local governments' own revenues, limiting their financial independence.

Comparative analysis of Polish and Estonian municipalities at the unit level

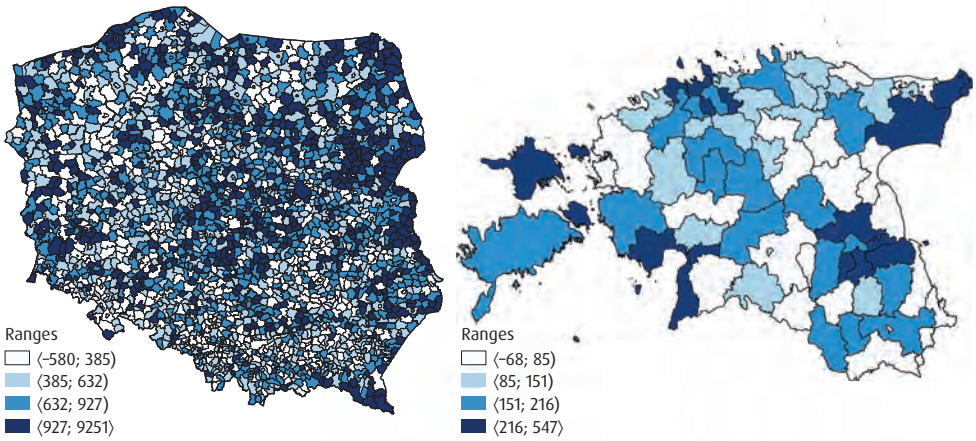
An interesting complement to the research is micro-level analysis, taking into account information about individual municipalities from Poland and Estonia. These countries were selected due to the availability of comparable unit-level data and the desire to compare representatives of two groups: Visegrad Group countries and Baltic countries. Estonia is also an interesting example for comparison, as in recent years, it has ranked first among OECD countries in terms of tax competitiveness [Mengden, 2023].

Figure 6 presents operational surplus per capita, with all municipalities assigned to one of four equally sized groups determined based on quartile measures. The average values of this metric at the national level (first the indicator values for each municipality were established, and then the average was calculated) were comparable, amounting to PLN 699.26 for Polish municipalities and EUR 165.49 for Estonian municipalities. The average operational surplus per capita for rural municipalities in Estonia in 2022 was EUR 171.01, higher than that of urban municipalities (average EUR 141.93). The distribution for Polish municipalities is similar. For rural municipalities, the average is the highest at PLN 839.17, for urban-rural municipalities it is PLN 543.99, for urban municipalities it is PLN 347.66, and for cities with poviat rights it is PLN 306.45.

Reasons for such dependencies are both the diversity of municipalities in terms of population size and the scope and manner of financing investment activities. Operational surplus is one of the most important sources of financing local investments, although European funds and state budget grants also remain significant [BGK, 2022]. The size of operational surplus depends on both external and internal factors. The former include, above all, factors related to macroeconomic conditions and systemic regulations affecting the size of own revenues and current transfers, as well as the scope of expenditures financed from local budgets. The size of operational surplus is

also directly related to the decisions of local authorities and the way they conduct their current financial policy [cf. Swianiewicz, Łukomska, 2023].

Figure 6. Operational surplus per capita in municipalities in Poland (left, PLN) and Estonia (right, EUR) in 2022



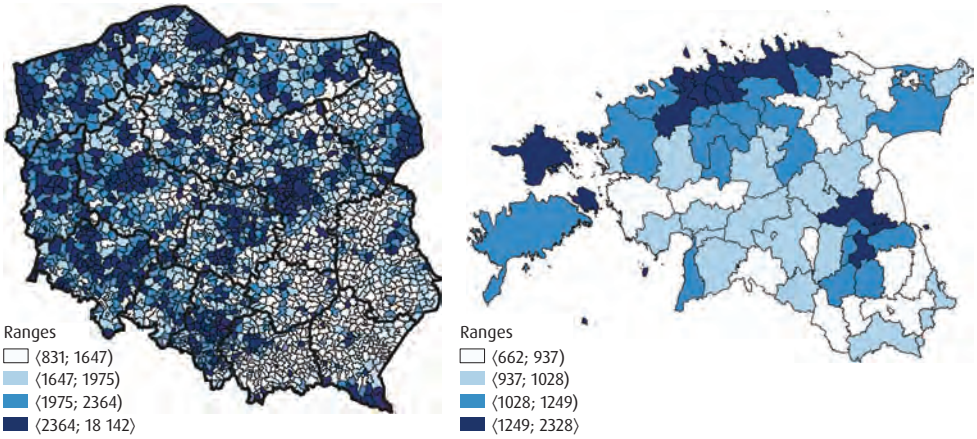
Source: Self-reported data based on the data of Statistics Estonia [2024] and Ministry of Finance of Poland [2024a].

Figure 7 presents tax revenues per capita divided into quartiles, i.e. four equally sized intervals. The average for Poland is PLN 2122.72, which is more than twice as low as the average for Estonia, which stands at EUR 1122.18 (based on EUR/PLN exchange rate in 2022 at about PLN 4.20 per EUR 1). The direction of dependencies by municipality type is different in both analysed countries. For Polish rural and urban-rural municipalities, the average tax revenue per capita is PLN 2070.87, which is lower than the average tax revenue per capita in urban municipalities (PLN 2345.80) and in cities with poviat rights (PLN 3033.81). Meanwhile, in Estonia, rural municipalities have on average higher tax revenues per capita (average EUR 1158.16) than urban municipalities (average tax revenue per capita here is EUR 968.70).

In the case of Poland, one explanation is the relatively higher tax revenue from shares in personal and corporate income taxes (a larger population means a higher share; cities with poviat rights also have a share in poviat taxes). The map also shows that in the north-western Poland, there are more municipalities with higher tax revenue per capita, which can be explained primarily by the lower population density of these areas compared to municipalities in other voivodships. Two other factors also matter: the availability of natural resources (part of the revenue from the exploitation fee funds municipal budgets) and the location of municipalities (municipalities situated in agglomerations benefit from this fact, attracting more businesses and residents,

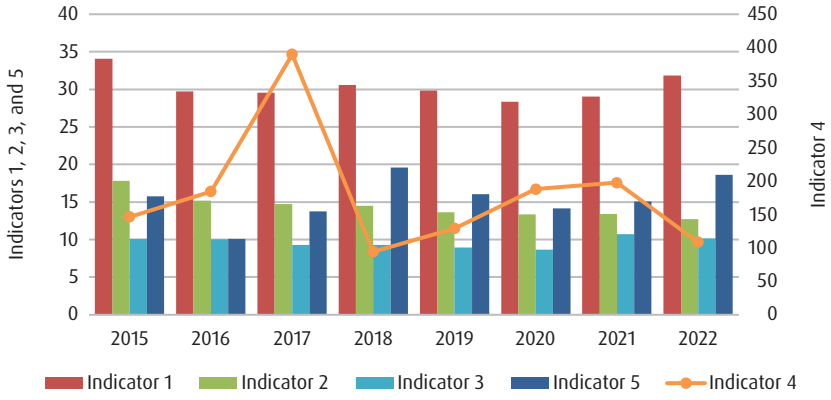
which translates into an increase in their revenues from shares in income taxes). Conversely, in Estonia, there are more municipalities with higher tax revenues per capita in the north (municipalities located near the state capital).

Figure 7. Tax revenue per capita in municipalities in Poland (left, PLN) and Estonia (right, EUR) in 2022



Source: Self-reported data based on the data of Statistics Estonia [2024] and Ministry of Finance of Poland [2024a].

Figure 8. Indicator values for Poland in 2015–2022 (%)

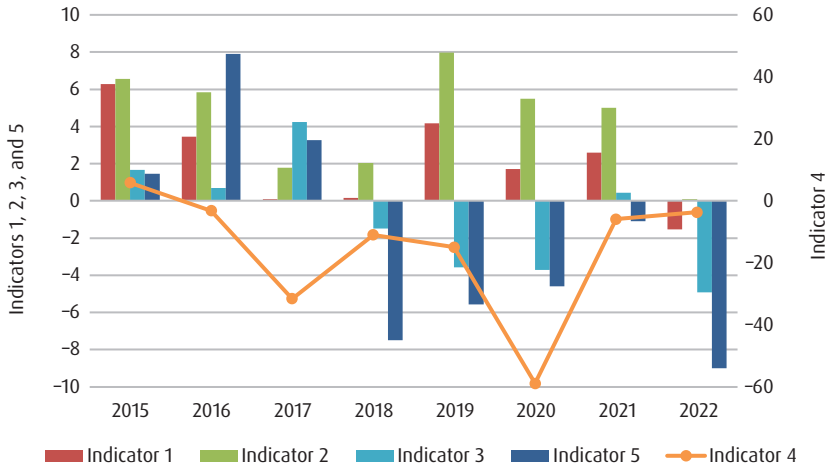


Source: Self-reported data based on data of the Ministry of Finance of Poland [2024a, 2024b]

The averaged values of the indicators for the entire country are presented in Figure 8. Indicators 1–3 and 5 are shown in a bar chart with values on the left axis. Indicator 4, which is characterized by the highest variability and highest values, is presented

as a line chart with values on the right axis. In other countries, indicator 4 followed a similar pattern (see Figure 5). An analysis of individual indicators was also conducted, taking into account municipality types on the examples of Poland and Estonia.

Figure 9. Percentage differences between indicators of cities with poviat rights and other municipalities in Poland in 2015–2022 (%)



Notes: A downward bar (values below zero) indicates that cities with poviat rights have on average higher indicator values than other municipalities (rural, urban, mixed urban-rural).

Source: Self-reported data based on data of the Ministry of Finance of Poland [2024a, 2024b]

Comparing the percentage differences in indicator values between cities with poviat rights and other Polish municipalities, it can be observed that in the initial years of the analysed period, the average indicator values for cities were lower than for other municipalities. This is confirmed by the data presented in Figure 9 and Table 5. In 2015, differences in individual indicators ranged from 2% to 7% in favour of municipalities that are not cities with poviat rights. However, this changed in subsequent years. For example, for indicator 4, the direction of difference reversed, starting in 2016, and for indicators 3 and 5, this happened in 2018 (an election year). The positive direction of the difference was maintained only for indicator 2 throughout the analysed period. It is worth noting that for four out of the five indicators, the sign of the percentage difference reversed in 2022 compared to 2015 (the last year of the analysed period), and cities with poviat rights recorded, on average, higher indicator values than other municipalities. Moreover, in the case of indicator 2, despite maintaining the same sign, the difference decreased over eight years from 6.6% to 0.1%.

It should be borne in mind that current revenues also include shares in revenues from personal income tax (PIT) and corporate income tax (CIT), and cities with pov-

iat rights participate in these revenues in both the poviat and municipal parts. However, in the following years, the denominator for calculating indicator 2 for cities with poviat rights did not grow as rapidly as for other municipalities. Thus, the cities with poviat rights had better results for this indicator because other municipalities achieved higher current revenues. The finding that cities with poviat rights achieve higher indicator values should therefore be interpreted as more favourable for other municipalities, not for cities with poviat rights. The results for indicator 1 can be interpreted in a similar way.

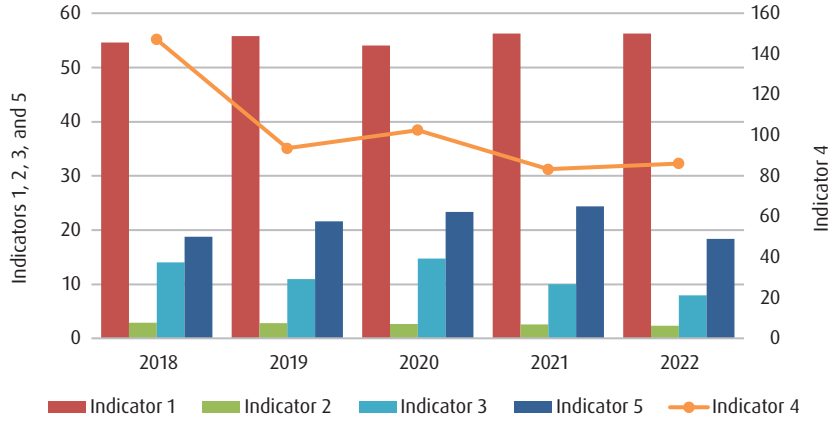
Table 5. Percentage differences between indicators of cities with poviat rights and other municipalities in Poland in 2015–2022 (%)

Specification	2015	2016	2017*	2018	2019	2020	2021	2022
Indicator 1	6.3	3.4	0.1	0.1	4.2	1.7	2.6	–1.5
Indicator 2	6.6	5.9	1.8	2.0	8.0	5.5	5.0	0.1
Indicator 3	1.7	0.7	4.2	–1.5	–3.6	–3.7	0.4	–4.9
Indicator 4	5.9	–3.2	–31.5	–10.9	–14.9	–58.9	–5.9	–3.7
Indicator 5	1.5	7.9	3.3	–7.5	–5.6	–4.6	–1.1	–9.0

* For 2017 Indicator 4 does not include one municipality due to its deviating value that could distort the result for the population as a whole.
Notes: Green colour (positive) means that cities with poviat rights have lower average indicator values than other municipalities; red colour (negative) indicates the reverse.

Source: Self-reported data based on data of the Ministry of Finance of Poland [2024a, 2024b]

Figure 10. Indicator values for Estonia in 2018–2022 (%)



Source: Self-reported data based on the data of Statistics Estonia [2024].

The averaged values of the indicators for Estonia are presented in Figure 10, with indicators 1–3 and 5 shown in a bar chart using the values on the left axis, while the values for indicator 4 are placed on the right axis due to its highest variability. No significant differences were observed regarding the type of municipality.

An analysis of percentage differences between the indicators calculated for urban and rural municipalities shows that the values for urban municipalities are higher for almost all years and all indicators, except for indicator 4. This is confirmed by the data presented in Figure 11 (bars directed towards negative numbers) and Table 6.

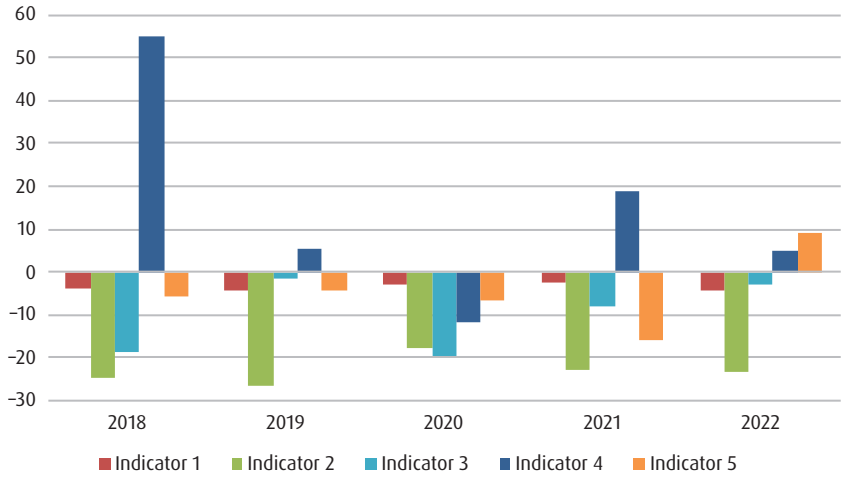
Table 6. Percentage differences between indicators of urban and rural municipalities in Estonia in 2018–2022 (%)

Specification	2018	2019	2020	2021	2022
Indicator 1	–4.0	–4.5	–3.0	–2.6	–4.5
Indicator 2	–24.9	–26.5	–17.6	–23.0	–23.3
Indicator 3	–18.5	–1.4	–19.8	–7.8	–2.8
Indicator 4	55.0	5.4	–11.8	18.9	5.2
Indicator 5	–5.7	–4.3	–6.8	–16.1	9.3

Notes: Green colour (positive) means that urban municipalities have lower average indicator values than rural municipalities; red colour (negative) indicates the reverse.

Source: Self-reported data based on the data of Statistics Estonia [2024].

Figure 11. Percentage differences between indicators of urban and rural municipalities in Estonia in 2018–2022 (%)



Source: Self-reported data based on the data of Statistics Estonia [2024].

Summary and recommendations

The revenue system for local government units is crucial for their efficient and effective functioning. Tax solutions can stimulate local socioeconomic development. However, systemic imperfections create barriers to entrepreneurship and hinder financial stability. A significant issue is the strong dependence of local government units' revenue potential on the priorities of central economic policy. Since any systemic changes, especially in income taxes, affect the financial condition of local government units, it is essential to emphasize how important it is to adjust revenues to the tasks of local government.

An analysis of strategies implemented in some Visegrad Group countries to ensure stable sources of own revenue for local government units shows that an important factor which affects their financial security is revenue, whose volume reflects the needs of the local community, and which comes from the widest possible range of public levies. Municipality's own revenue strongly linked to a single levy makes it particularly vulnerable to decisions regarding the state tax policy. This pertains to both actions taken in the aforementioned countries to tighten the tax system (including the implementation of the BEPS package) and social and economic initiatives. From 2020 to 2023, all Visegrad Group countries made decisions to intensify the use of tax tools to increase their investment attractiveness, facilitate business operations in the face of epidemic and geopolitical threats, and reduce the burdens on low-income individuals. These decisions, resulting in changes in the size of tax allowance and deductions from the tax base, reduced local government units' revenues from personal income tax (PIT). The impact of this deficit on the financial condition of local government units was largely related to the importance of this revenue source and the diversity and scope of tax revenue sources for municipalities. Solutions applied in Czechia are particularly positively evaluated, where significant shares of CIT and VAT were transferred to local governments, ensuring financial stability while avoiding complications in the tax system. This phenomenon of complex tax system is found in Hungary. Granting broad legislative powers regarding the local business tax (decisions on imposing and shaping the tax rate matrix and tax preferences) to municipalities has resulted in varying amounts and principles of its collection depending on the region. This in turn has made business tax settlement particularly time-consuming and prone to errors.

Some Baltic countries have also implemented solutions important from the perspective of local government. Shares in PIT have become part of equalisation mechanisms aimed at ensuring financial security for poorer local government units. For instance, Lithuania introduced mechanisms for reallocating PIT revenues. According to this method (since 2016), a municipality receives a percentage share of PIT based

on the forecasted municipal PIT revenue per capita compared to average forecasted PIT per capita of all municipalities. A reverse transfer of part of the PIT share applies to those municipalities where the forecasted PIT per capita is higher than the average forecasted value of PIT per capita of all municipalities.

Efforts to improve the competitiveness of local tax systems, particularly regarding income taxes, may result in decreasing shares (or revenues) of municipalities from income taxes. That is why municipalities must seek additional sources of own revenue. For example, in Latvia, local government units get additional revenue by imposing a mandatory minimum state insurance contribution. This solution funds salary increases for teachers and healthcare workers.

An interesting connection exists between additional sources of municipalities' own revenue and the implementation of environmental policy. In the Baltic states, part of municipalities' own revenue comes from environmental taxes. In Latvia, this includes tax on the extraction of natural resources, environmental pollution, disposal and use of hazardous goods, and packaging used for business activities, and the disposal of single-use tableware. In Lithuania, the pollution tax, paid by individuals and legal entities emitting pollutants from fixed and mobile sources, is charged on physical, chemical, or biological pollutants that negatively impact humans and the environment.

Poland has been modifying its tax system particularly frequently and in exceptionally broad scope. However, the structure of property taxes still has not been changed, which makes it difficult to significantly improve the efficiency of local tax collection. Still, numerous changes were made to shared taxes, PIT and CIT, especially those imposed by the Polish Deal. Due to their scale, scope, and consequences, these changes can only be compared to the 1992 tax reform, which established a universal and uniform personal income tax. Specialists agree that changes in local government revenue sources, caused by the tax changes provided for by the Polish Deal, limited their financial autonomy.

Undoubtedly, the implementation of this socioeconomic program has also intensified discussions about the financial potential of local government units. Their own revenues remain too low (and unevenly distributed) to enable local governments to perform public tasks effectively. It is therefore necessary to reform local government's own revenue sources in Poland, in line with the principles of an efficient local finance and tax system theory.

The following solutions for tax revenues should be considered;

- zoning the property tax [Felis et al, 2023b],
- standardizing property tax to cover all types of properties (including agricultural and forest land),

- a municipal PIT,
- extensive use of lump-sum taxes (neutral taxes),
- different principles for calculating local government units' shares in state taxes,
- increasing local government units' competencies in local taxes.

These recommendations should be viewed not only in terms of efficiency, stability, or predictability but also in terms of enhancing municipalities' financial autonomy, thereby increasing their ability to stimulate regional and local development, particularly in crisis conditions. Obviously, this issue is more complex and involves the design of the entire local government revenue system, which requires [Malinowska-Misiąg, Misiąg, 2021]:

- valuation of global costs of local government tasks,
- dividing available types of public revenues between the state and local government (assigning revenue from one source entirely to central or local authorities or sharing these revenues in established proportions among different levels of public authority),
- assessing whether the revenues allocated for individual municipalities are sufficient to cover the costs of their public tasks, taking into account justified differences in the costs of performing the same tasks in different municipalities,
- establishing principles for supplementary funding for those local government units where available own revenues are insufficient.

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ECONOMIC SITUATION IN CENTRAL AND EASTERN EUROPE

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Abstract

Since the economic slowdown in late 2020s, economies of CEE have been going through a difficult time. Their economic processes were strongly affected by external factors: COVID-19 and the war in Ukraine. The year 2023 was not a time of prosperity, either. Economic slowdown, or even recession in some countries, with persistent high inflation disrupted the economic development in CEE and especially the situation of consumers more deeply than in 2020. In such conditions, Poland's economy coped relatively well. Baltic states are still struggling with recession. By the end of 2023, some signs could be observed indicating a reversal of the downward trend. This observation has been confirmed by the latest business and consumer research results. It should be expected that 2024 will be a period of a rebound from the downturn and coming back to the path of long-term growth in the CEE countries.

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Since the economic slowdown in late 2020s, economies of Central and Eastern Europe (CEE) have been going through a difficult time. Their economic processes were strongly affected by external factors: COVID-19 pandemic, energy crisis, and the war in Ukraine. The year 2023 was not a time of prosperity, either. The adverse economic situation in the region was exacerbated mostly by high inflation (see

Table 1) and the accompanying tightened financing of consumption through loans, resulting in worse household purchasing power and, consequently, worse internal demand in most countries. The effect was either slower growth (in Bulgaria, Romania, Slovakia), or economic recession (in Baltic states, Czechia, Poland, and Hungary). At the same time, situation on the job market in most economies remained good. In the second half of 2023 the pace of inflation processes began to gradually fade. Signs indicating that the downward trend in the business cycle would reverse occurred by the end of the last year.

This study analyses the situation in nine CEE economies: Bulgaria, Czechia, Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, and Hungary in 2023, with particular consideration for the economic climate in the processing industry, construction industry and trade. The analysis uses quantitative variables describing the macroeconomic situation: gross domestic product, investments, private consumption, retail sales, production sold in the processing and construction industries, as well as indicators developed on the basis of research on the economic climate made using the test method. They reflect opinions and sentiment of business actors.

The analysis of economic situation focuses on the evaluation of cyclical fluctuations, defined as deviations from the main trend. Reference variables for fluctuations in the region's economy are relevant macroeconomic indicators, describing the situation in the European Union as a whole (EU-27).

Table 1. Growth rate harmonised indices of consumer prices (HICP) in CEE countries and the EU in the years 2021–2023 (%, YOY)

Year	Slovakia	Romania	Poland	Hungary	Latvia	Lithuania	Estonia	Czechia	Bulgaria	UE-27
2021	2.8	4.1	5.2	5.2	3.2	4.6	4.5	3.3	2.8	2.9
2022	12.1	12.0	13.2	15.3	17.2	18.9	19.4	14.8	13.0	9.2
2023	11.0	9.7	10.9	17.0	9.1	8.7	9.1	12.0	8.6	6.4

Source: Eurostat.

General economic situation

The analysis of GDP changes in 2023 in CEE indicates significant differences in the conditions of individual economies. Seasonally adjusted real GDP growth in Poland in the 4th quarter of 2023 of 1.6% YOY was one of the highest rates in the EU-27, which placed Poland's economy on the 4th position in the region,[1] after Croatia

[1] Countries of the region are understood as those countries of CEE that have joined the EU after 2003.

(growth by 4.4% YOY), Slovenia (2.4% YOY), and Slovakia (2.2% YOY). Economic slowdown in Poland (in the first two quarters of the last year real GDP fell by, respectively, 1.1% and 0.5% YOY) stopped in the second half of 2023. A relatively fast economic growth in late 2023 occurred not only in Poland, but in other CEE countries. In Bulgaria in the last quarter of 2023 the real GDP growth rate was 1.6% YOY (from the 1st to the 3rd quarter it was 2.4%, 2.0%, 1.8% respectively), in Slovakia 2.2% YOY (0.8%,1.5%, 1.8%), and in Romania 1.1% YOY (1.1%, 2.8%, 3.5%). Much slower economic growth in the last quarter of 2023 was reported in Hungary – 0.5% YOY (–1.1%, –2.1%, and –0.2% in previous quarters), Czechia – 0.2% YOY (–0.2%, –0.1%, –0.6%), and Lithuania – 0.1% YOY (–2.1%, 0.8%, 0.1%). In two countries, Latvia and Estonia, the 4th quarter of the last year saw a decrease in real GDP by, respectively, 0.1% YOY (0.2%, –0.3%, 0.2%), and 2.5% YOY (–3.9%, –3.0%, and –3.1%). In the EU-27 economy in the 3rd and 4th quarter of 2023 real GDP (seasonally adjusted and smoothed) grew by respectively 0.1% and 0.2% YOY (a year earlier the growth rate was, respectively, 2.6% and 1.8%). In the euro zone GDP fluctuations in the last two quarters of the previous year were 0.1% (2.5% and 1.9% in the 3rd and 4th quarter of 2022).

It seems that despite the negative impact of high inflation, monetary policy tightening to combat the inflation, and the war in Ukraine on the economic climate in 2023, the situation in the EU and the CEE region is gradually stabilising and some signs of economic recovery are being observed. It is true that, based on currently available data it is impossible to establish the lowest turning point in the business cycle, but the analysis of fluctuations in the economic sentiment index (seasonally adjusted), which is strongly correlated with the real growth rate, suggests that the trough has been reached. Among the nine analysed CEE countries, in 2023 ESI dropped only in Estonia (by 2.4 pts, to 80.6 points). The biggest increase in ESI was reported in Slovakia (by 9.5 pts – from 85.6 pts in December 2022 to 95.1 pts the next year) and in Poland (by 9 pts – from 89.8 pts to 98.8 pts). Other countries with relatively fast ESI growth are: Lithuania (8.0 pts – increase to 99.3 pts), Hungary (7.7 pts – increase to 97.8 pts), and Czechia (7.4 pts – increase to 91.3 pts). In two countries, Latvia and Bulgaria, ESI was rising at a moderate rate, respectively by 3.3 pts (to 96 pts) and 4.2 pts (to 107.4 pts). The reference value for the sentiment index growth for EU-27 was 0.5 pts (to 96 pts). In all these countries the cyclical component of ESI showed a clear bottom turning point. Only in Estonia is the economic sentiment still falling, and in Romania it moves along a sideways trend (the change from December 2022 to December 2023 was 0.6 pts). Generally, despite the upturn in 2023, ESI values in most CEE countries remain below 100 pts, which indicates a large potential for economic climate improvement in the region. Results of research on the economic situation in January 2024 confirm this observation.

Private consumption

The situation of households in recent years, just as the general economic situation, was determined first by the economic crisis caused by the COVID-19, and then by the energy crisis and the war in Ukraine. As already mentioned, their consequence was a rapid growth of inflation rate across EU-27, especially in CEE. To combat inflation, central banks tightened their monetary policies, which raised interest rates, in some countries even by 10-odd percentage points. High inflation, combined with high interest rates, did have an impact on the economic situation of households and affected their economic behaviour. Lower purchasing power caused by an increase in non-adjustment of prices of consumer goods and services to nominal salaries resulted in reduced household consumption in some countries as soon as in late 2021. In part of the region (Estonia, Lithuania, Slovakia) real consumption is still declining. In Czechia, Poland, and Hungary, the decline stopped in the 2nd quarter of 2023 (although the real consumption is still lower than at the highest turning point in the 2nd quarter of 2022). In Bulgaria, Romania, and the EU-27 real consumption has been moving along a growth trend since the end of the COVID-19 crisis.

Cyclical fluctuations of household economic sentiment are more synchronous than cyclical fluctuations of real household consumption. Since late 2022 consumer sentiments in all the countries of the region have been moving up, except for Estonia, where since the 2nd quarter of 2023 the economic sentiment started to deteriorate again (we have no data for the last three years for Romania). The biggest improvement in the sentiment could be observed in Hungary and Poland (by 29 and 22 pts respectively), especially compared to EU-27 (increase by 13.5 pts). In the other countries the increase in the consumer sentiment index (CSI) was around ten-odd points. In Hungary, Czechia, Bulgaria, and EU-27, despite an upturn, consumer sentiments have not recovered to the level recorded in the last highest turning point (end of the 2nd and beginning of the 3rd quarter of 2021). In Estonia CSI is by 26 pts lower than at the last peak.

Business investments

After a 5.2% decrease in fixed assets investments in the EU in 2020 (due to the COVID-19 pandemic) and their rebound in the next year, in the first three quarters of 2022 the investment rate stabilised between 2.2% and 4.5% (quarterly, YOY, seasonally and calendar adjusted, in constant prices). In the last quarter of 2022, however,

the rate fell sharply (to 1.6%), and it has not recovered yet. It is probable that the local minimum of 0.7% annual growth occurred in the 3rd quarter of 2023. The growth in EU-27 investments in the 4th quarter of 2023 by 1.2% may suggest that that the trend has reversed.

Against this background the situation in CEE in 2023 looked better than on average in the EU-27. In each country of the region, apart from Hungary and Estonia, the investment rate in 2023 was higher than the EU average, and in each case, apart from Hungary and Bulgaria, average annual investment growth was higher in 2023 than in 2022. Thus, despite the shock of Russian invasion in Ukraine, high inflation and interest rates, enterprise investments did not collapse (which does not mean that the events did not negatively affect the investment rate).[2]

In 2023 the highest, yet quite changeable annual investment rate in the Visegrad Group was recorded in Slovakia (9.6%). Poland had second highest result in terms of real investments increase (8.4% YOY), with stable growth in each quarter. In Czechia investments started to rise substantially in the 2nd quarter of the last year, at an average annual rate of 4.0% YOY. Hungary clearly lags behind in this ranking, as its investments in 2023 dropped by as much as 7.4% YOY (according to preliminary data), although two quarters of higher, yet still negative, investment growth rate may be a sign of recovery.

The highest growth of fixed assets investments in 2023, which was also most stable in consecutive quarters, was reported in Romania (14.4% according to preliminary data). The lowest and least stable increase was found in Bulgaria (3.3% according to preliminary data). Among Baltic states both Lithuania and Latvia had in 2023 high and stable investment growth of 10.6% and 8.2% respectively, unlike Estonia, where real investments fell by 3.4% and fluctuated significantly.

The average annual investment increase and changes between respective quarters of 2023 allow us to be optimistic about their further development in CEE countries, and thus a positive impact on their economies. In some cases, such as Poland and Romania, a continuing investment upturn can be observed – the lowest turning point in the investment cycle occurred in 2022 or in early 2023. In other cases, especially in Baltic states and Hungary, there is no formal basis (three consecutive quarters of improvement) to identify a cyclical upturn phase.

[2] Evaluation based on descriptive statistics (here: time series) cannot be regarded as fully reliable. It would require more complex (e.g. econometric) analysis in *ceteris paribus* conditions, i.e. taking into account all other factors shaping the business investment rate.

Economic situation in the processing industry

Changes in the economic confidence in the processing industry in the CEE countries have had a considerable impact on the general economic situation, and their course is the closest to GDP fluctuations. After the 2022 downturn, industrial production has been changing a lot. First signs of recovery occurred in late 2023. It was reflected by confidence indicators in the processing industry, which are leading indicators towards quantitative data, just like other variables covered by the research on economic situation. In the first quarter of 2024 the economic situation indicators in the processing industry kept growing. Combined with optimistic forecasts of manufacturers about the coming months, this gives hopes for a permanent recovery.

In the EU, the index of sold production of the processing industry (2015 = 100) reached its top turning point at the end of the 3rd and beginning of 4th quarter of 2022. In the next year, the index value was gradually falling. Only in the last quarter of 2023 did it rise, so it is impossible to state, based on a cyclical component analysis, whether the downward trend was reversed. The upturn by the end of the year was so strong that it lifted the index value by 2.6 pts above the December 2022 result. A disruption of the downward trend is visible in the course of cyclical component of industrial confidence indicator (ICI) for the processing industry – the lowest turning point in the cycle was recorded in August 2023. Starting from September, increase in the (seasonally adjusted and smoothed) indicator was small, but, considering data from January and February 2024, it is clear that the sentiment among manufacturers has been optimistic. The improvement in sentiment probably forecasts an improvement in the economic situation in the processing industry in the EU-27 in 2024.

The course of changes in the economic situation in the Visegrad Group was similar, especially in Poland. First three quarters of 2023 were a period of decline in the sold production index, which began already in the second half of 2022. At the turn of the 3rd quarter (4th quarter in Czechia and Slovakia) signs of recovery could be seen. By the end of the year the index value in Czechia and Slovakia was higher in December 2022 – 2.5 and 1.5 pts respectively, while in Poland it was lower, but only by 1.2 points. Only in Hungary does the downward trend continue and the cyclical component of the index does not show any signs of recovery. However, an analysis of fluctuations of ICI (seasonally adjusted and smoothed) for this group of countries suggests a clear upturn in the economic situation. Its signs are visible especially in cyclical components. In Poland and Slovakia the downward trend was reversed already in the 1st quarter, in Czechia and Hungary it did so in the 3rd quarter. Although in all these countries the sentiment index values remained negative until the end of the year, they have been consistently rising since the breakthrough moment (lower turning point).

In 2023 in Czechia, Poland, and Slovakia ICI values where higher than the year before by, respectively: 3.4, 2.8 and 11 pts. Only in Hungary by the end of the year was the index lower than in December 2022 (by 2.9 pts). Data for the first two months of 2024 indicated that the growth trend across the Visegrad Group has stabilised.

The course of changes in the economic situation in Baltic states has been different, though. Values of the sold production index are much higher than in the EU-27. There are no clear signs of the downward trend stopping or even slowing down. Certain signs of upturn could be observed in Estonia and Latvia in late 2023; in Lithuania, the index fluctuates around the level established in the second half of 2022. A potential recovery is however suggested by industrial confidence indicators. Lower turning points were recorded already in the 1st quarter of 2023. In Lithuania (seasonally adjusted and smoothed) ICI value has been growing since June, and in December it was by 10.3 pts higher than the year before. In Estonia and Latvia the increases are not that strong, and were hampered by the decline continuing since the 3rd quarter of 2022; by the end of the year the sentiment index in Latvia was only by 1.0 pts lower than in December 2022 (in Estonia the difference is 6.2 pts).

Yet another scenario of changes was observed in Bulgaria and Romania. Both countries are going through a downward trend that started already in the second half of 2022. For the entire year 2023 the values of (seasonally adjusted and smoothed) index of sold production in the processing industry were either falling (Bulgaria) or fluctuating around 111–114 pts, without any signs of an upturn (Romania). In Bulgaria, the index value in 2023 fell to a level by over 13 pts lower than in the end of 2022, thereby making the country's industry one of the worst performing in the region. Unlike other CEE countries, the industrial sentiment index in the processing industry does not show any signs of the downward trend coming to an end. In Romania ICI has been rising since October 2023, and data for the first two months of 2024 seem to confirm that an upturn phase began by the end of the last year.

Confidence indices in most CEE countries therefore indicate a recovery in the processing industry and continuous improvement of the economic situation. In order for these changes to become permanent, it is necessary for the manufacturers' sentiment to strengthen and for business activity conditions to stabilise. In Poland, a rapid rise in optimism among producers can be observed since the announcement of parliamentary elections in October 2023. Improved sentiment is also evident in other countries of the region, except for Bulgaria. Let us remember that in recent years industrial enterprises have been operating in the conditions of growing uncertainty caused by internal and external tensions, sometimes of non-economic nature. Even if state authorities do not have any control over fortuitous events and shocks in the external economic environment, they should reduce the adverse economic impact

of those factors which are external in nature. One of the main limitations for business activities was recently the demand barrier. It was becoming more burdensome with the growth of inflation, which reduced purchasing power of income and curbed competitiveness of goods on international markets. An increase in demand depends on how effectively inflation is combated by state monetary authorities. Uncertainty may also be substantially alleviated by fiscal policy. Factors of great importance for entrepreneurs are less burdensome administrative barriers, stable law, and reasonable, predictable tax policy. Business sentiment, measured by e.g. ICI, is very sensitive to changes in the economic policy in the business environment. In recent months they have been improving, which is evidence of some stabilisation of business conditions in the eyes of manufacturers on the one hand, and on the other it translates (with a few-months' delay) into a better situation in the processing industry. Initial data for 2024 confirm this causality.

Economic situation in the construction industry

Because of persistent high inflation, supply chain disruptions, and high costs of production, a downturn in the economic situation in the region's construction industry is being observed.[3] The index of sold construction and assembly production (2015 = 100, seasonally adjusted and smoothed) in Bulgaria, Czechia, Hungary and Slovakia in the 4th quarter of 2023 was lower than in December 2022 by, respectively: 2.1, 4.4, 7.6, and 8.5 pts. An increase was recorded only in Poland and Romania, by, respectively: 20.5 and 39.6 pts. In UE-27 the increase was 2.5 pts.

Like in the processing industry, the downturn in the building sector in 2022–2024 was substantially affected by worse sentiment in the industry. In all the region's economies values of the construction confidence indicator (CCI, seasonally adjusted) in 2023–2024 were negative, although in some CEE countries the sentiment improved. Between December 2022 and December 2023 the indicator values rose in Poland (by 6.9 pts), Bulgaria (by 9.1 pts), Romania (by 2.2 pts), and Latvia (by 2.4 pts). Decreases were recorded in Lithuania (by 3.5 pts), Hungary (by 0.8 pts), Slovakia (by 4.0 pts), Czechia (by 3.0 pts), and Estonia (by 7.6 pts). In the EU-27 the indicator value since May 2023 has been negative, and the difference between December 2022 and December 2023 was –6.8 pts.

In the research on the situation in the Polish construction industry, conducted by the SGH Institute Economic Development in the 1st quarter of 2024, higher prices of

[3] This is indicated also by a lower number of building permits issued.

building materials were found to be the major development barrier, according to 56.3% of construction companies' representatives (72.5% in the 1st quarter of 2023). Just like processing industry enterprises, construction companies have to face challenges posed by excessive tax burden (47.4%) and unstable law (44.8%). The situation of the construction industry in Poland depends on the date of launching the national recovery plan, EU regulations on building industry's net zero CO2 emissions, and the election calendar, which makes local government less eager to initiate investment projects. At the same time, the government Safe Loan 2% programme drives lending and pushes up property prices in many Polish cities.

Fewer tendering procedures for construction works, shortage of skilled workers and growing building costs have led to a significant deterioration of sentiment among Lithuanian construction companies. Persisting high prices of building materials and components have a negative impact on construction activities also in Slovakia. In Hungary, high inflation and interest rates exacerbate the consequences of government cuts in infrastructure spending in the face of uncertainty about receiving EUR 10.4 billion under the national recovery plan.

In September 2023, the European Commission confirmed a modified EUR 9.2 billion national recovery plan for Czechia, pursuant to which 43% of funds will be allocated for green transformation and 23% – for digital transformation. Green transformation assumes investments in energy and transport, as well as development of new sources of solar energy, railway electrification and modernisation of electricity grid across the country.

In 2022 Latvia observed a significant decline in its construction and assembly production. However, last year the industry stabilised and its production grew rapidly: by some statistics, the rise reached almost 18.5%. It is expected that the building sector may also grow in 2024 and the following years, considering the availability of EU funds under national recovery plans and Rail Baltica project.

According to preliminary data of Statistics Estonia, in 2023 the total value of Estonian construction companies' production in the country and abroad grew by 6.1%, compared to 2022. As for the national market only, the volume of construction growth was 3.8%. The construction market in 2024 will be determined by a growing increase in construction costs, higher interest rate, and worse consumer confidence.

In Bulgaria, an economic decline in 2023 was caused by higher costs of materials, energy, and labour. Bulgaria was granted EUR 8.1 billion under the national recovery plan, which may considerably affect the construction industry in the coming years.

A record increase in the industry volume was recorded in Romania, both due to investments in transport infrastructure projects, and in electricity and housing projects. Investments made as a part of EUR 28.5 billion national recovery plan will

contribute to the growth of Romanian construction market in the nearest future. According to the plan, 44.1% of funds will be allocated for green transformation, and 21.8% – for digital transformation.

Attracting skilled workers, cost management and stimulating demand for construction projects are key factors for the improvement of the sector's situation in the region. Investments in renewable energy projects and transport energy projects financed from national recovery also remain important.

Economic situation in trade

The fact that the trade sector is so diverse and complex, and that it is so strongly linked to the global economy (supply chains) makes it particularly exposed to consequences of any sudden events disrupting these relations and the flow of goods. We observed it during the COVID-19 pandemic and can still observe it in CEE countries neighbouring Russia, Belarus, and Ukraine, which are directly exposed to the shock of Russian invasion in Ukraine.

In 2020 CEE countries experienced a deep economic decline as a result of the COVID-19 pandemic. Two years later, when the region's economies started to recover from the crisis and gradually improve, they received another blow caused by Russia's attack on Ukraine and resultant outflow of foreign capital, inflow of immigrants, restricted international trade with Russia, and energy crisis, which provoked an increase in energy prices. Year 2022 was therefore a period of downturn in the trade sector. However, in the last quarter the situation improved slightly, partly because businesses had adapted to the new conditions. Year 2023 in trade can be divided into two periods. In its first half the economic climate in trade kept deteriorating across the EU-27 and CEE, while in the second half the adverse trend reversed in some countries of the region.

In Poland in the first half of 2023 the situation in trade improved. Value of IRGTRD (indicator of economic situation in trade developed by SGH Institute of Economic Development) increased in the 1st quarter of 2023 by 9.1 pts, to –3.6 pts (compared to –12.7 pts in the 4th quarter of 2022). In the 2nd quarter of 2023 it grew by 12.4 pts, exceeding the last ten-years average for second quarters. Data about retail sales were worse, since the value of sold goods (in constant prices) in the 1st quarter fell by 3.5% YOY, and in the 2nd quarter by 7.3% YOY. In the first half of the year the biggest drops in retail sales in Poland were reported for the following categories: "solid, liquid, and gas fuel," "press, books, and other goods sold in specialised shops", and "other" (15% YOY each); only in one category, "automobiles, motorcycles, components" did the index increase (by 0.1% YOY).

The value of seasonally adjusted retail trade confidence indicator (RCI) across the EU in the first half of 2023 fell by 1.6 YOY. In the CEE countries the decline in the trade sector was deeper than in other European countries; the index dropped in Slovakia (by 25.2 pts), Estonia (by 22.6 pts), Hungary (by 9.3 pts), Bulgaria (by 6.8 pts), Romania (by 4.1 pts) and Czechia (by 3.9 pts). Only in Latvia and Lithuania an increase was observed of 5.0 and 2.2 pts, respectively.

The second half of 2023 in Poland was a period of downturn in the trade sector, as the IRGTRD index fell by 11.9 points in the 3 rd quarter to –3.1 pts, and later by further 6.4 pts, thereby ending the year at –9.5 pts. The downturn was also visible in data concerning retail sales. Although the real value of goods sold in the 3 rd quarter grew by 1.4% YOY, in the next quarter it fell by 0.5% YOY. Retail sales in real term in the entire year 2023 (i.e.. in December 2023 compared to December 2022 dropped by 2.3%. The biggest drops were observed in the following categories: "sales of books and other products in specialised shops" (by 14.7% YOY), and "furniture and household appliances" (by 13.4%), while increases occurred only in the categories "automobiles, motorcycles, components" (by 6.5%), and "pharmaceuticals, cosmetics, orthopaedic equipment" (by 0.7%).

In the second half of 2023 in EU-27 the index measuring the situation in trade (RCE) grew slightly – by 1.1 pt. The economic situation in CEE was changing in different directions and with various force. From December 2022 to December 2023 the indicator rose in Slovakia (by 11 pts), Hungary (by9.1 pts), Romania (by 3.9 pts), and Czechia (0.7 pts). Decreases were recorded in Lithuania (by 0.2 pts), Bulgaria (by 0.6 pts), Latvia (by 1.0 pts), and Estonia (by 6.5 pts).

In general, the decline in trade continued in 2023. In December the volume of real retail sales (seasonally adjusted and smoothed) was lower or slightly higher than the year before – the biggest drops in the single-based index value (2015 = 100) were found in Estonia (by 5.7 pts) and Slovakia (by 4.9 pts), in Bulgaria and Hungary the drops were smaller, by 0.6 pts each, which is exactly the same as for the entire EU. Moderate increases occurred in Poland (by 0.6 pts), Czechia (by 0.8 pts) and Latvia (by 0.9 pts). The biggest increases in real retail sales were reported for Lithuania (by 2.6 pts) and Romania (by 2.5 pts). In the second half of the year in some countries (Czechia, Hungary, Romania, and, to a smaller extent, in Poland) some signs of an upturn could be observed, which were confirmed by qualitative indicators. In most CEE economies the indicator of economic situation in trade by the end of the year was lower than the year before – the biggest RCI drops were found in Slovakia (by 16.7 pts) and Estonia (by 10.6 pts), in the second half of the year the decrease slowed down (except Baltic countries), and in some cases (mostly in the Visegrad Group) an upward trend started to emerge.

Summary

The year 2023 in CEE countries was a time of economic decline and changing sentiment of economic actors. High inflation, combined with high interest rates, had a powerful impact on the economic situation of households and affected their economic behaviour. Lower real incomes resulted in reduced private consumption. In part of the region (Estonia, Lithuania, Slovakia) real consumption is still declining. In Czechia, Poland, and Hungary the downward trend ended in the 2nd quarter of 2023. Economies of Bulgaria and Romania are on an upward trend, carried by consumer optimism.

The situation was relatively good in terms of investments – in CEE countries it was better than on average in the UE-27. In the entire region, apart from Hungary and Estonia, the investment rate in 2023 was higher than the EU-27 average, and in each case, apart from Hungary and Bulgaria, average annual investment growth was higher in 2023 than in 2022. It can be said that against the background of CEE economies, Poland and Romania are experiencing a strong investment upturn. Generally speaking, despite the shock of Russian attack on Ukraine, high inflation and interest rates, business investments did not collapse.

However, the situation on the production side turned out to be more difficult. Here changes proceeded in different directions with various force in individual countries of the region and economy sectors covered by the study. In the processing industry 2023 was a year in which the downward trend that had begun a year earlier continued. In the Visegrad Group states signs of recovery were observed in the autumn of 2023, confirmed by qualitative indicators. In Baltic countries similar signs occurred by the end of 2023 and at the beginning of 2024. Bulgaria and Romania are still going through a slowdown and see no signs of reversal of the negative trend.

A similar situation is observed in the construction industry. In most economies of the region the sector is going through a serious decline, exacerbated by negative sentiment. Only in Poland and Romania some signs of an upturn in the building sector can be seen. The year 2023 in trade can be divided into two periods. In its first half the economic climate continued to deteriorate (across the EU-27 and CEE), while in the second half the adverse trend reversed in some countries of the region. Some signs of an upturn, confirmed by qualitative indicators, could be observed in the second half of the year in Czechia, Hungary, Romania, and, to a smaller extent, in Poland.

To sum up, in 2023 the countries which performed best in the difficult unfavourable conditions were those from the Visegrad Group, in particular Poland. Baltic countries are still in recession caused by overlapping crises. In the second half of 2023 most economies of the region observed numerous signs of recovery. Results of

the research on the economic condition in the first months of 2024 suggest that an economic revival in CEE is coming. The expectation of the revival is reasonable, especially considering the fact that the biggest economy of the region has recently gained access to EU funds under the national recovery plan.

APPENDIX

Attachment 1. Description of variables

The analysis covered major quantitative macroeconomic indicators:

- gross domestic product (GDP), constant prices 2015 = 100, Q1 1995 – Q4 2023;
- consumption of households and *non-profit* organisations providing services for households (CONS), constant prices 2015 = 100, Q1 1995 – Q4 2023;
- investments (INV), constant prices 2015 = 100, Q1 1995-Q4 2023;
- sold production of the processing industry (IP), constant prices 2015 = 100, January 2000 – December 2023;
- sold production of the building and assembly industry (BLD), constant prices 2015 = 100, January 2000 – December 2023, excluding Estonia, Lithuania, and Latvia because of unavailability of data;
- trade retail sales (TRD), constant prices 2015 = 100, January 2000 – December 2023;
- and qualitative data from research carried out using business situation test method:
- economic sentiment indicator (ESI), January 1996 – January 2024;
- consumer sentiment index (CSI), May 2001 – January 2024, excluding Romania because of unavailability of data;
- industrial confidence index (ICI), January 2000 – January 2024;
- construction confidence index (CCI), January 1998 – January 2024;
- retail trade confidence index (RCI), January 2000 – January 2024.

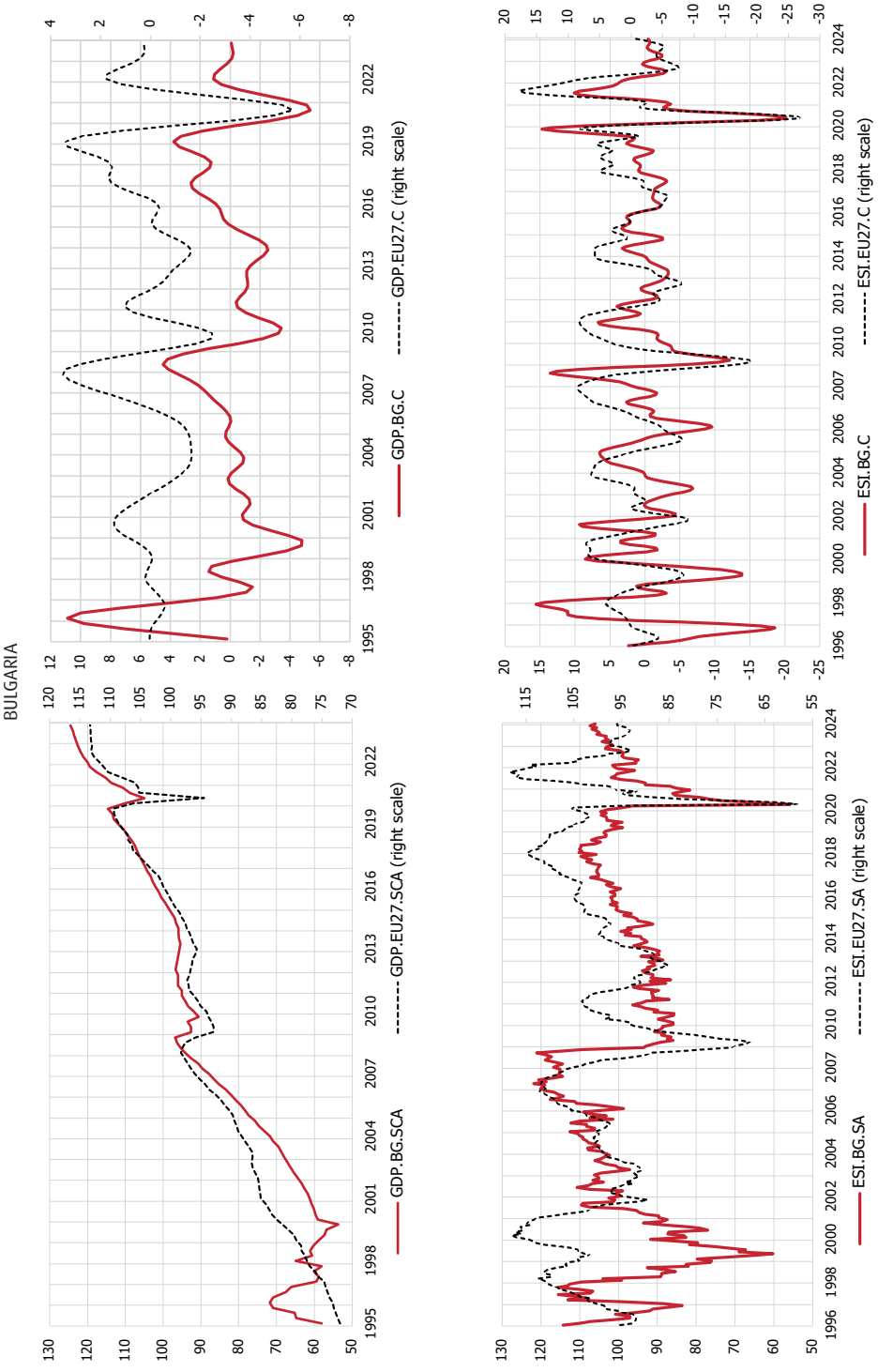
Time series for confidence indicators in the processing and construction industries and retail trade sector in Poland were taken from research on economic climate conducted by the SGH Institute of Economic Development.[4] The other data are based on Eurostat (https://ec.europa.eu/eurostat/data/database) in the form of seasonally adjusted (SA) or seasonally and calendar adjusted (SCA) series, subject to availability.

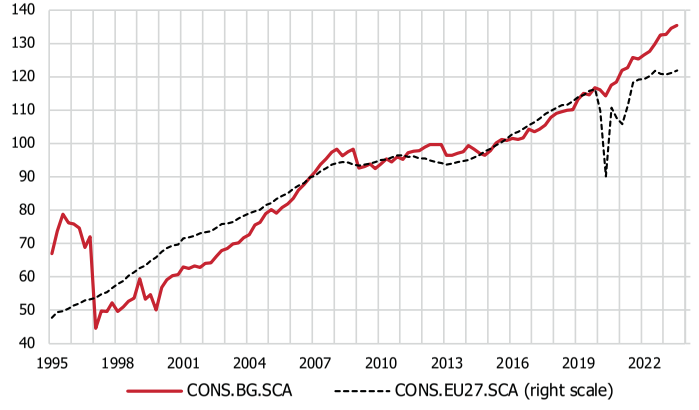
[4] More information about economic climate research by the SGH Institute of Economic Development is available on http://kolegia.sgh.waw.pl/pl/KAE/struktura/IRG/ koniunktura/ Strony/default.aspx (accessed: 12.06.2024).

Cyclical components (C) were separated using Christiano – Fitzgerald filter. Data of the SGH Institute of Economic Development have been de-seasonalized before detrending using the X-13ARIMA-SEATS method.

Adjusted series and their cyclical components in charts in Attachment 2 are described in the following manner: [code_of the indicator]. [code_of the country]. [code_of transformation_of series]. For example GDP.BG.C means cyclical component of single-based index for Bulgarian GDP in (average) prices from 2015, ICI.PL.C means cyclical component of the Polish industry confidence indicator (based on the research of SGH IED).

Attachment 2. Graphic documentation

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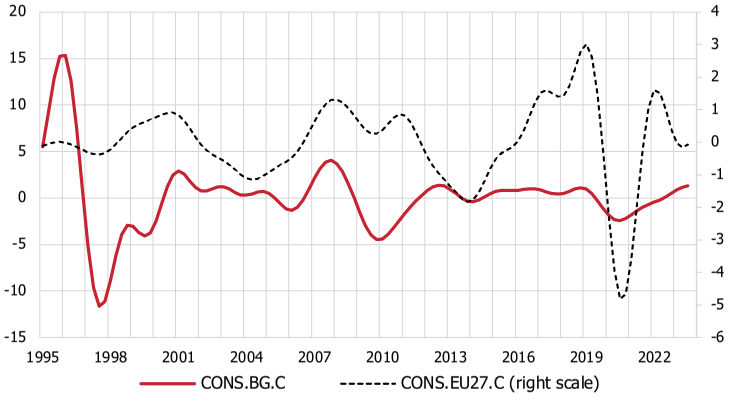
CONS.EU27.SCA (right scale)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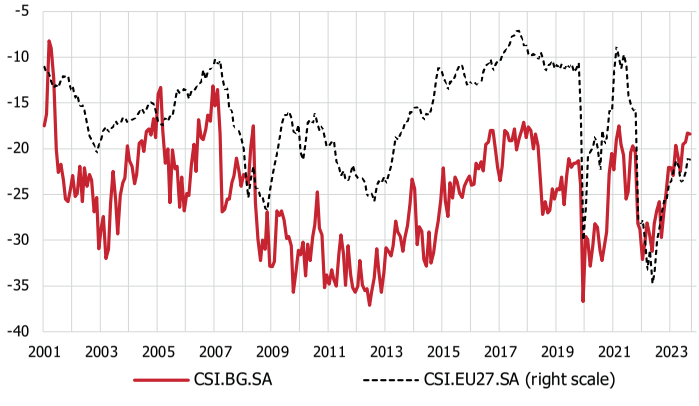
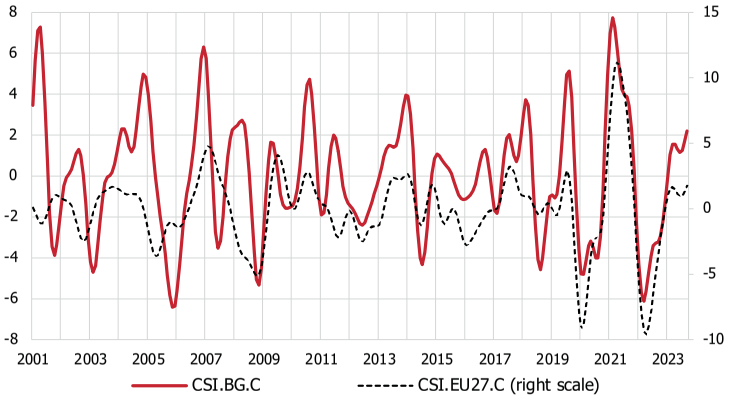

CSI.BG.SA
CSI.EU27.SA (right scale)


CSI.BG.C
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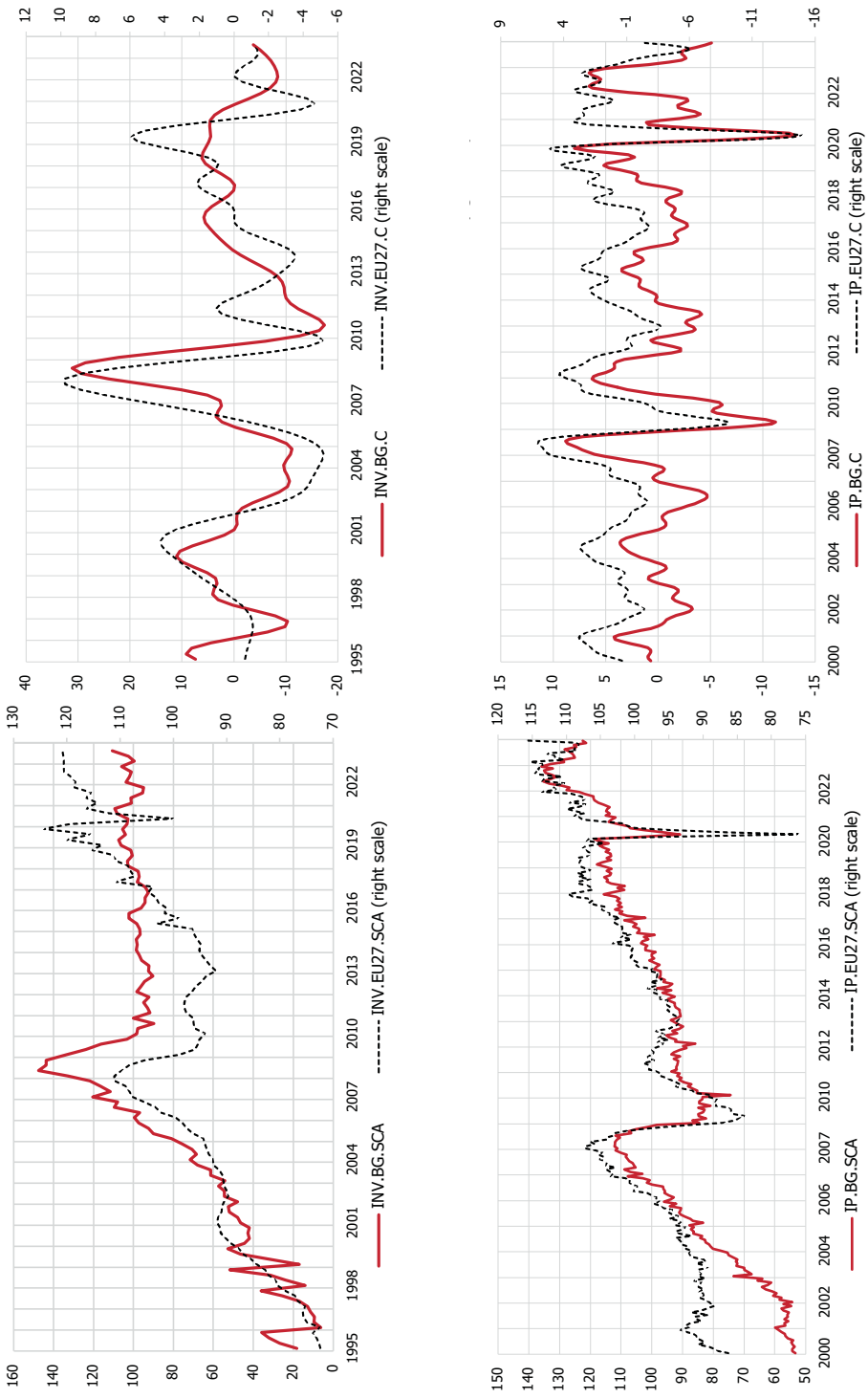
INV.BG.SCA
INV.EU27.SCA (right scale)
INV.BG.C
INV.EU27.C (right scale)
IP.BG.SCA
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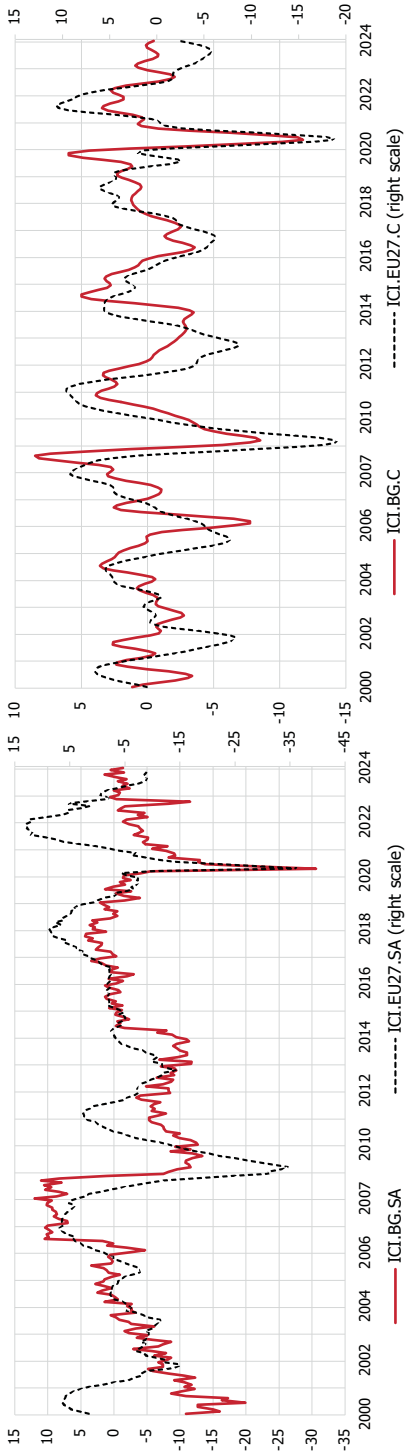
IP.BG.C
IP.EU27.C (right scale)


ICI.BG.SA
ICI.EU27.SA (right scale)

ICI.BG.C
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CCI.BG.SA
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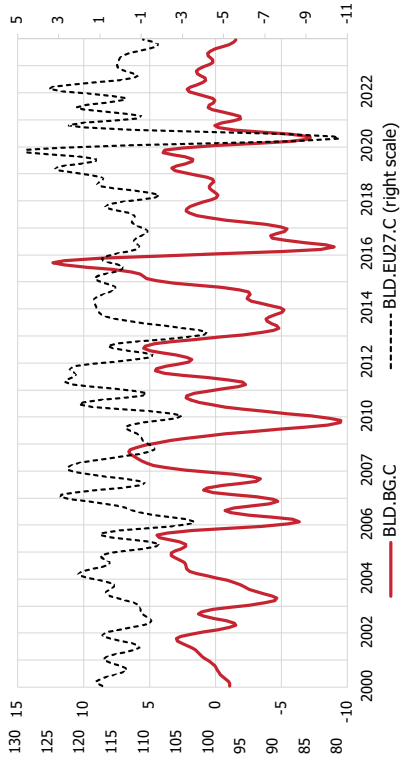
CCI.BG.C
CCI.EU27.C (right scale)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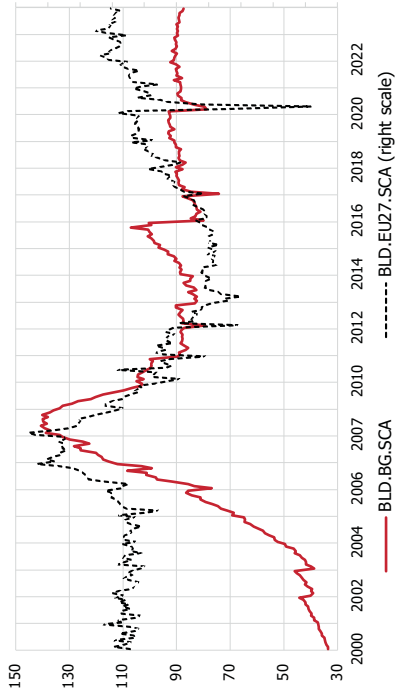
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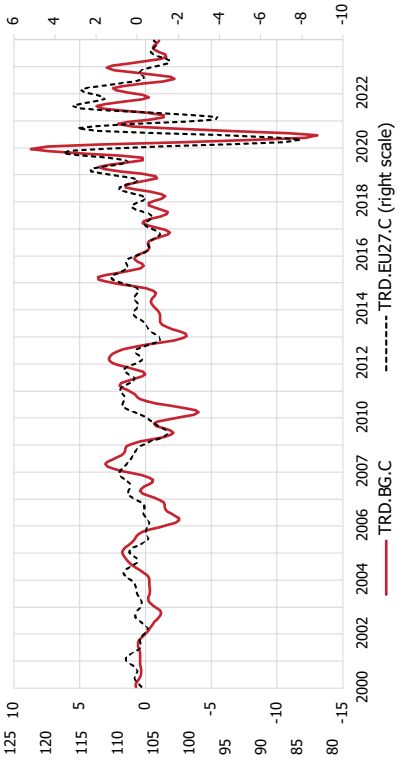
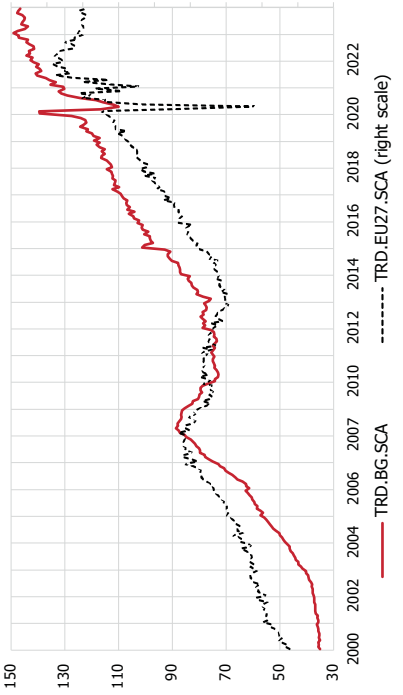

TRD.BG.C
TRD.EU27.C (right scale)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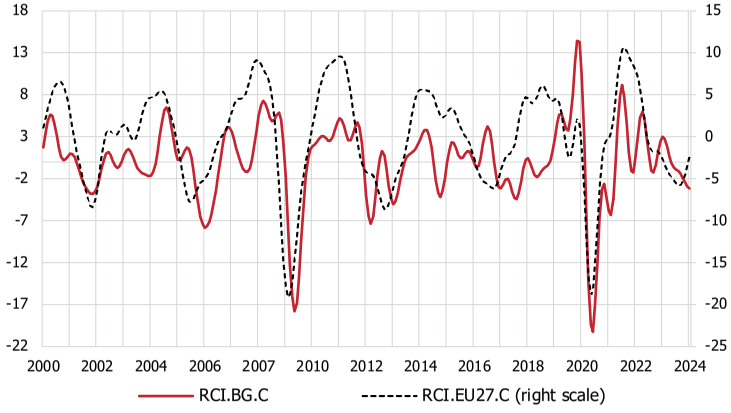
TRD.EU27.SCA (right scale)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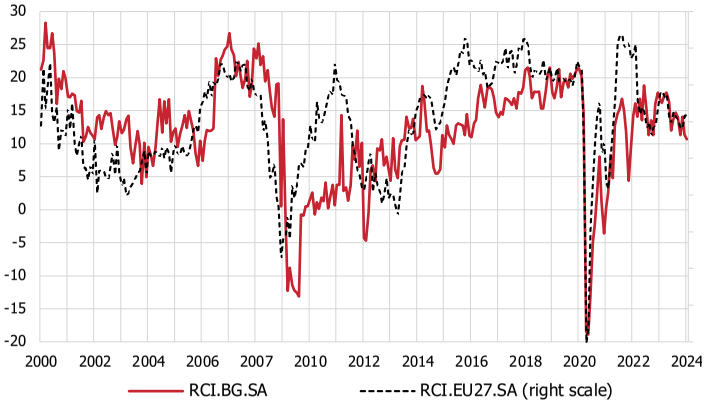
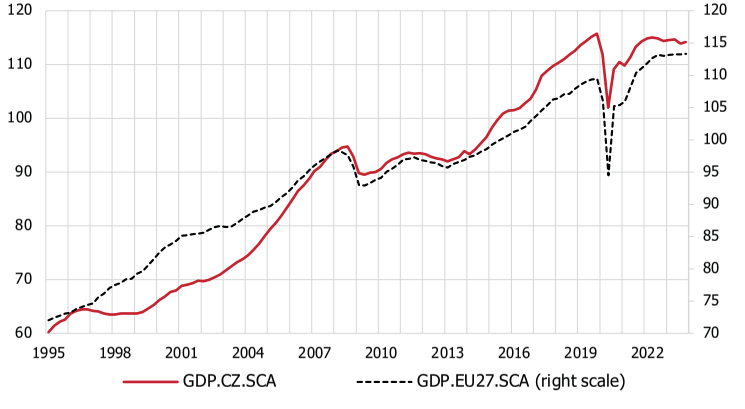

RCI.BG.SA
RCI.EU27.SA (right scale)

CZECHIA


GDP.CZ.SCA
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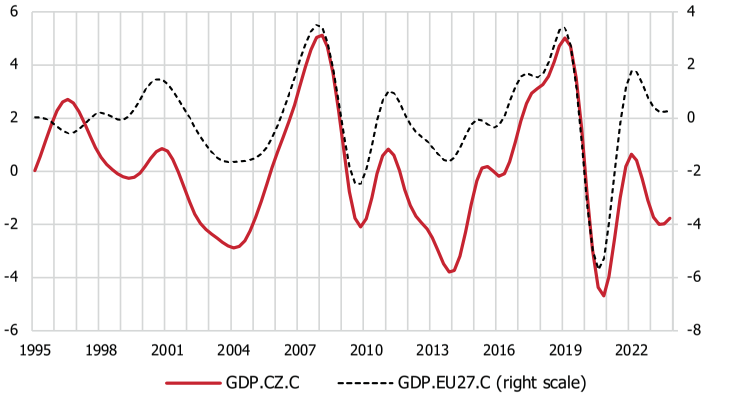
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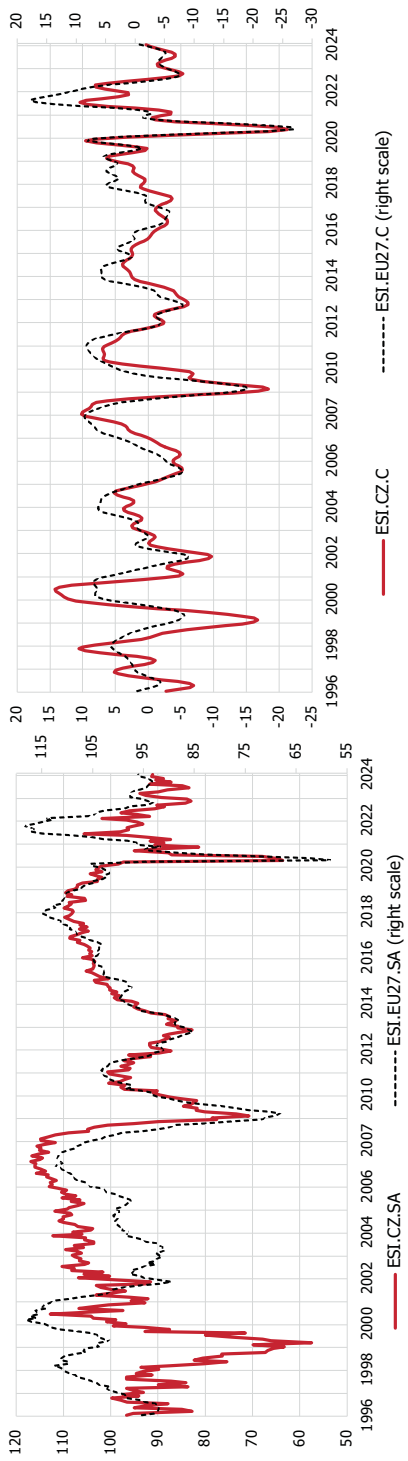
GDP.EU27.C (right scale)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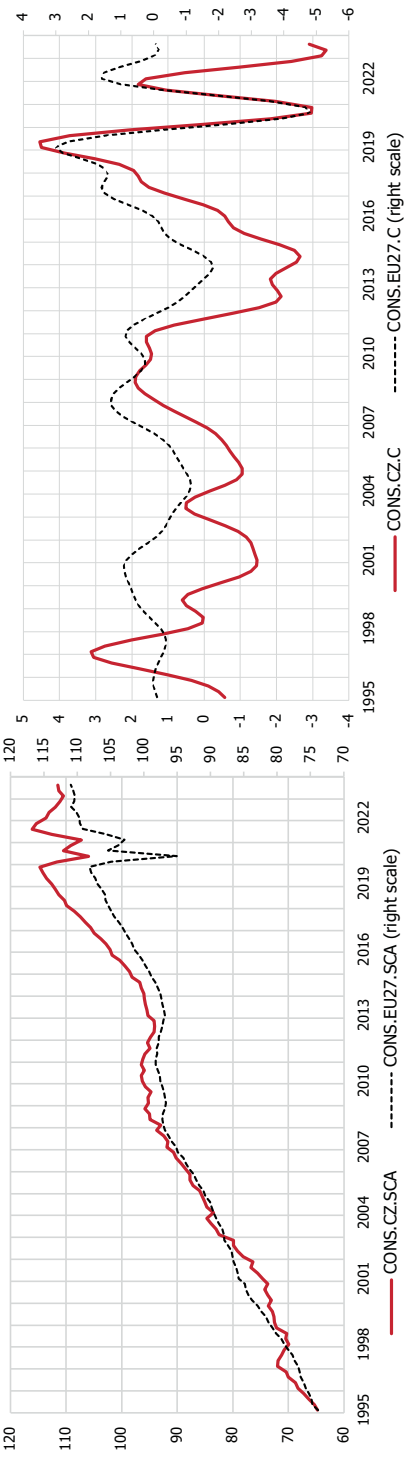
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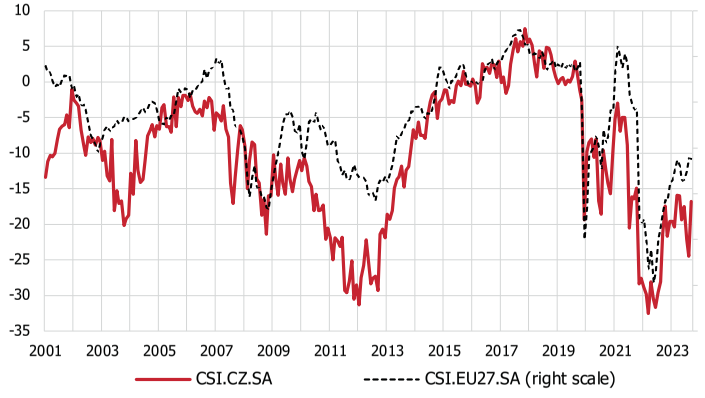
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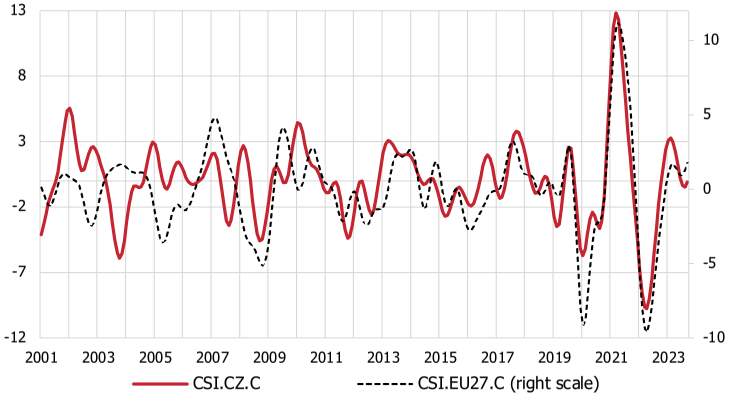
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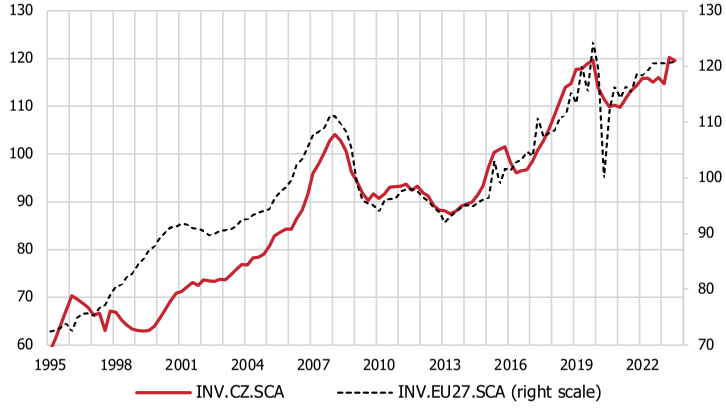
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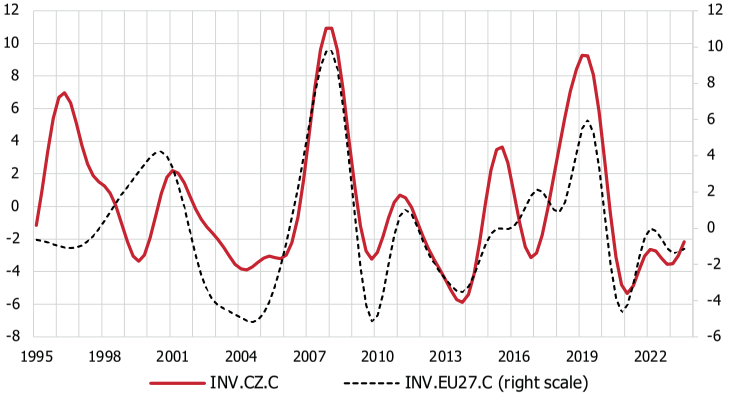
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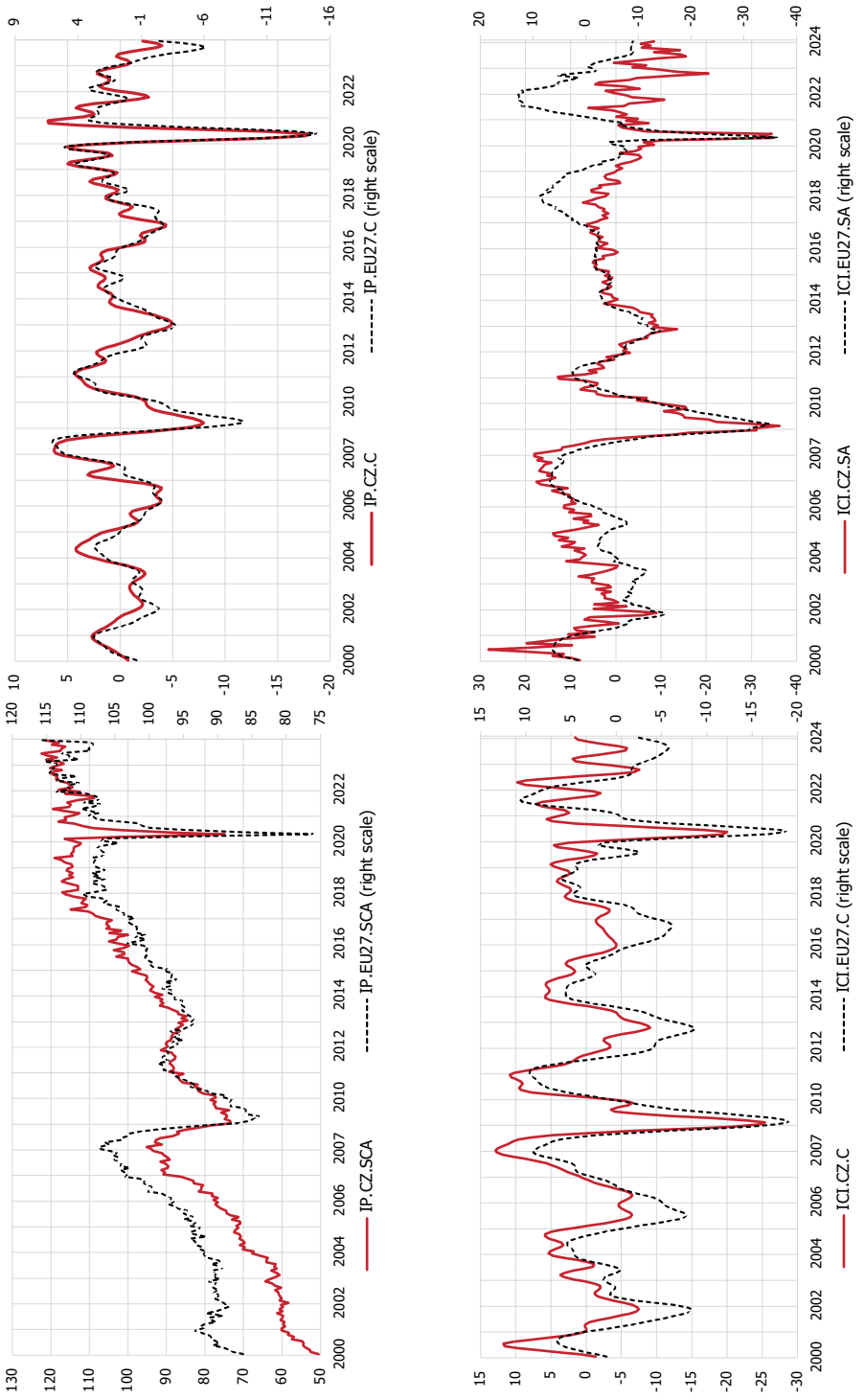
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ICI.CZ.SA
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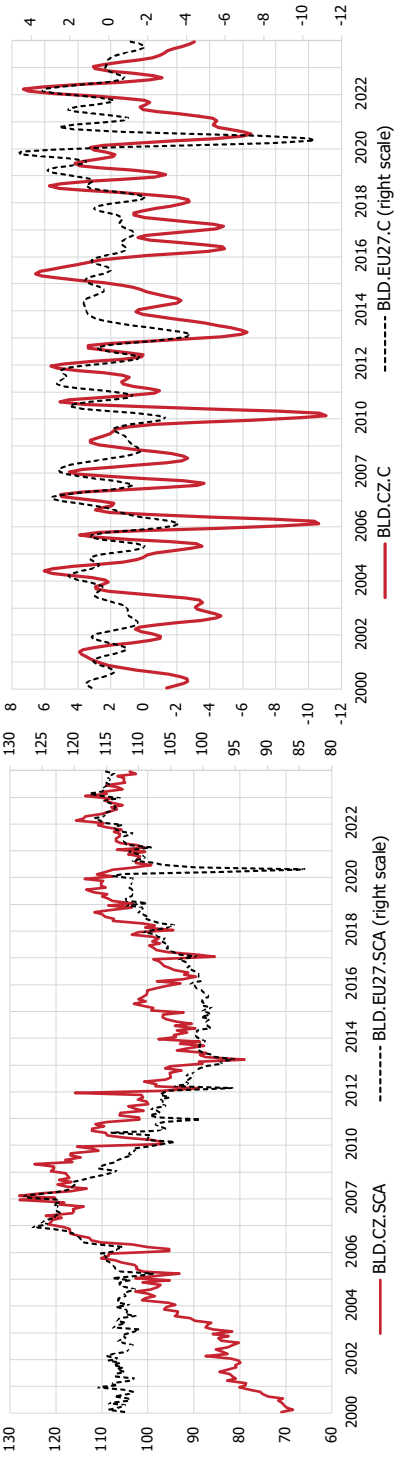
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BLD.CZ.C
BLD.EU27.C (right scale)

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CCI.CZ.C
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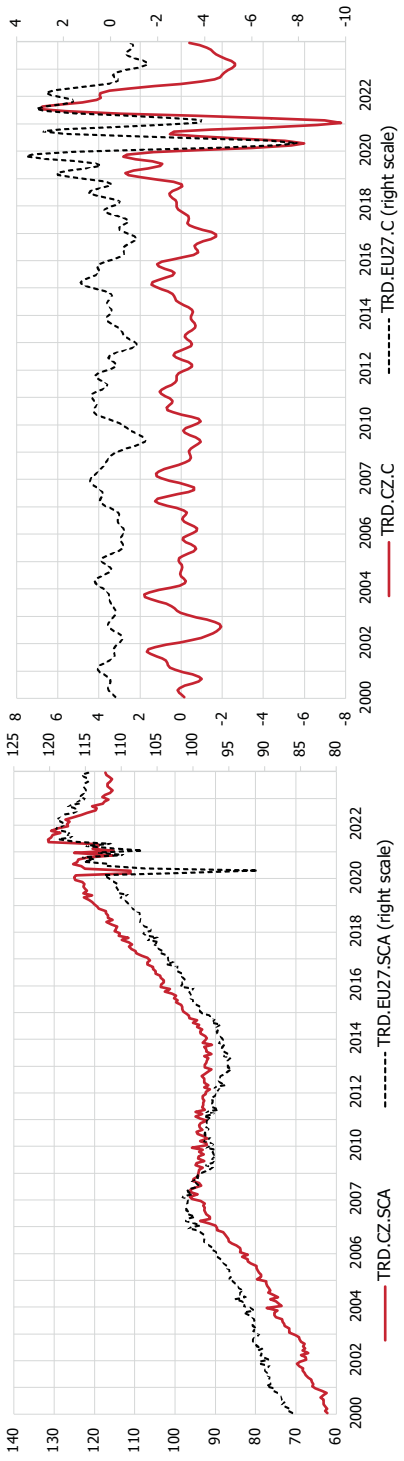
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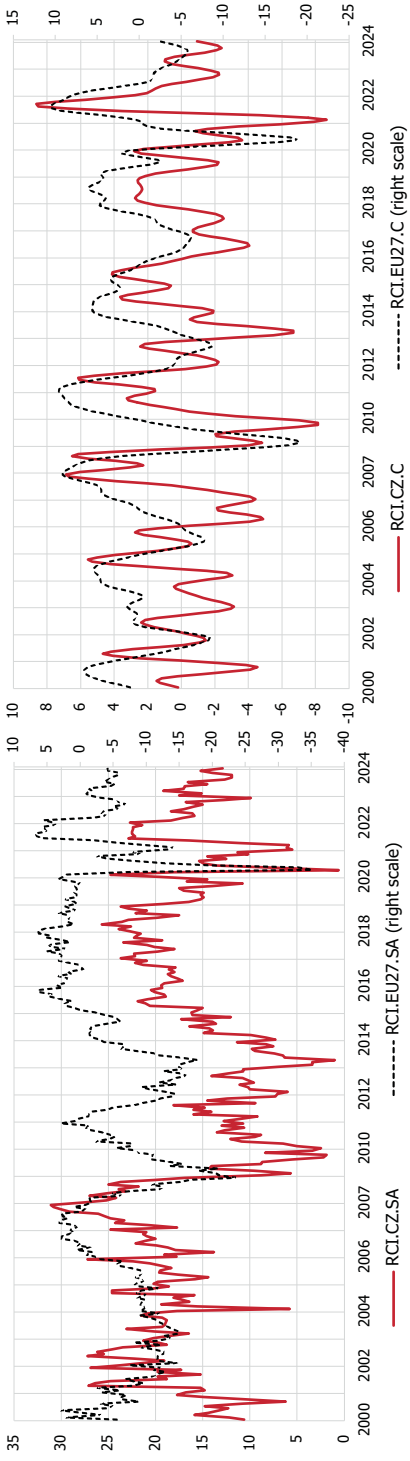
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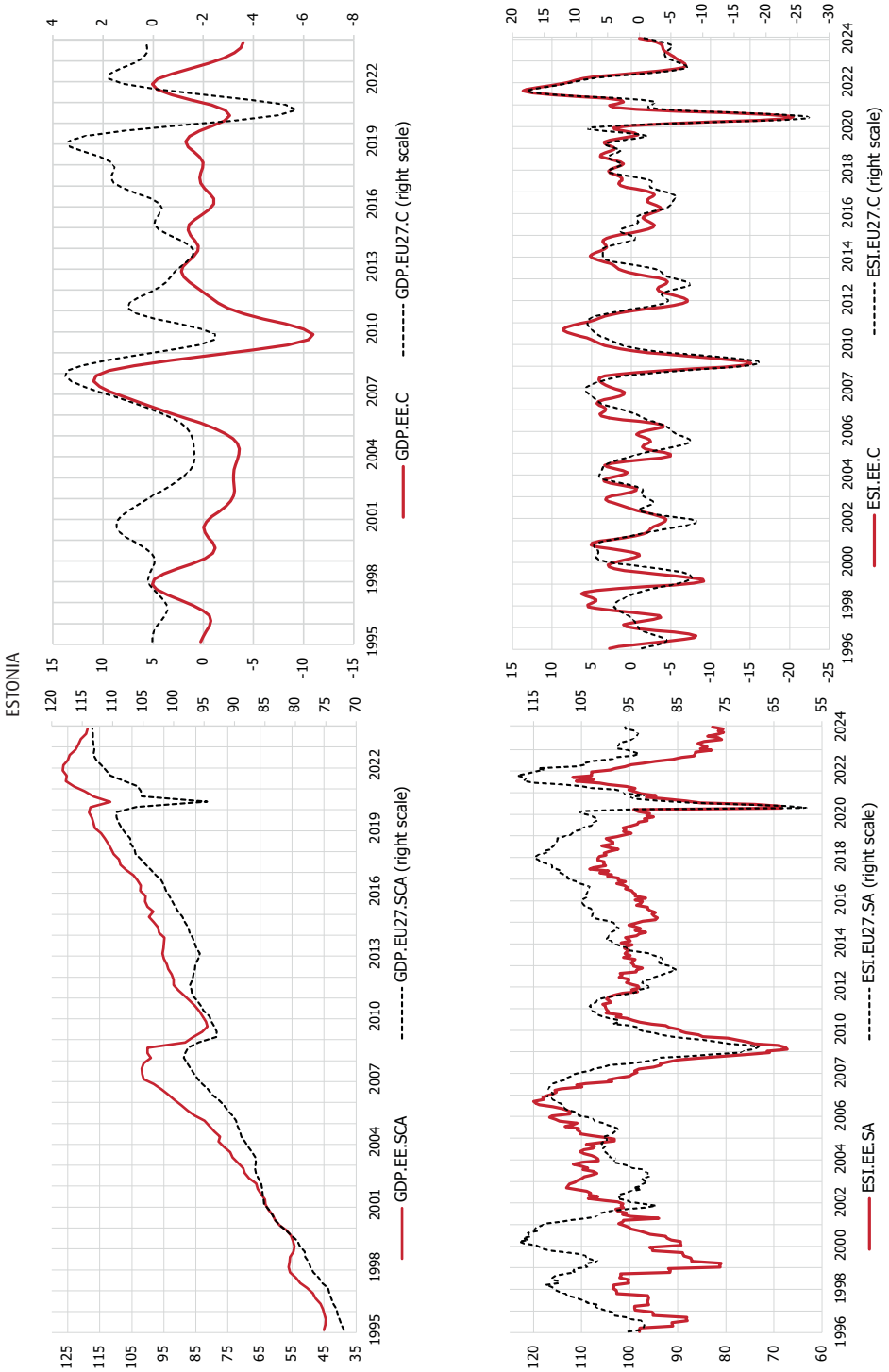
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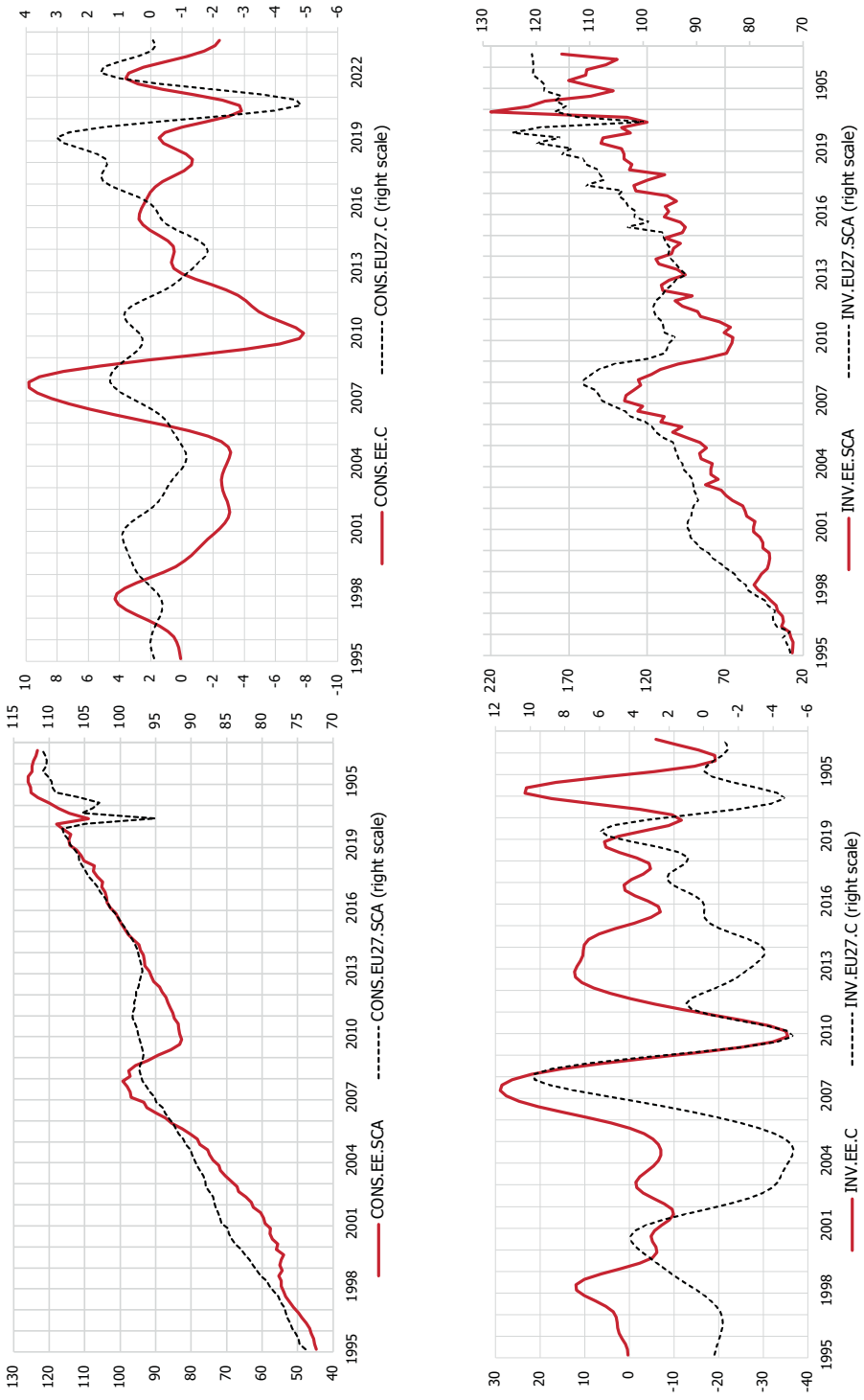
CONS.EE.SCA
CONS.EU27.SCA (right scale)
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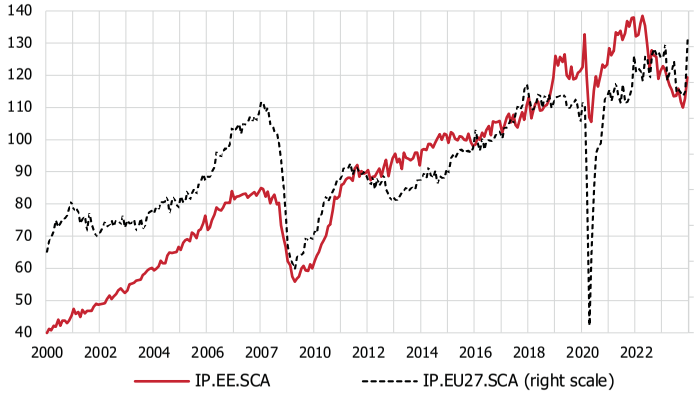
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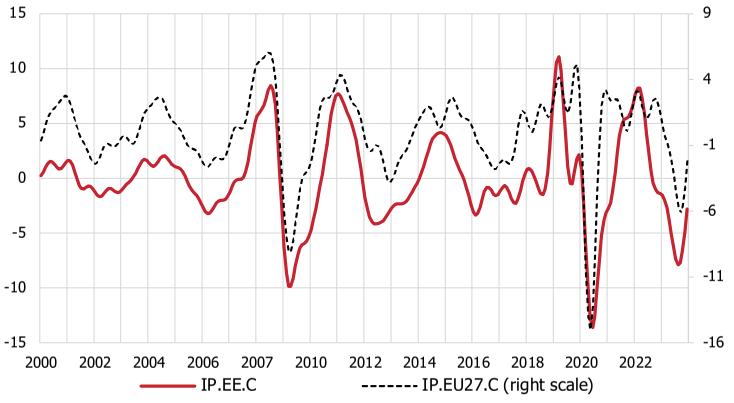
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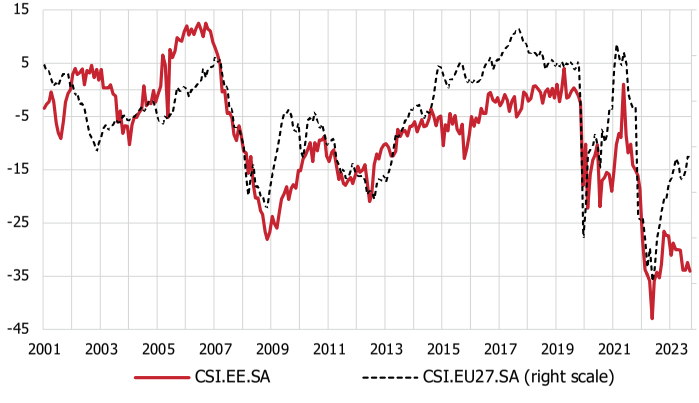
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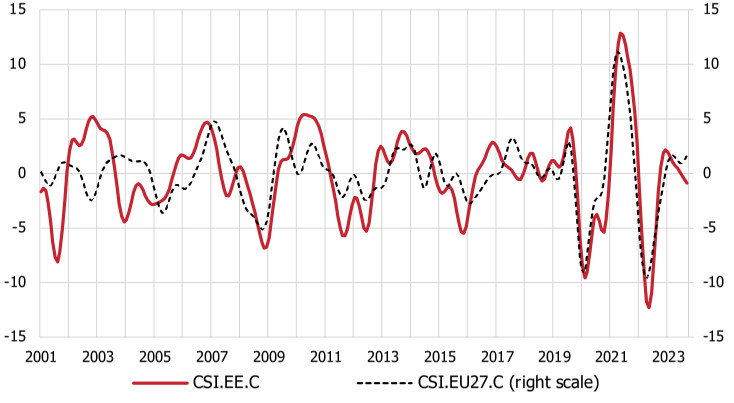
CSI.EU27.SA (right scale)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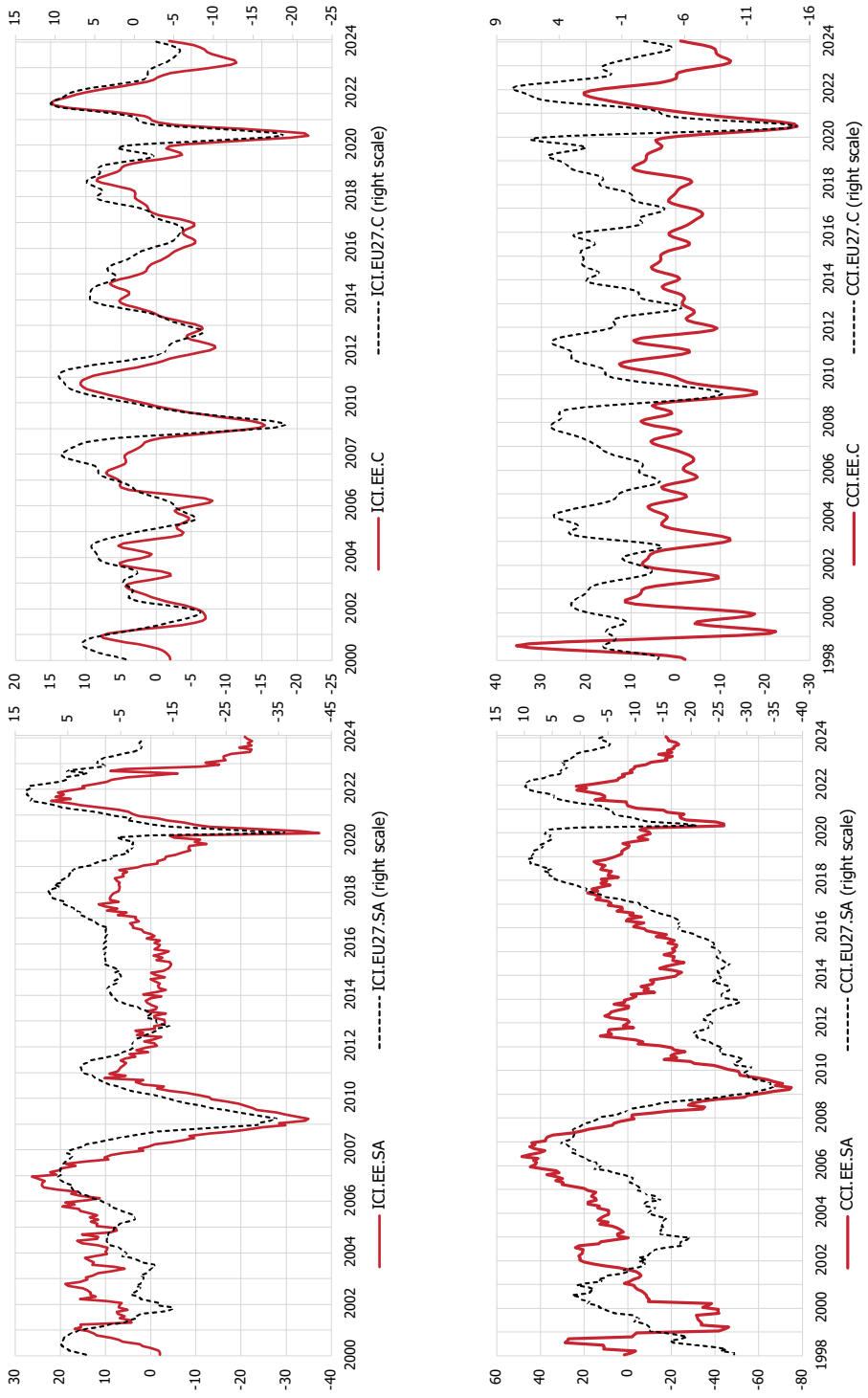
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ICI.EU27.SA (right scale)
ICI.EE.C
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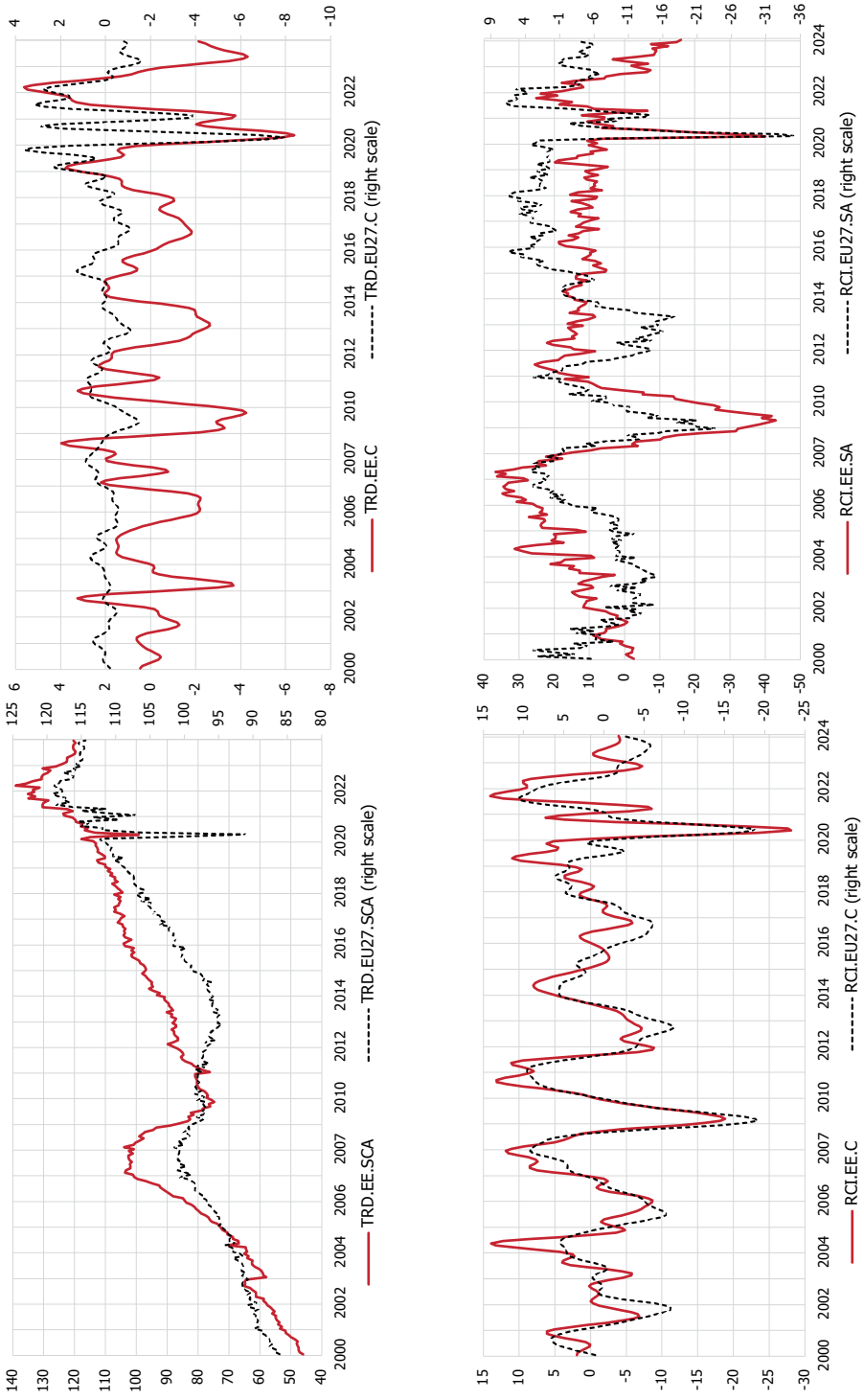
CCI.EE.C
CCI.EU27.C (right scale)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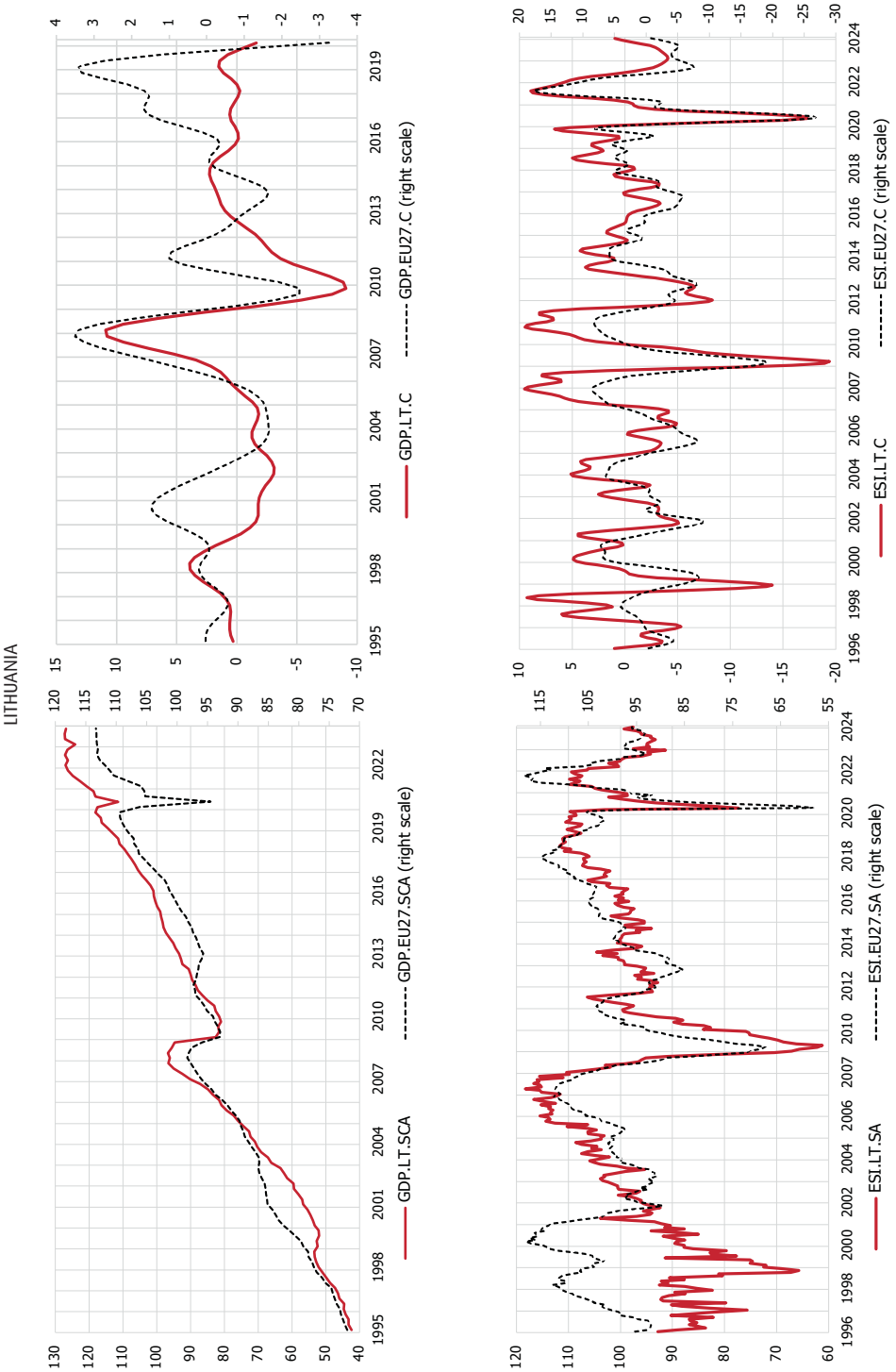
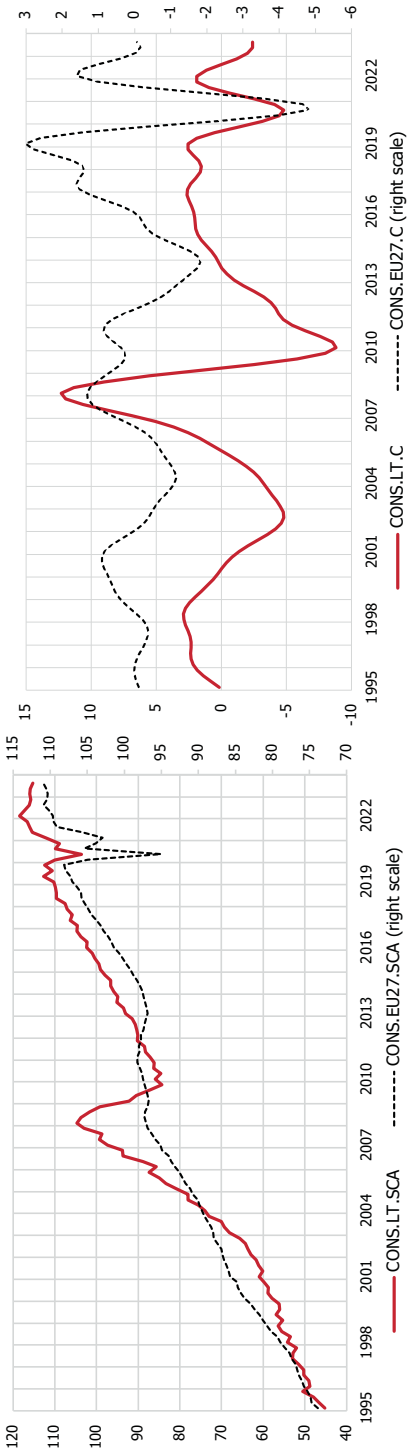
TRD.EU27.SCA (right scale)
TRD.EE.C
TRD.EU27.C (right scale)
RCI.EE.C
RCI.EU27.C (right scale)
RCI.EE.SA
RCI.EU27.SA (right scale)


LITHUANIA
GDP.LT.SCA
GDP.EU27.SCA (right scale)
GDP.LT.C
GDP.EU27.C (right scale)
ESI.LT.SA
ESI.EU27.SA (right scale)
ESI.LT.C
ESI.EU27.C (right scale)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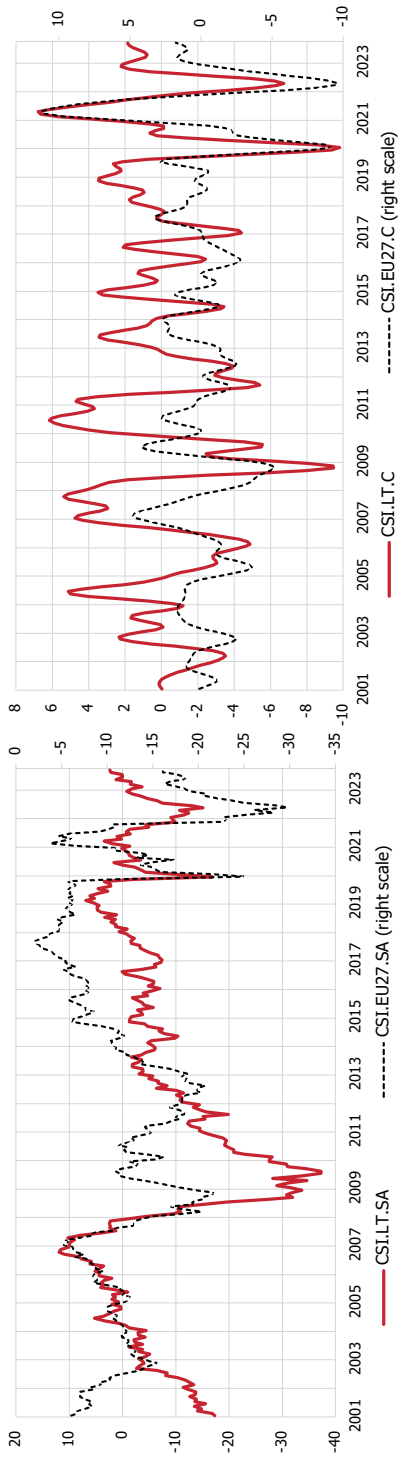
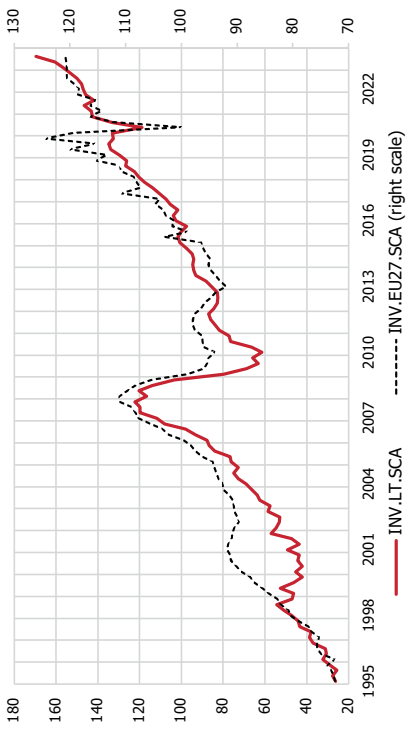
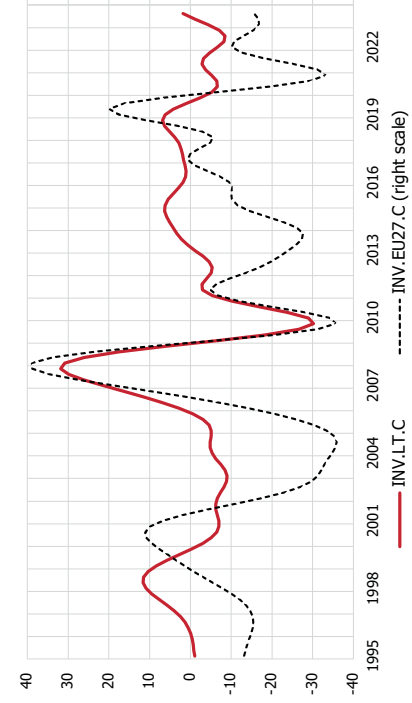
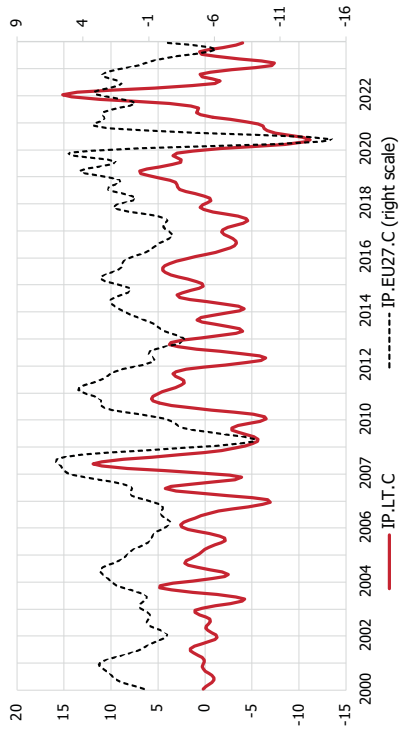
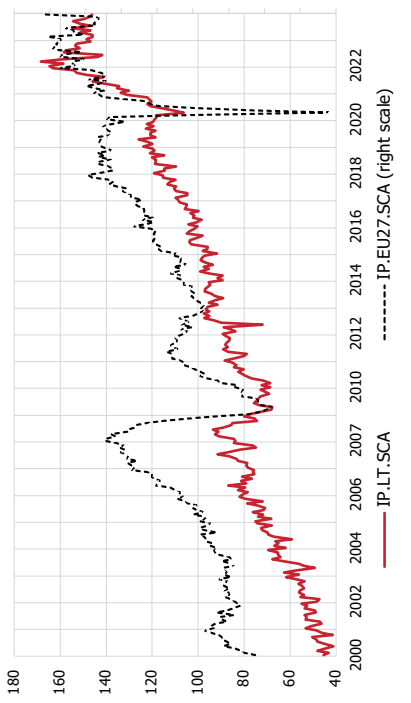
CONS.EU27.SCA (right scale)
CONS.LT.C
CONS.EU27.C (right scale)

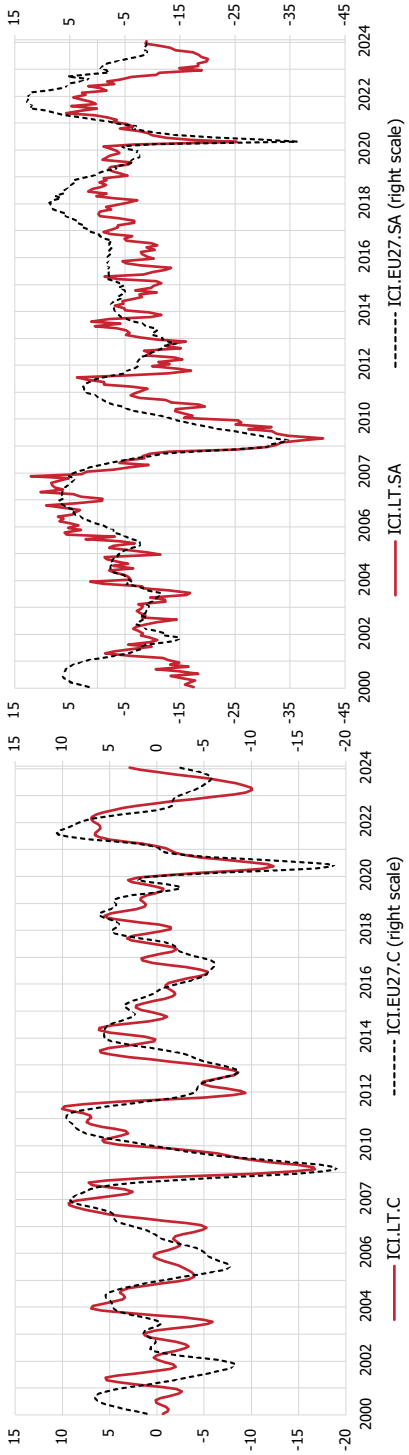

CSI.LT.SA
CSI.EU27.SA (right scale)
CSI.LT.C
CSI.EU27.C (right scale)

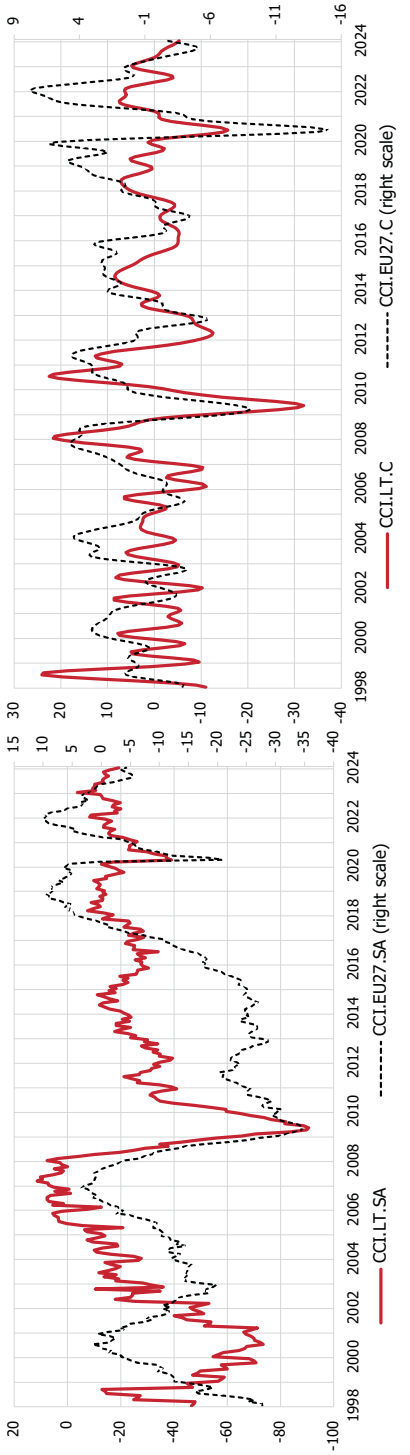

INV.LT.SCA
INV.EU27.SCA (right scale)

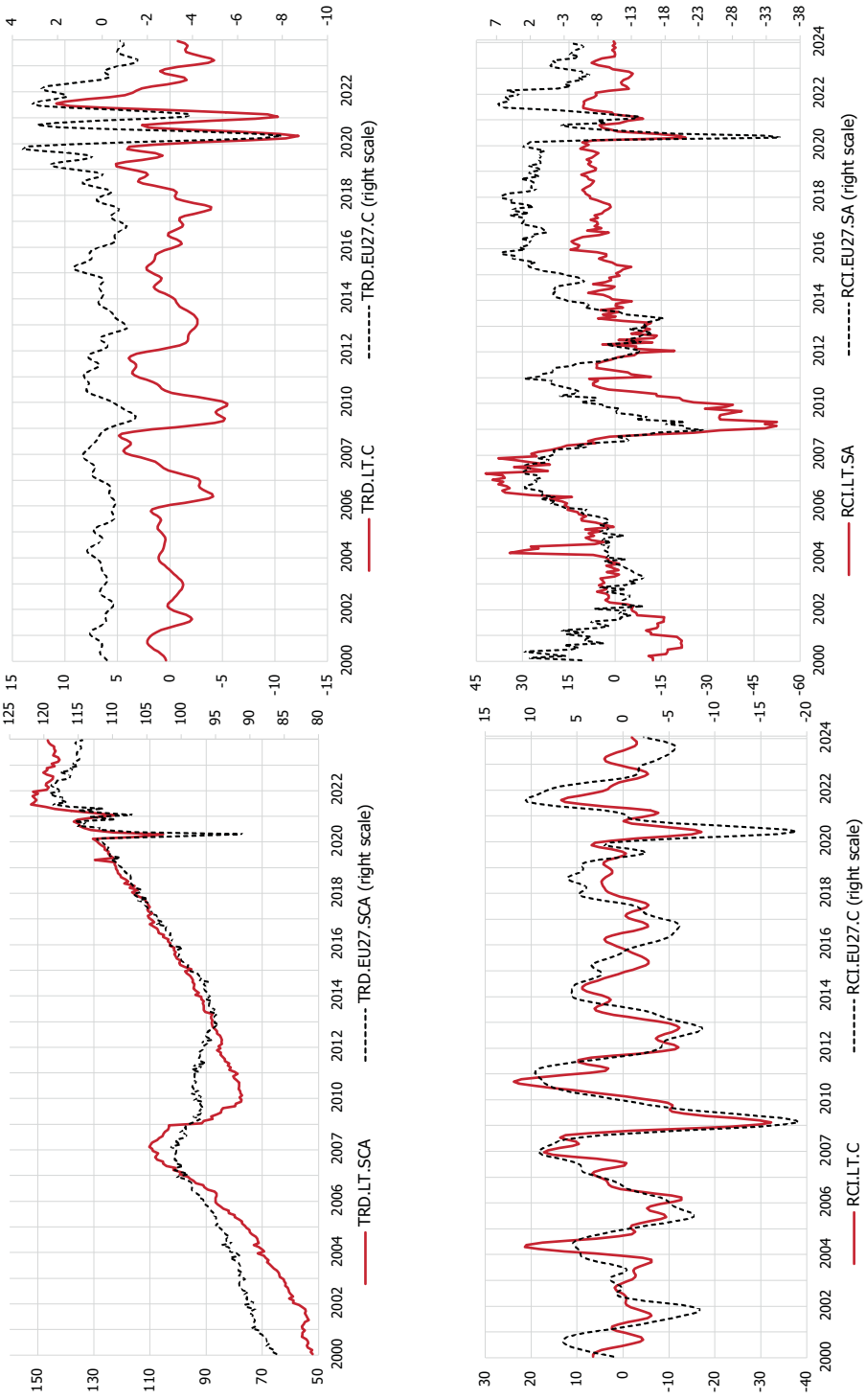

INV.LT.C
INV.EU27.C (right scale)


IP.LT.C
IP.EU27.C (right scale)

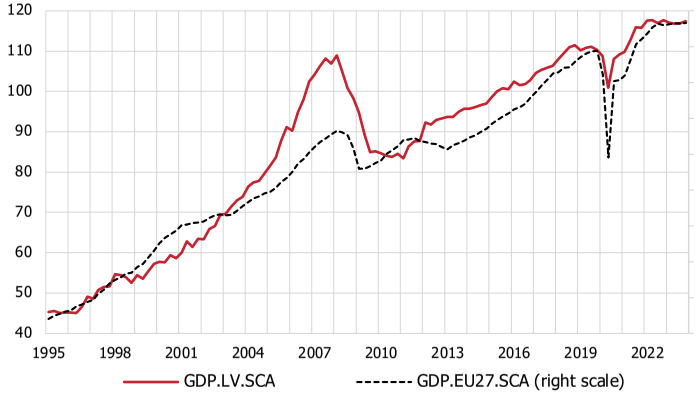

IP.LT.SCA
IP.EU27.SCA (right scale)

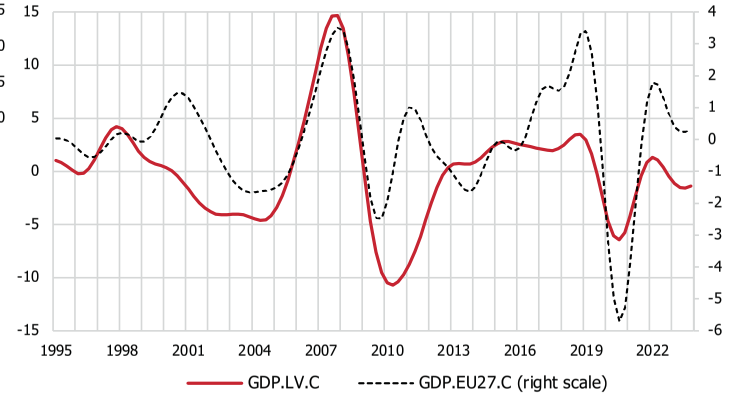

ICI.LT.SA
ICI.EU27.SA (right scale)
ICI.LT.C
ICI.EU27.C (right scale)

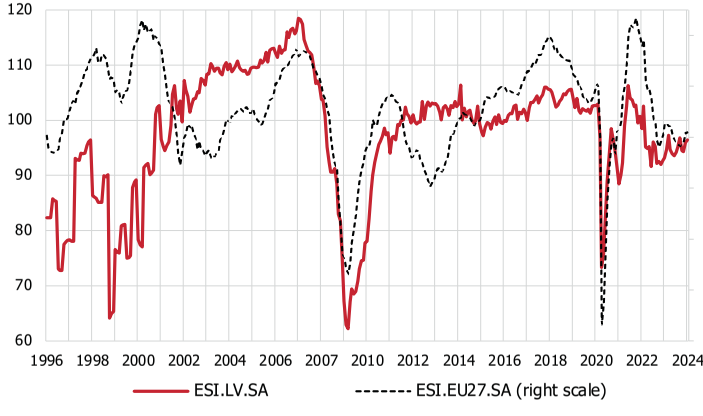

CCI.LT.C
CCI.EU27.C (right scale)
CCI.LT.SA
CCI.EU27.SA (right scale)

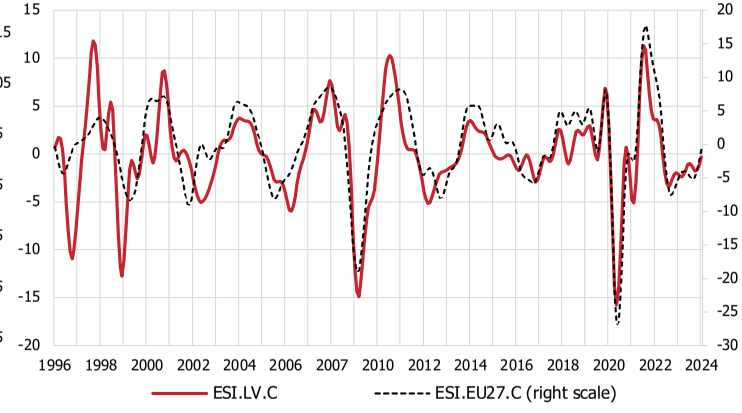

TRD.LT.SCA
TRD.EU27.SCA (right scale)
TRD.LT.C
TRD.EU27.C (right scale)
RCI.LT.C
RCI.EU27.C (right scale)
RCI.LT.SA
RCI.EU27.SA (right scale)

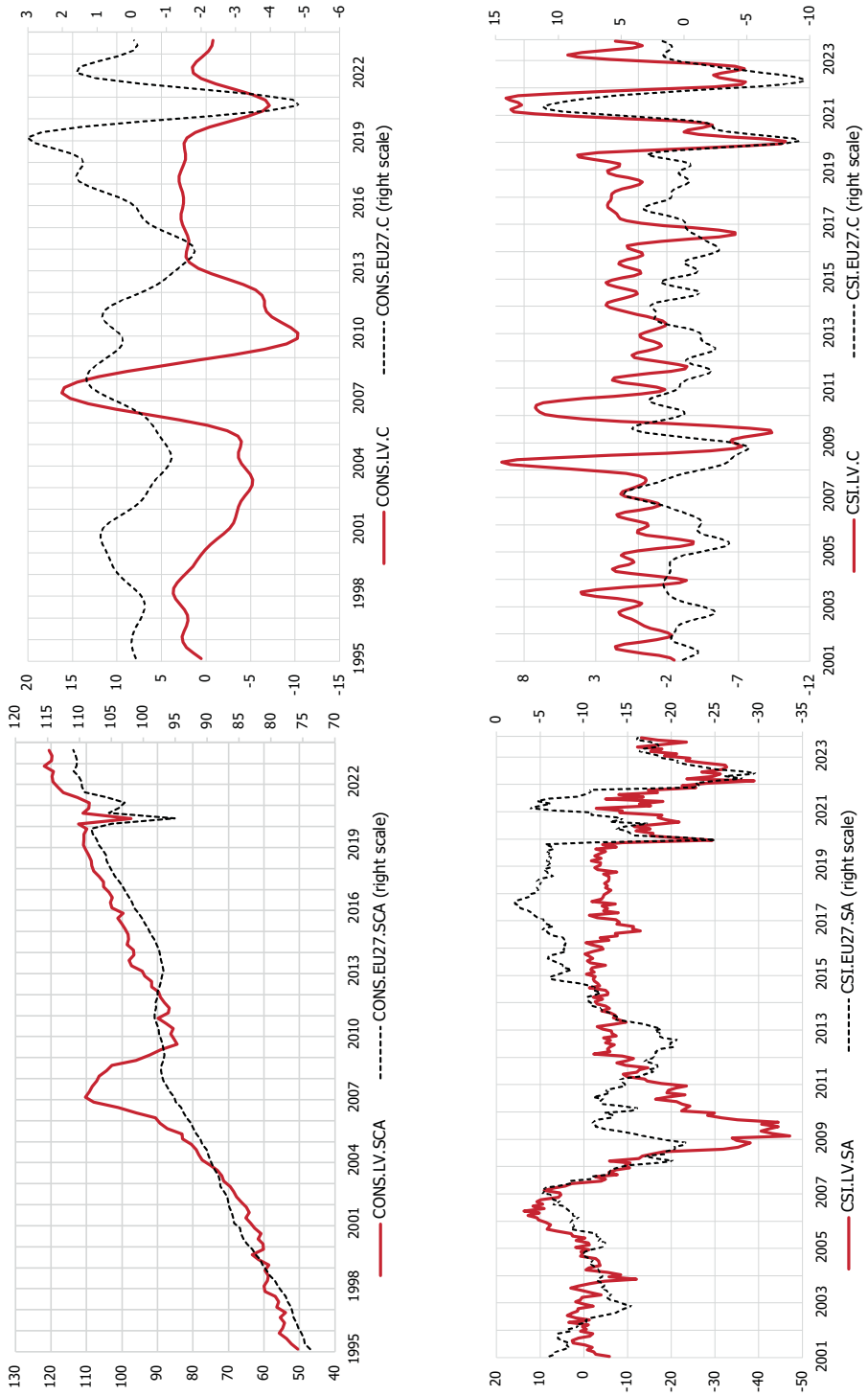
LATVIA

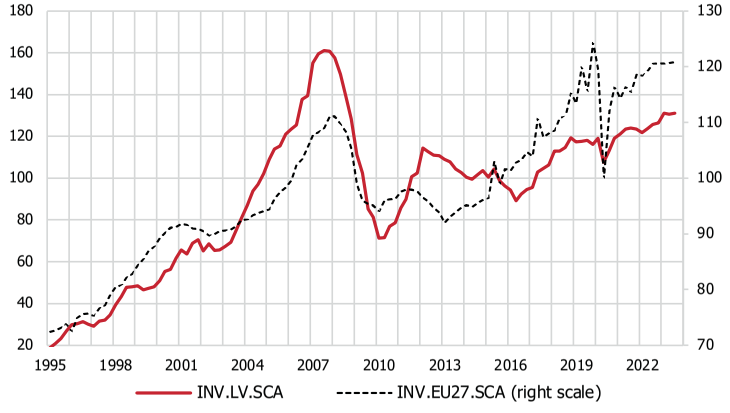

GDP.LV.SCA
GDP.EU27.SCA (right scale)

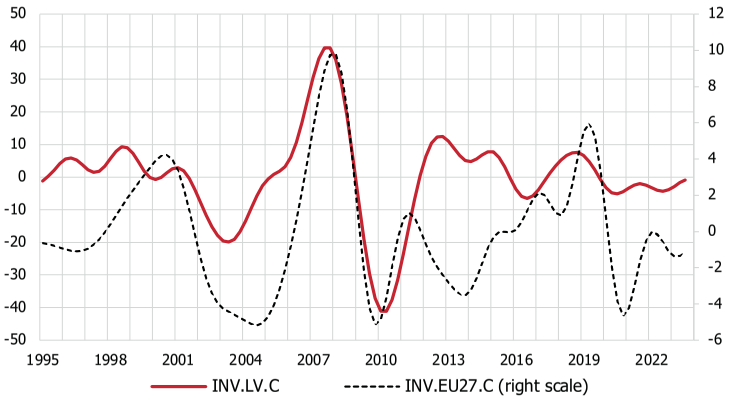

GDP.LV.C
GDP.EU27.C (right scale)

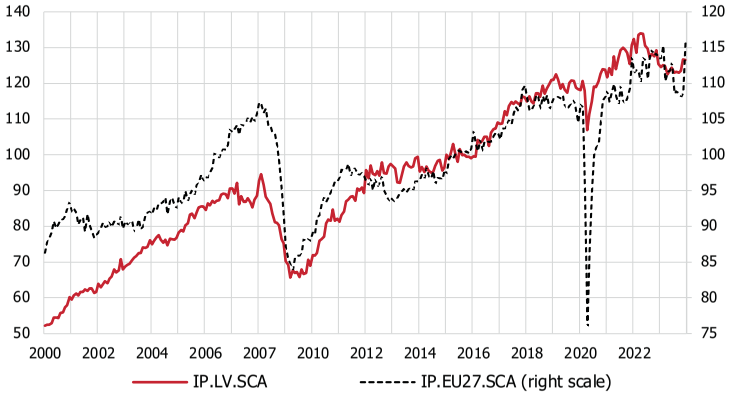

ESI.LV.SA
ESI.EU27.SA (right scale)

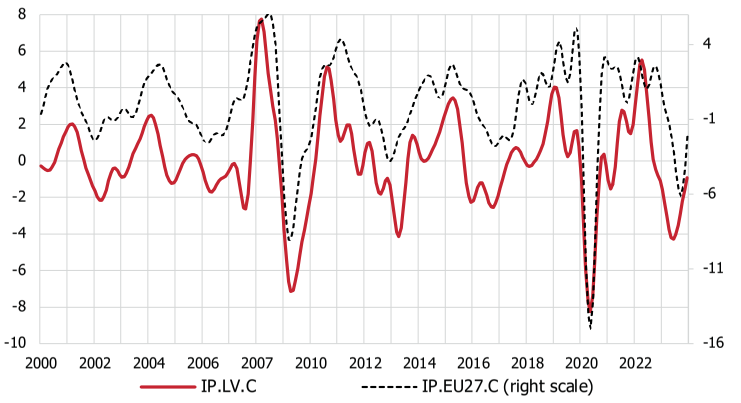

ESI.LV.C
ESI.EU27.C (right scale)

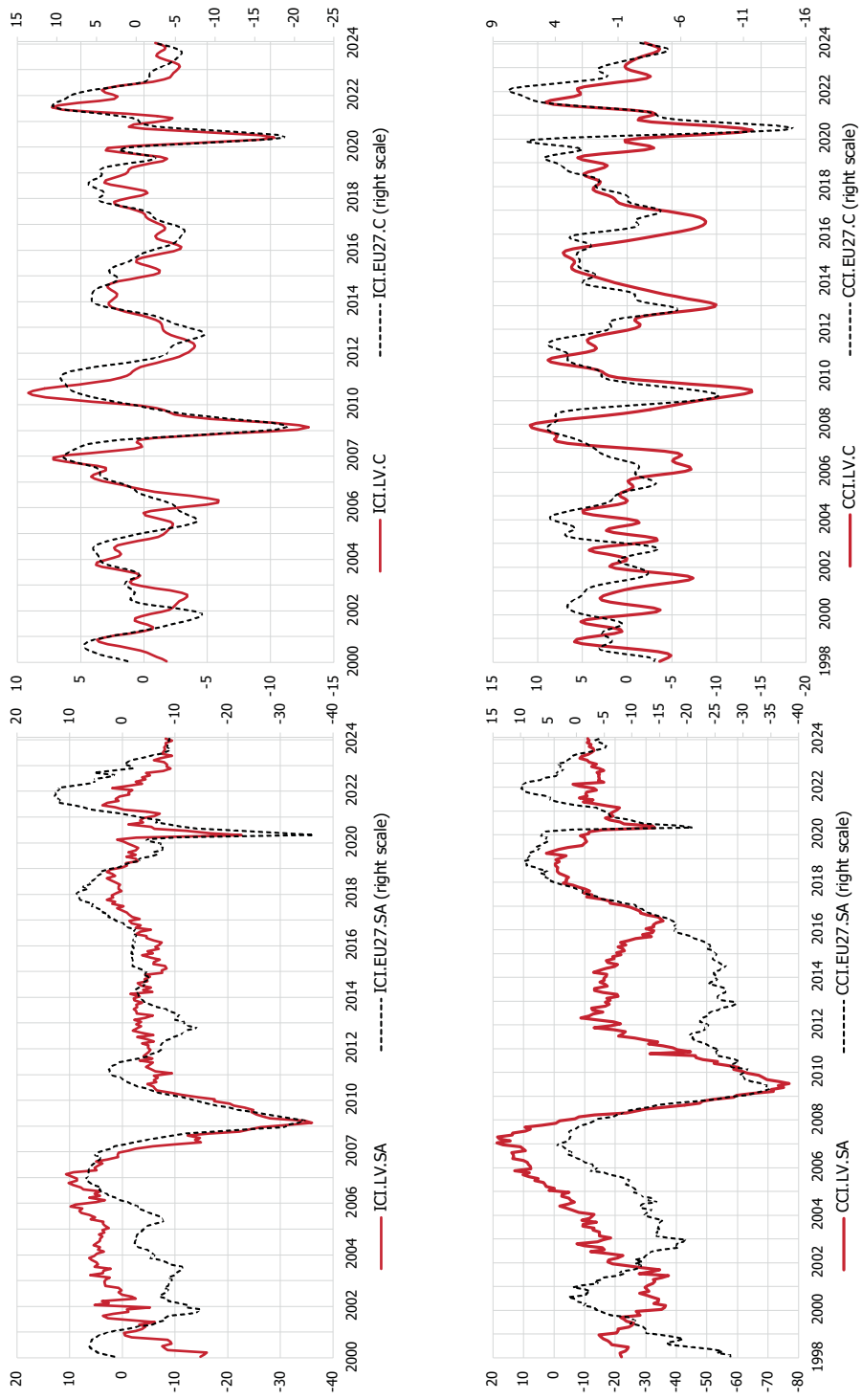

CONS.LV.SCA
CONS.EU27.SCA (right scale)
CONS.LV.C
CONS.EU27.C (right scale)
CSI.LV.SA
CSI.EU27.SA (right scale)
CSI.LV.C
CSI.EU27.C (right scale)

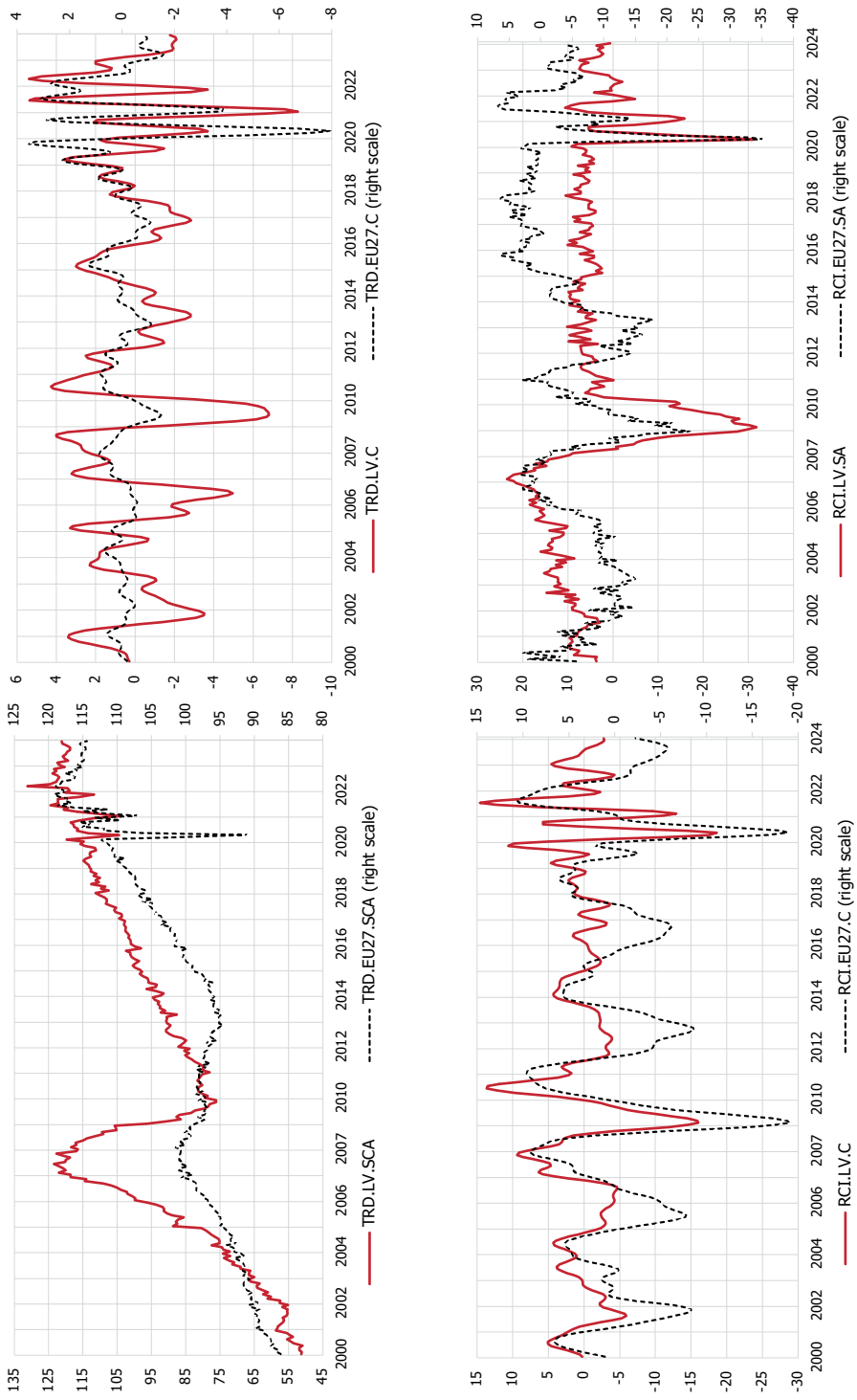

INV.LV.SCA
INV.EU27.SCA (right scale)

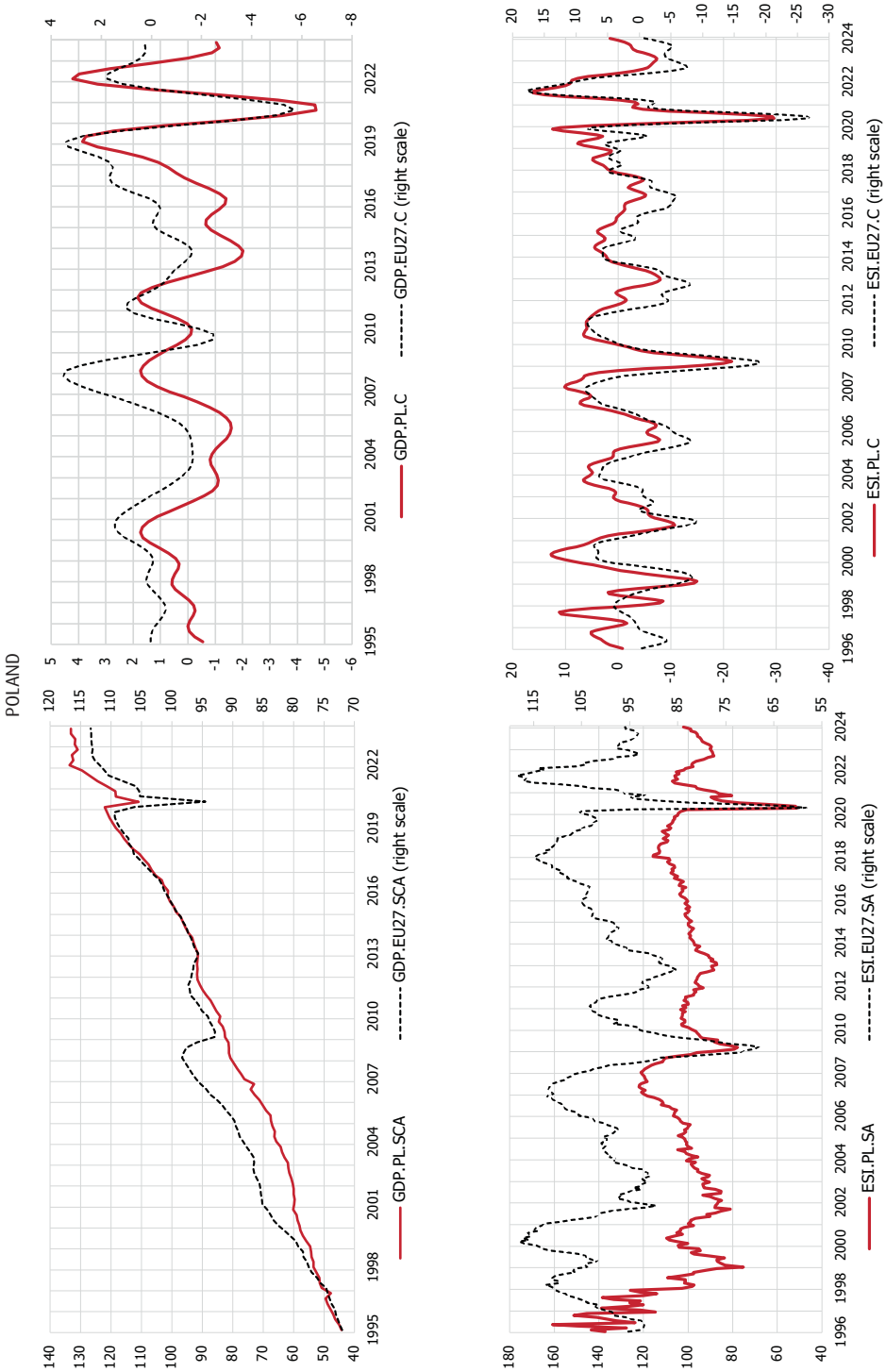

INV.LV.C
INV.EU27.C (right scale)

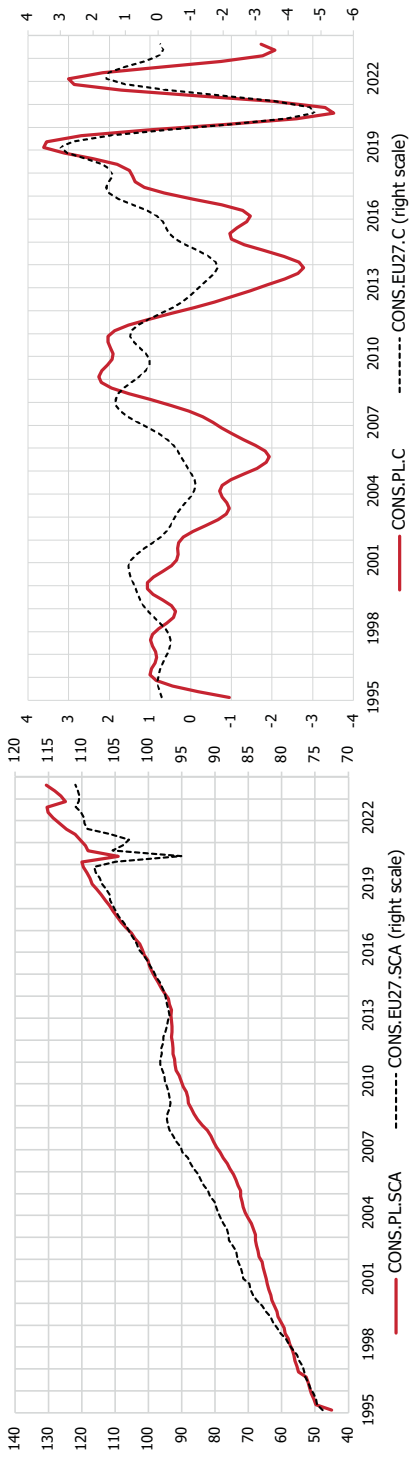

IP.LV.SCA
IP.EU27.SCA (right scale)

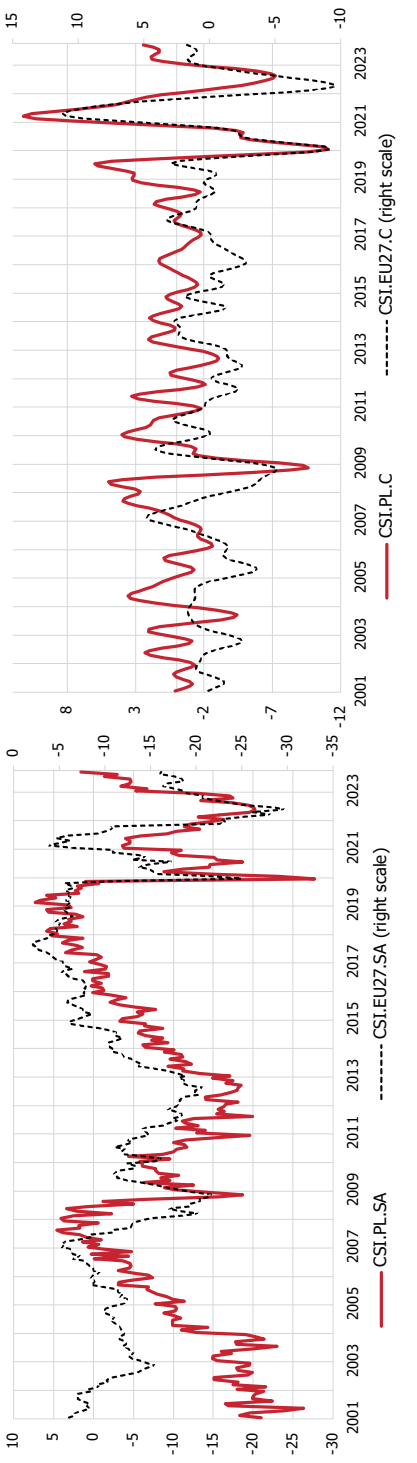

IP.LV.C
IP.EU27.C (right scale)

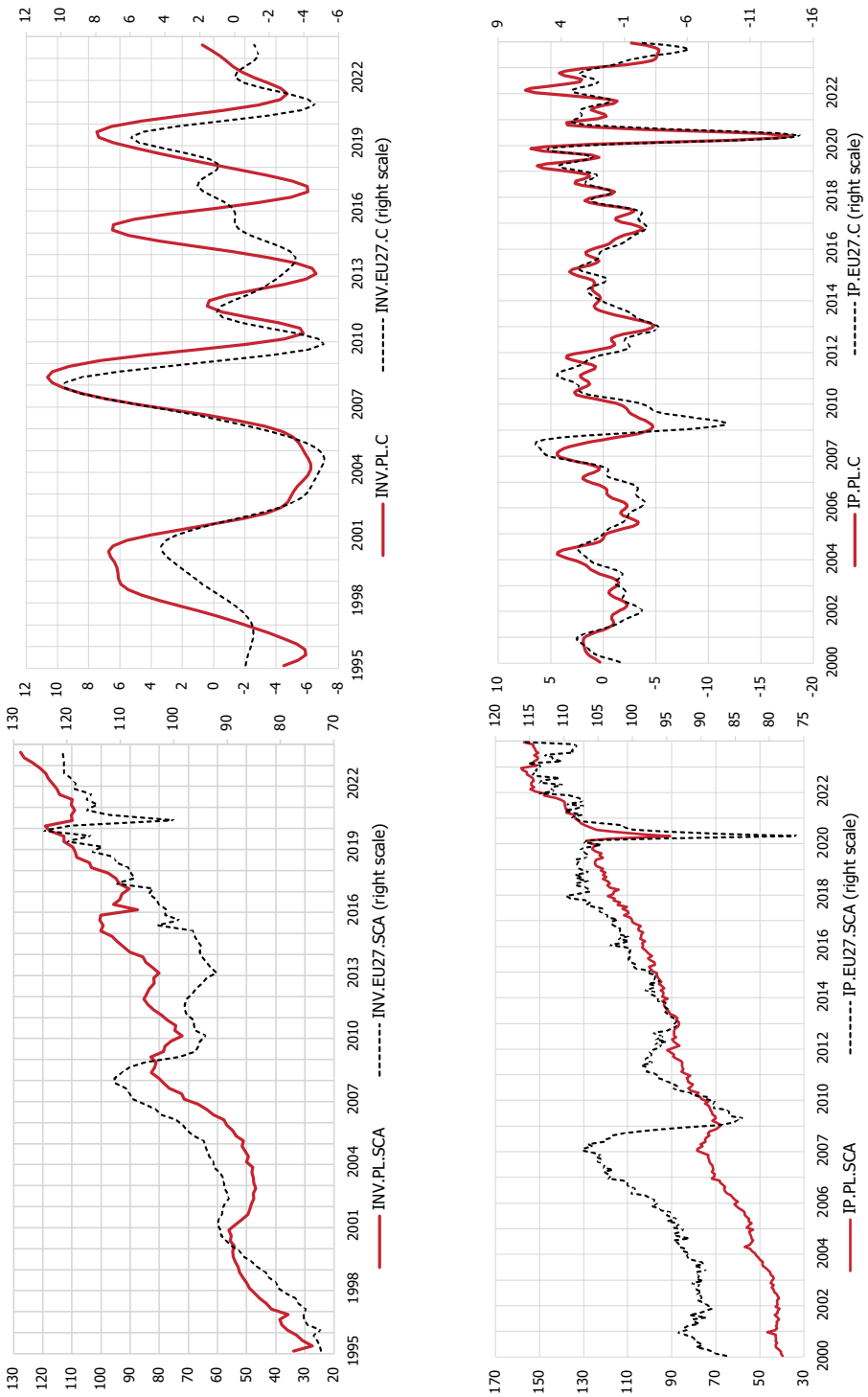

ICI.LV.C
ICI.EU27.C (right scale)
ICI.LV.SA
ICI.EU27.SA (right scale)
CCI.LV.C
CCI.EU27.C (right scale)
CCI.LV.SA
CCI.EU27.SA (right scale)


TRD.LV.SCA
TRD.EU27.SCA (right scale)
TRD.LV.C
TRD.EU27.C (right scale)
RCI.LV.C
RCI.EU27.C (right scale)
RCI.LV.SA
RCI.EU27.SA (right scale)


POLAND
GDP.PL.SCA
GDP.EU27.SCA (right scale)
GDP.PL.C
GDP.EU27.C (right scale)
ESI.PL.SA
ESI.EU27.SA (right scale)
ESI.PL.C
ESI.EU27.C (right scale)


CONS.PL.SCA
CONS.EU27.SCA (right scale)
CONS.PL.C
CONS.EU27.C (right scale)


CSI.PL.SA
CSI.EU27.SA (right scale)
CSI.PL.C
CSI.EU27.C (right scale)


INV.PL.C
INV.EU27.C (right scale)
INV.PL.SCA
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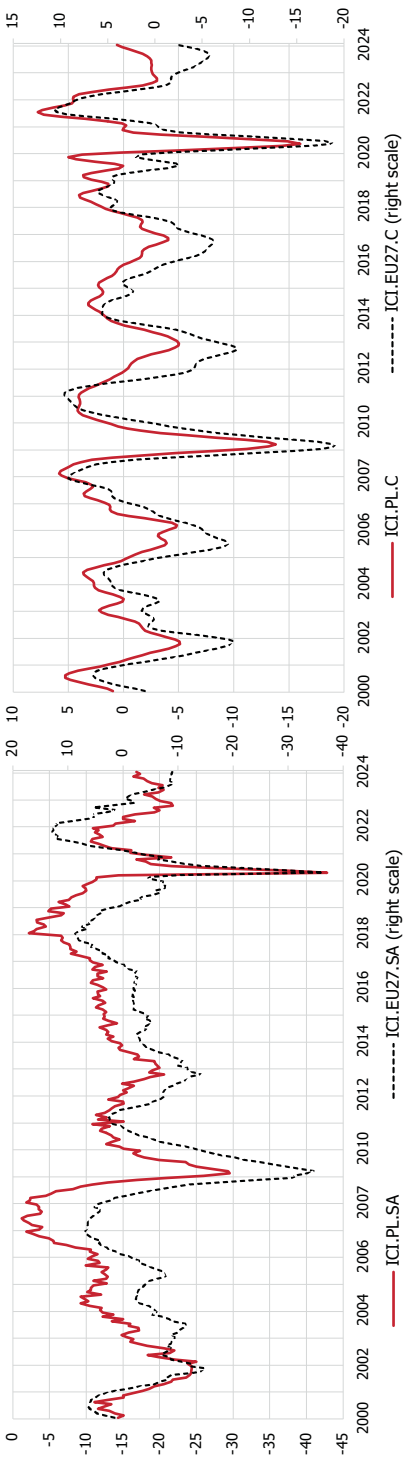
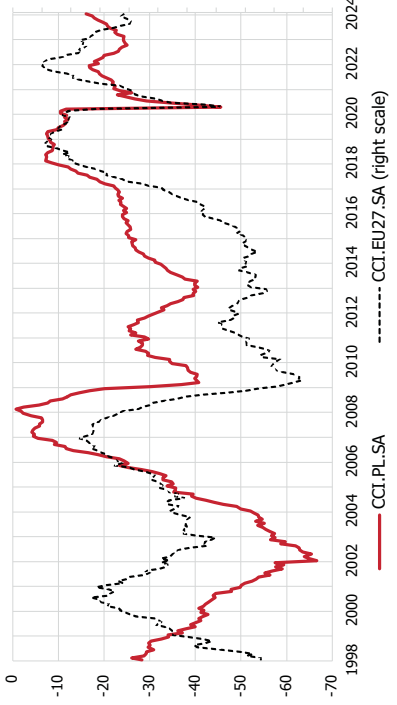
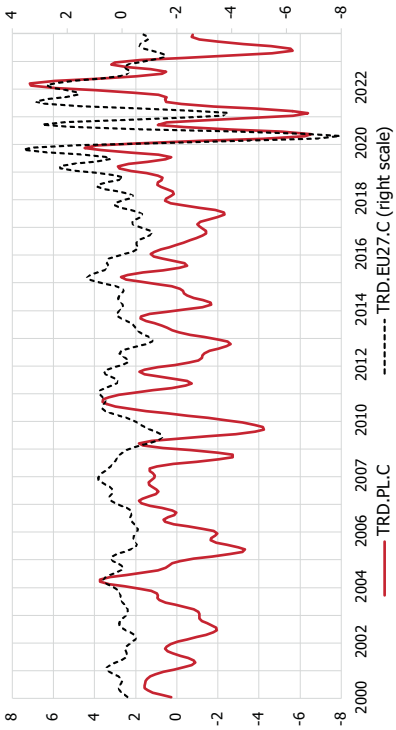
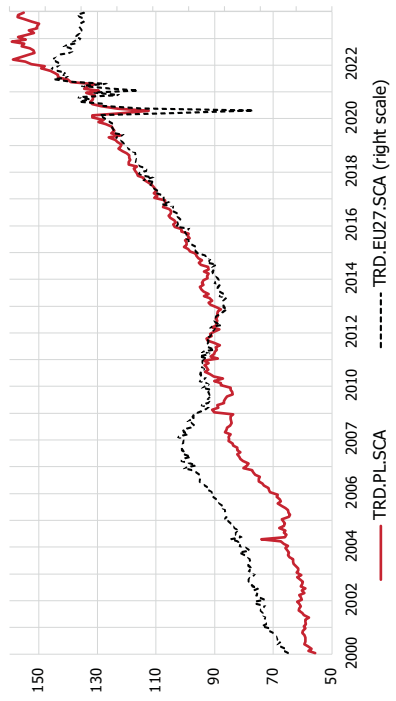
IP.PL.C
IP.EU27.C (right scale)
IP.PL.SCA
IP.EU27.SCA (right scale)

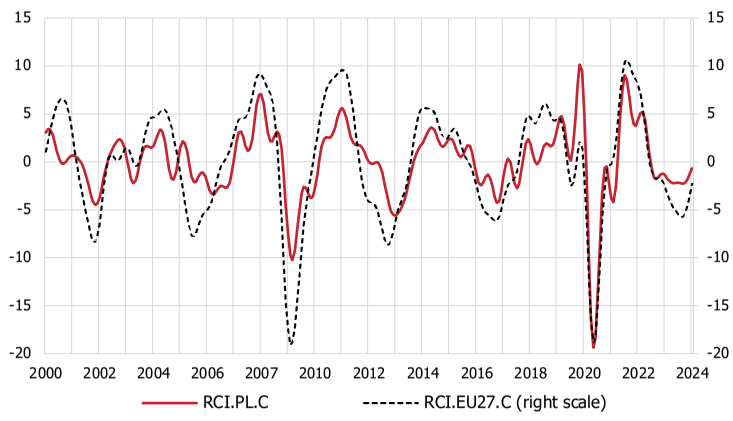

ICI.PL.SA
ICI.EU27.SA (right scale)
ICI.PL.C
ICI.EU27.C (right scale)
BLD.PL.SCA
BLD.EU27.SCA (right scale)
BLD.PL.C
BLD.EU27.C (right scale)


CCI.PL.C
CCI.EU27.C (right scale)


CCI.PL.SA
CCI.EU27.SA (right scale)


TRD.PL.C
TRD.EU27.C (right scale)


TRD.PL.SCA
TRD.EU27.SCA (right scale)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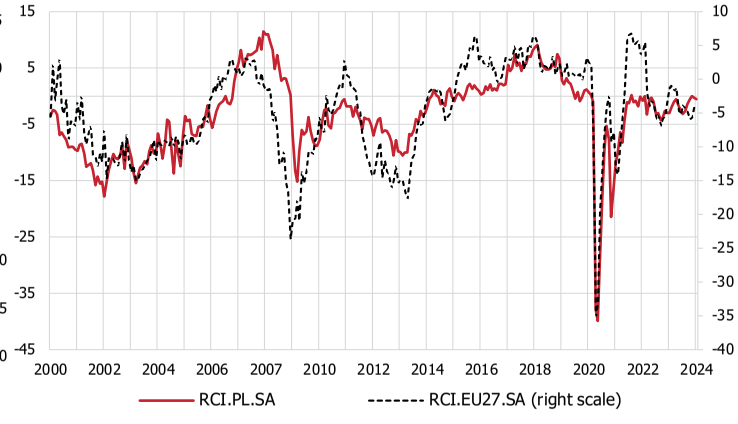
RCI.PL.C
RCI.EU27.C (right scale)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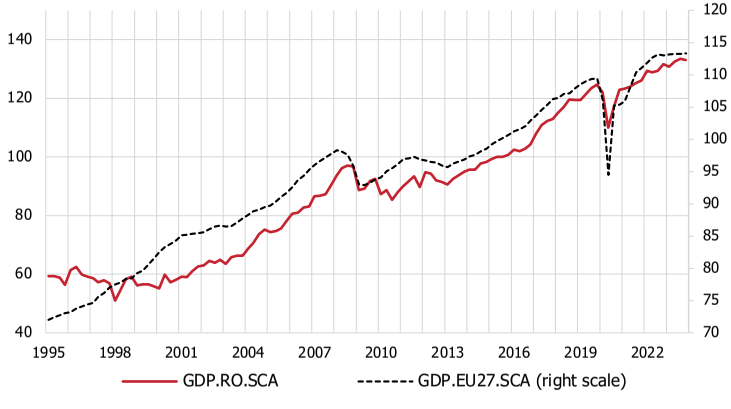
RCI.PL.SA
RCI.EU27.SA (right scale)

ROMANIA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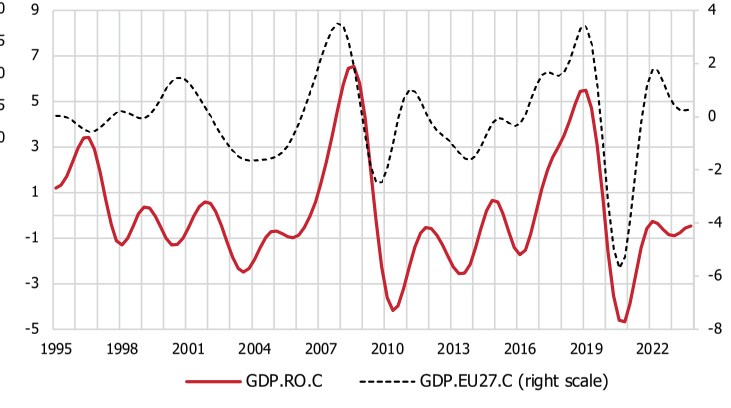
1995 1998 2001 2004 2007 2010 2013 2016 2019 2022
GDP.RO.SCA
GDP.EU27.SCA (right scale)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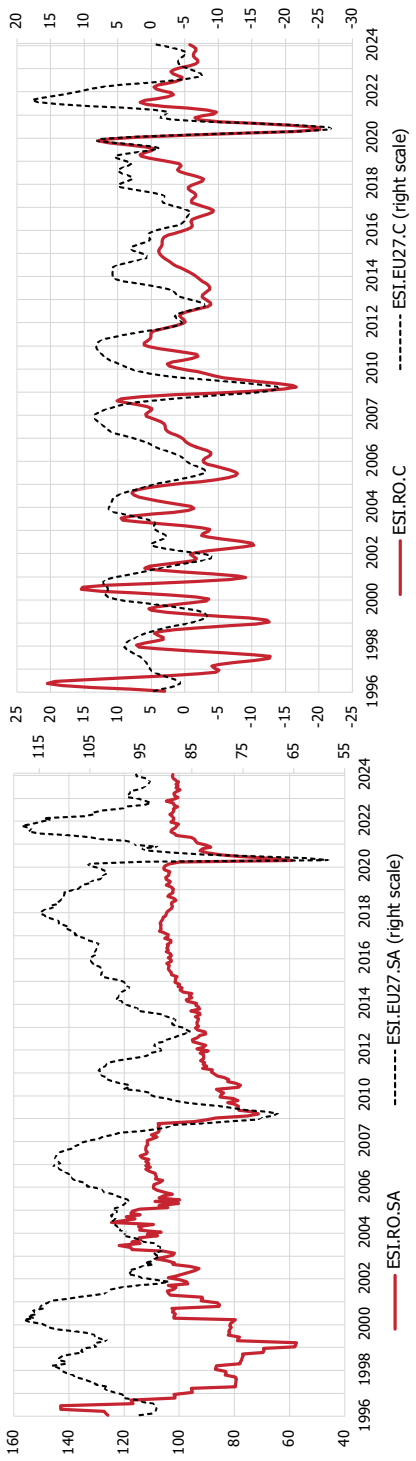
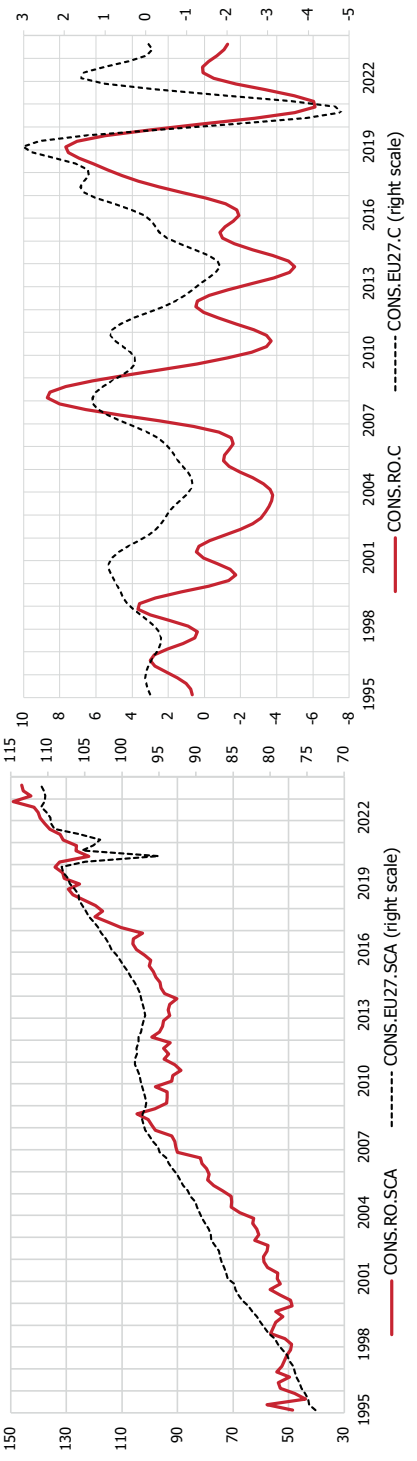
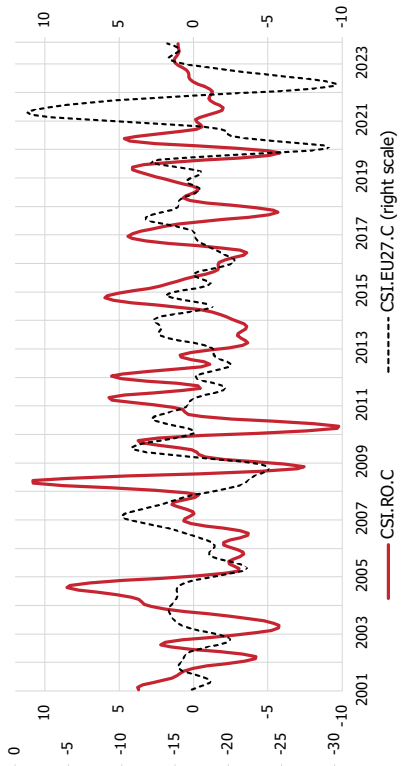
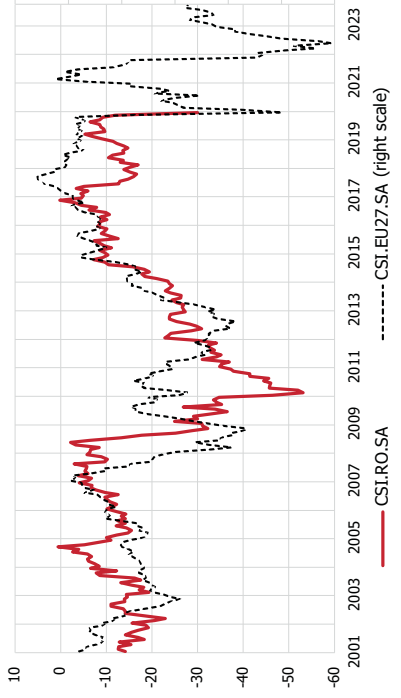
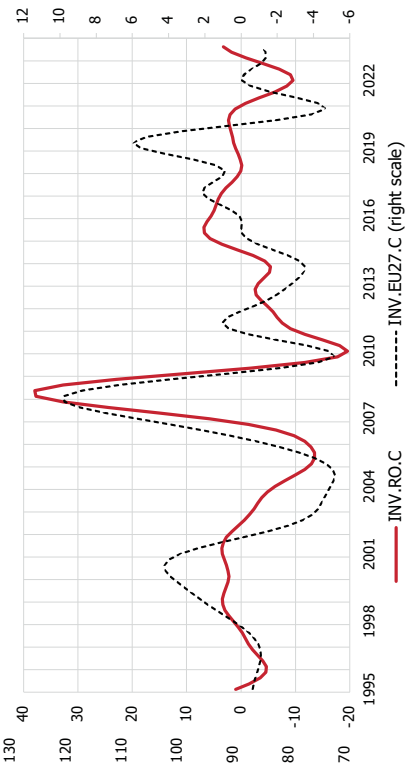
GDP.RO.C
GDP.EU27.C (right scale)

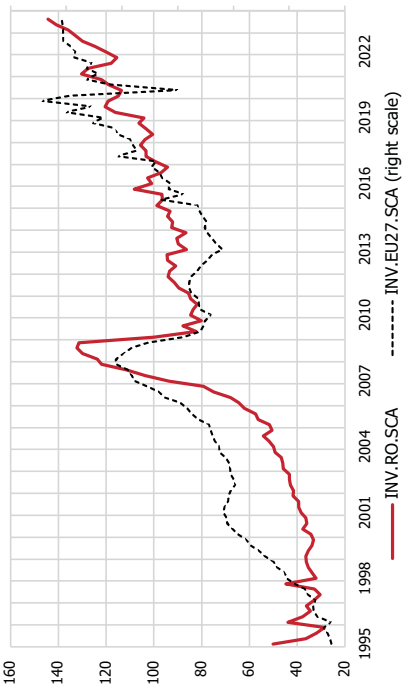

ESI.RO.SA
ESI.EU27.SA (right scale)
ESI.RO.C
ESI.EU27.C (right scale)

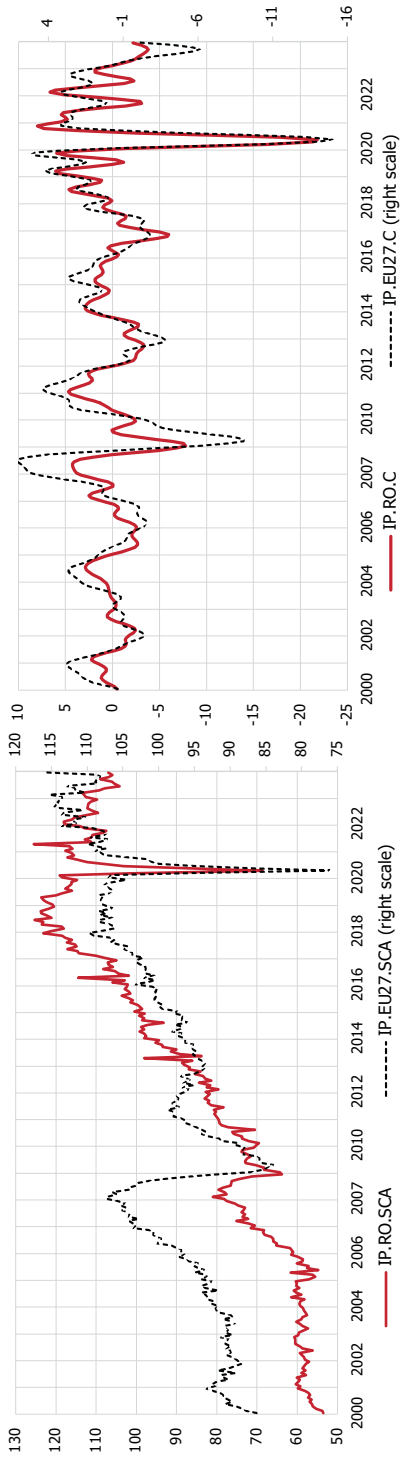

CONS.RO.SCA
CONS.EU27.SCA (right scale)
CONS.RO.C
CONS.EU27.C (right scale)

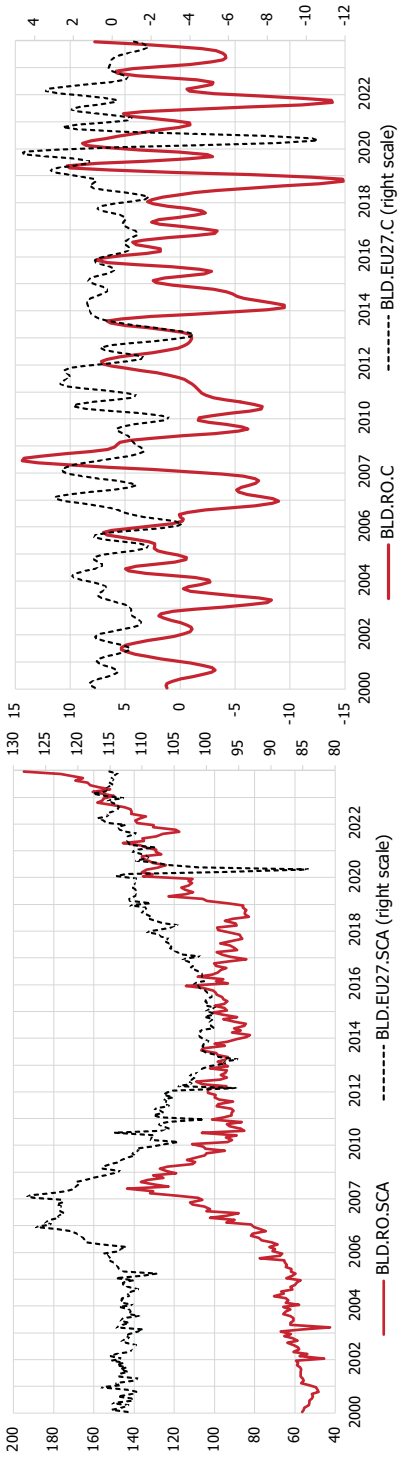

CSI.RO.C
CSI.EU27.C (right scale)

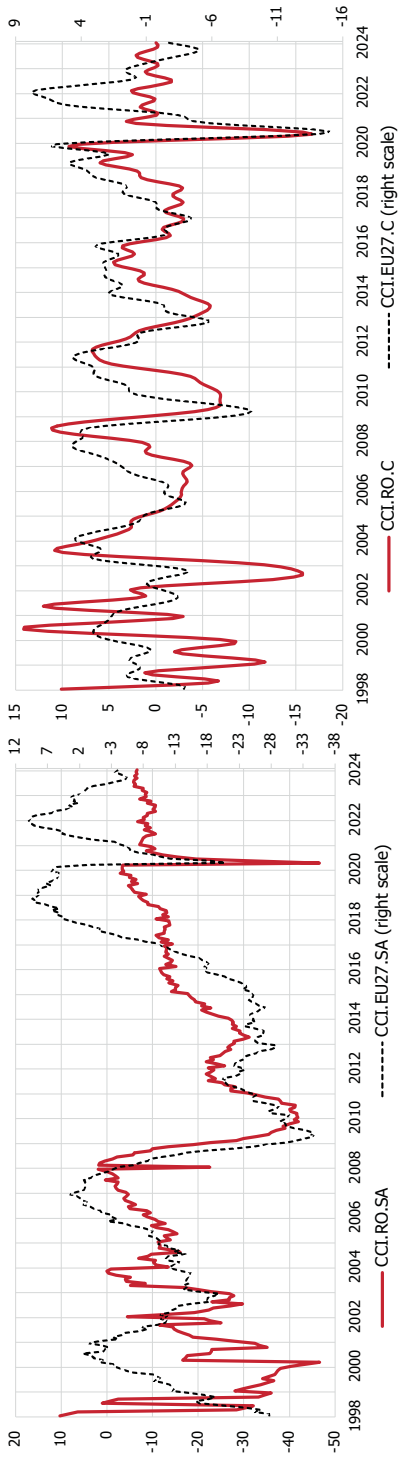

CSI.RO.SA
CSI.EU27.SA (right scale)

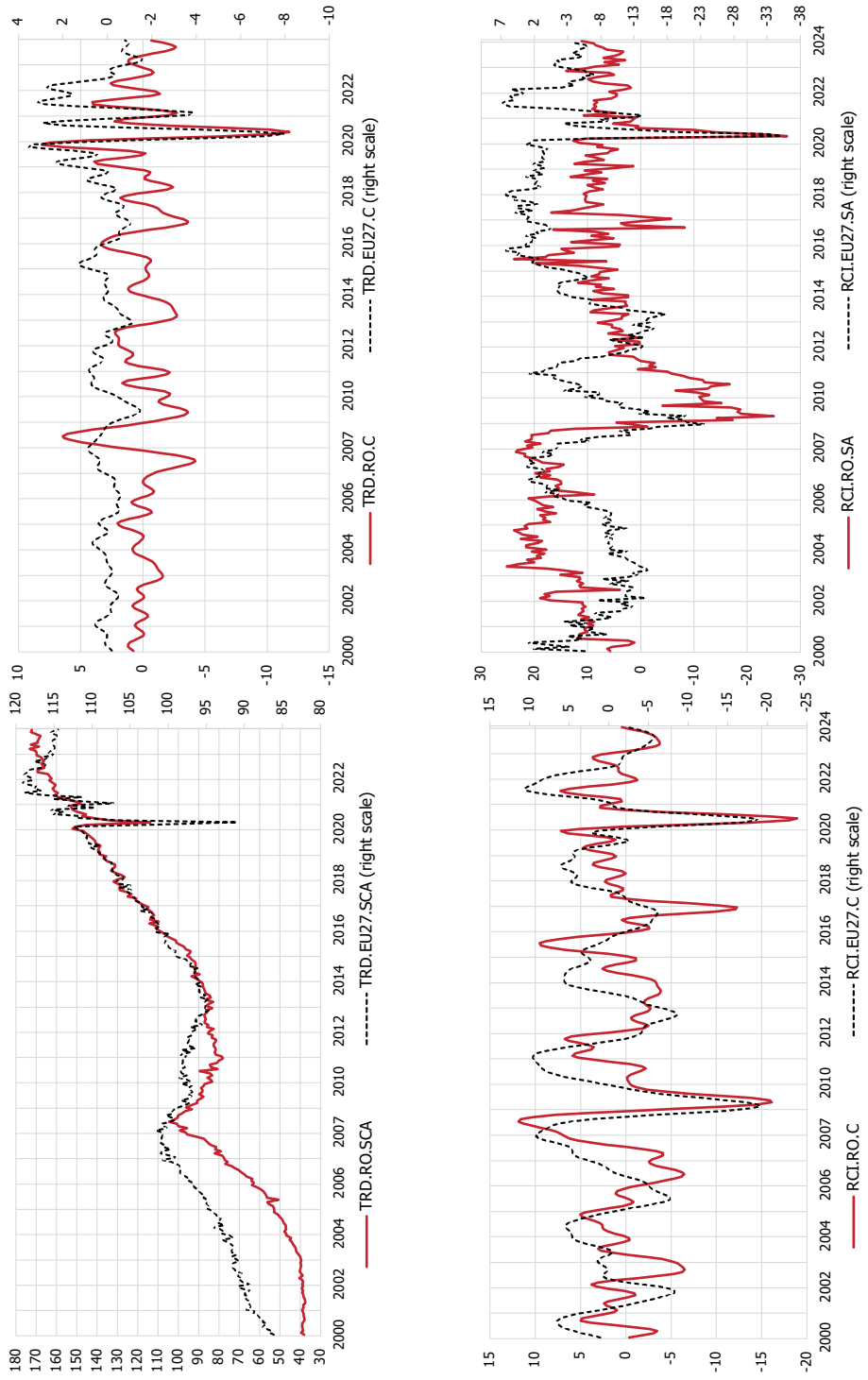

INV.RO.C
INV.EU27.C (right scale)


INV.RO.SCA
INV.EU27.SCA (right scale)

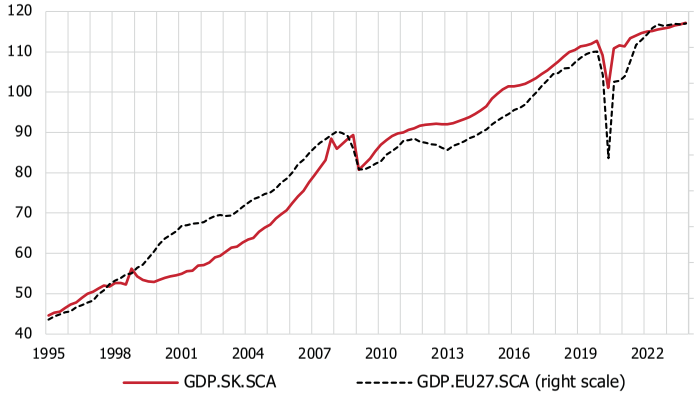

IP.RO.SCA
IP.EU27.SCA (right scale)
IP.RO.C
IP.EU27.C (right scale)
ICI.RO.SA
ICI.EU27.SA (right scale)
ICI.RO.C
ICI.EU27.C (right scale)


BLD.RO.SCA
BLD.EU27.SCA (right scale)
BLD.RO.C
BLD.EU27.C (right scale)


CCI.RO.SA
CCI.EU27.SA (right scale)
CCI.RO.C
CCI.EU27.C (right scale)


TRD.RO.C
TRD.EU27.C (right scale)
TRD.RO.SCA
TRD.EU27.SCA (right scale)
RCI.RO.SA
RCI.EU27.SA (right scale)
RCI.RO.C
RCI.EU27.C (right scale)

SLOVAKIA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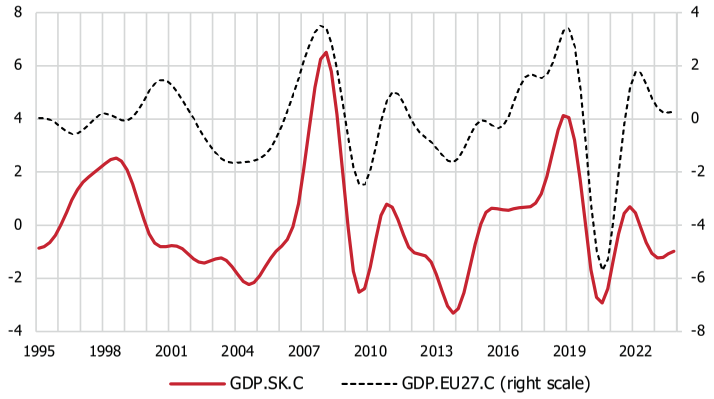
2016
2019
2022
GDP.SK.SCA
GDP.EU27.SCA (right scale)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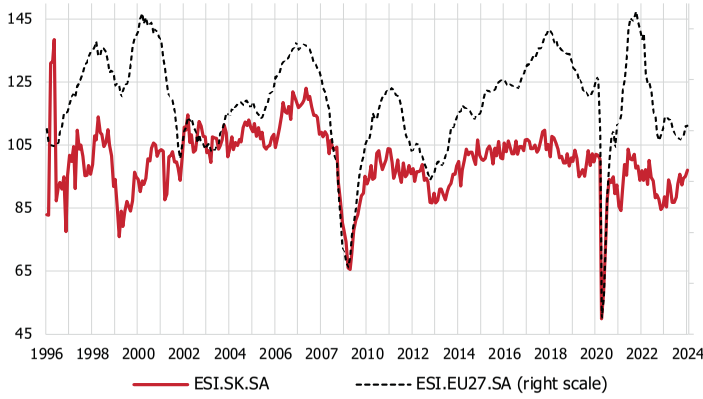
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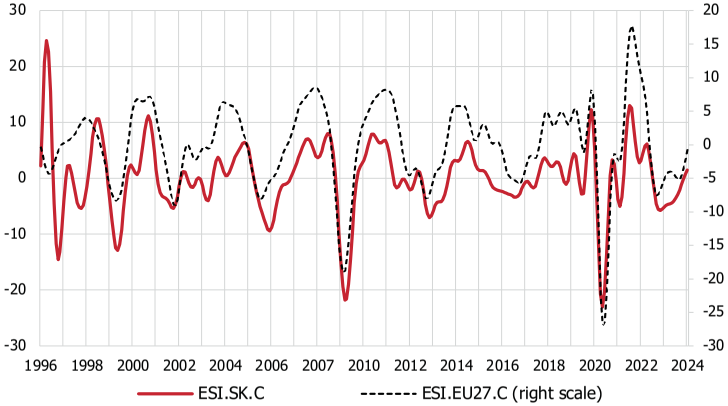
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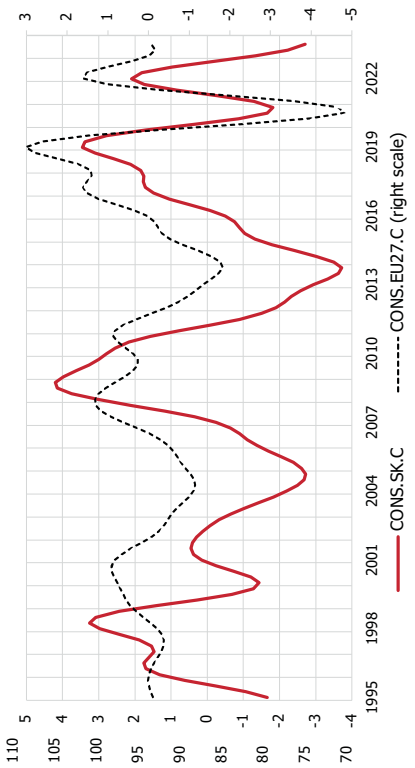
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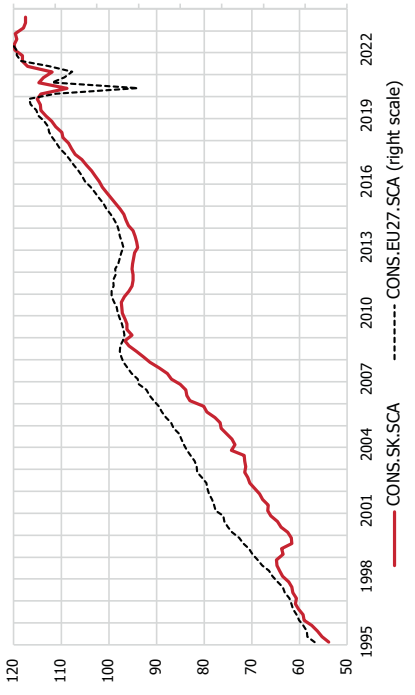
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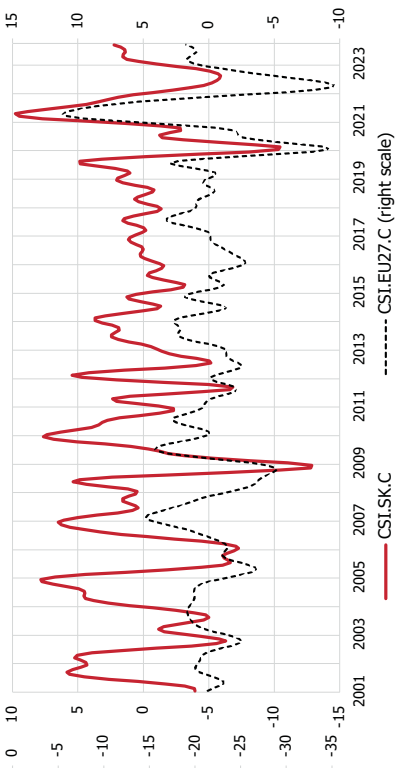
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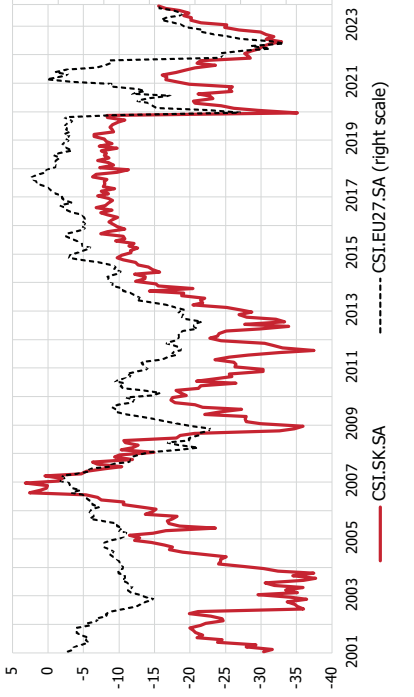
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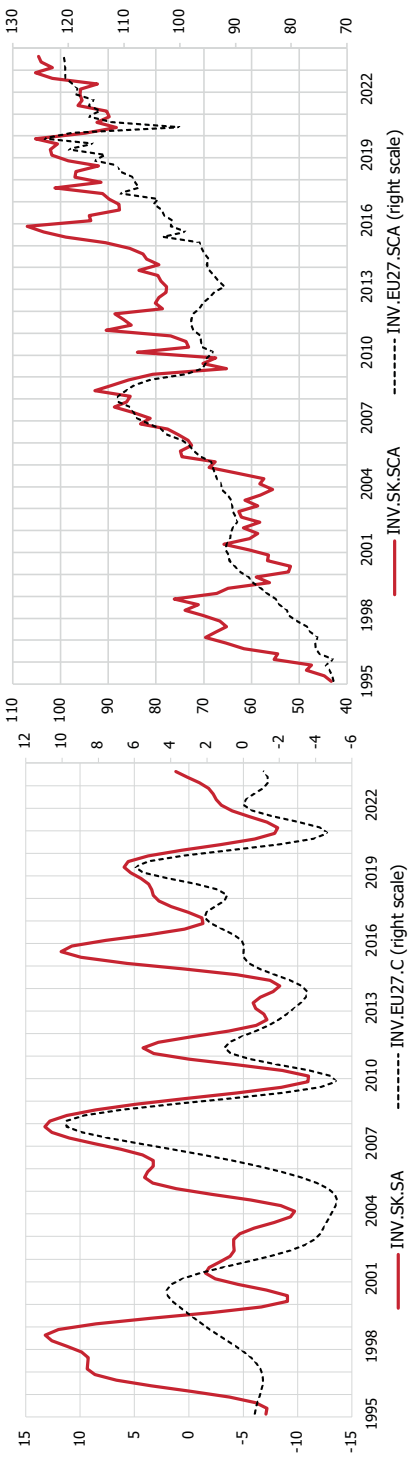
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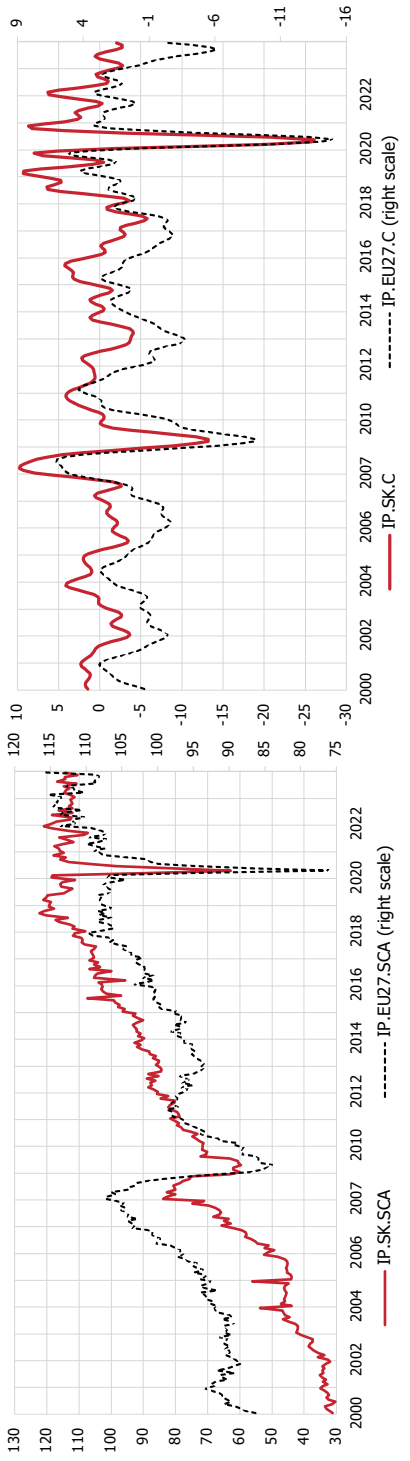
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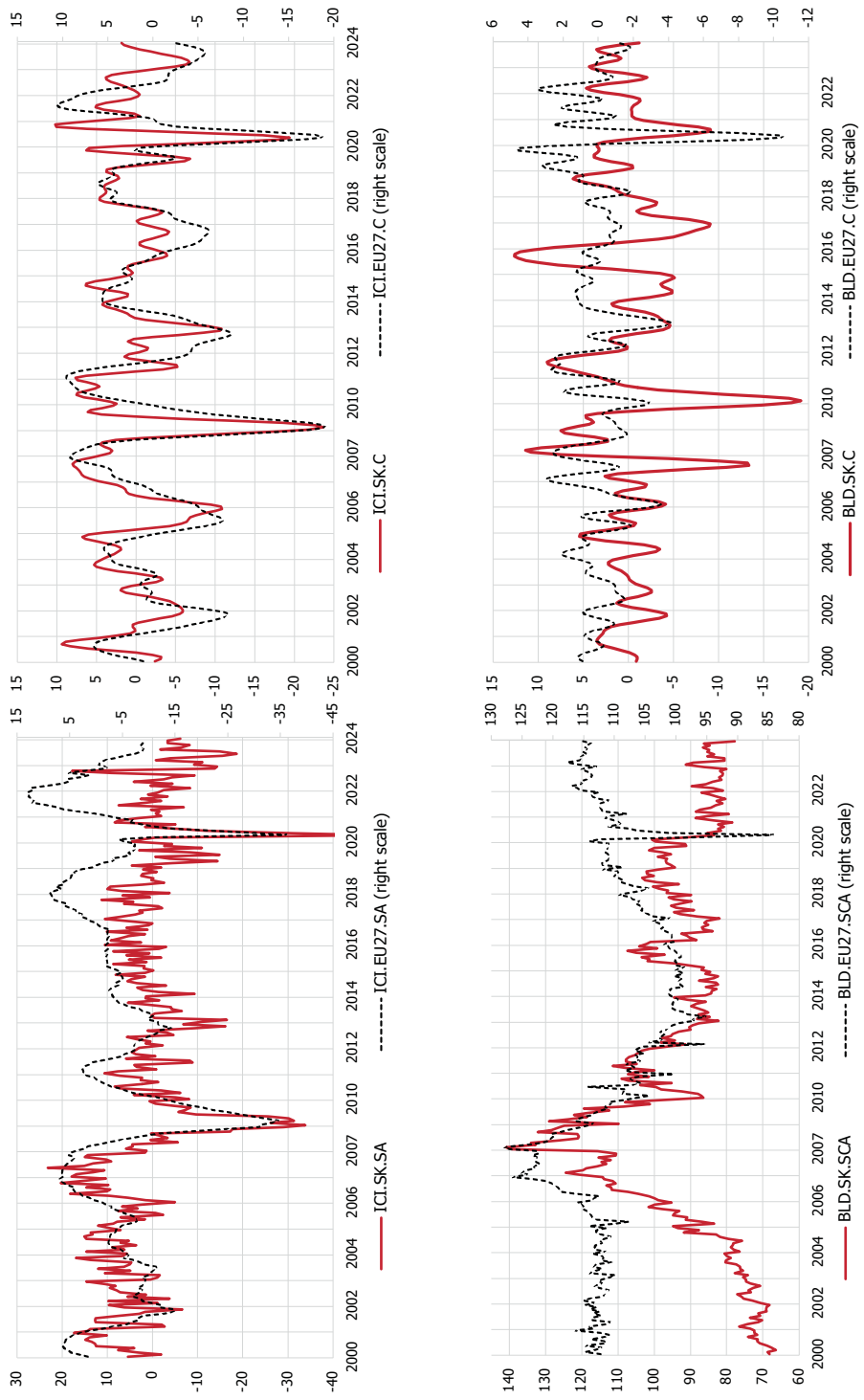
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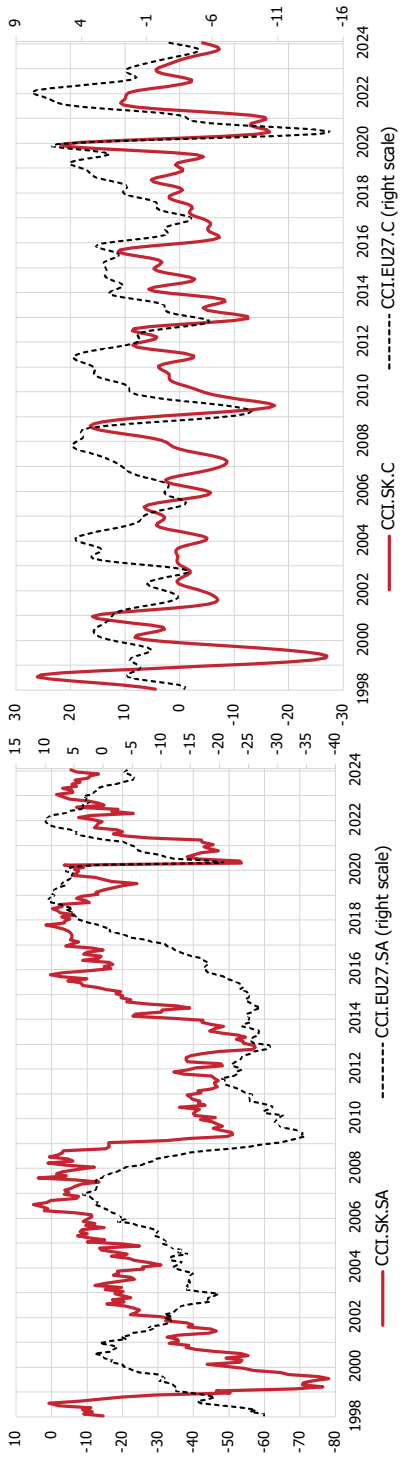
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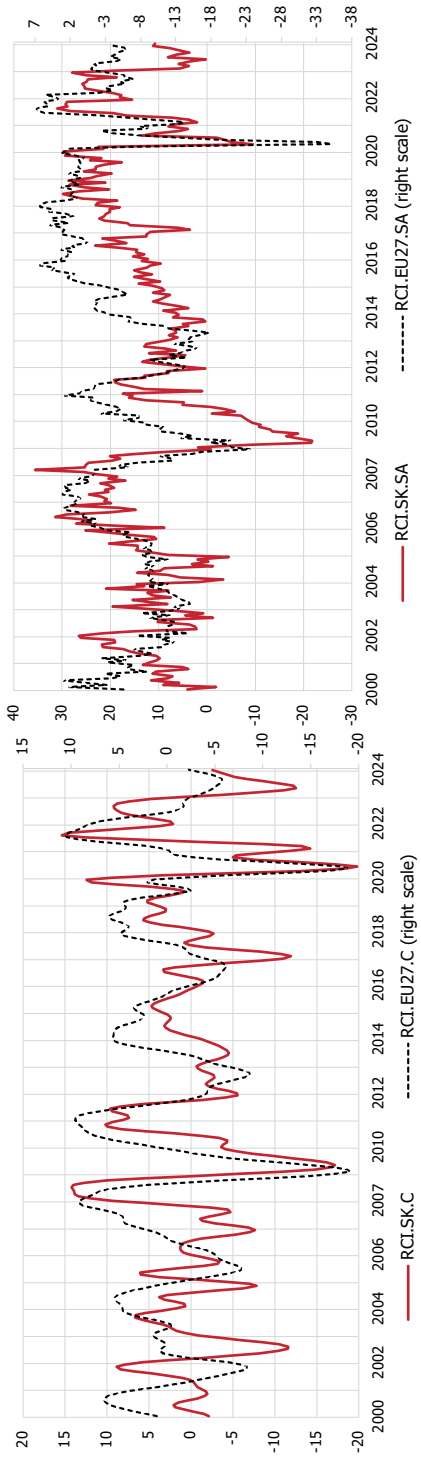
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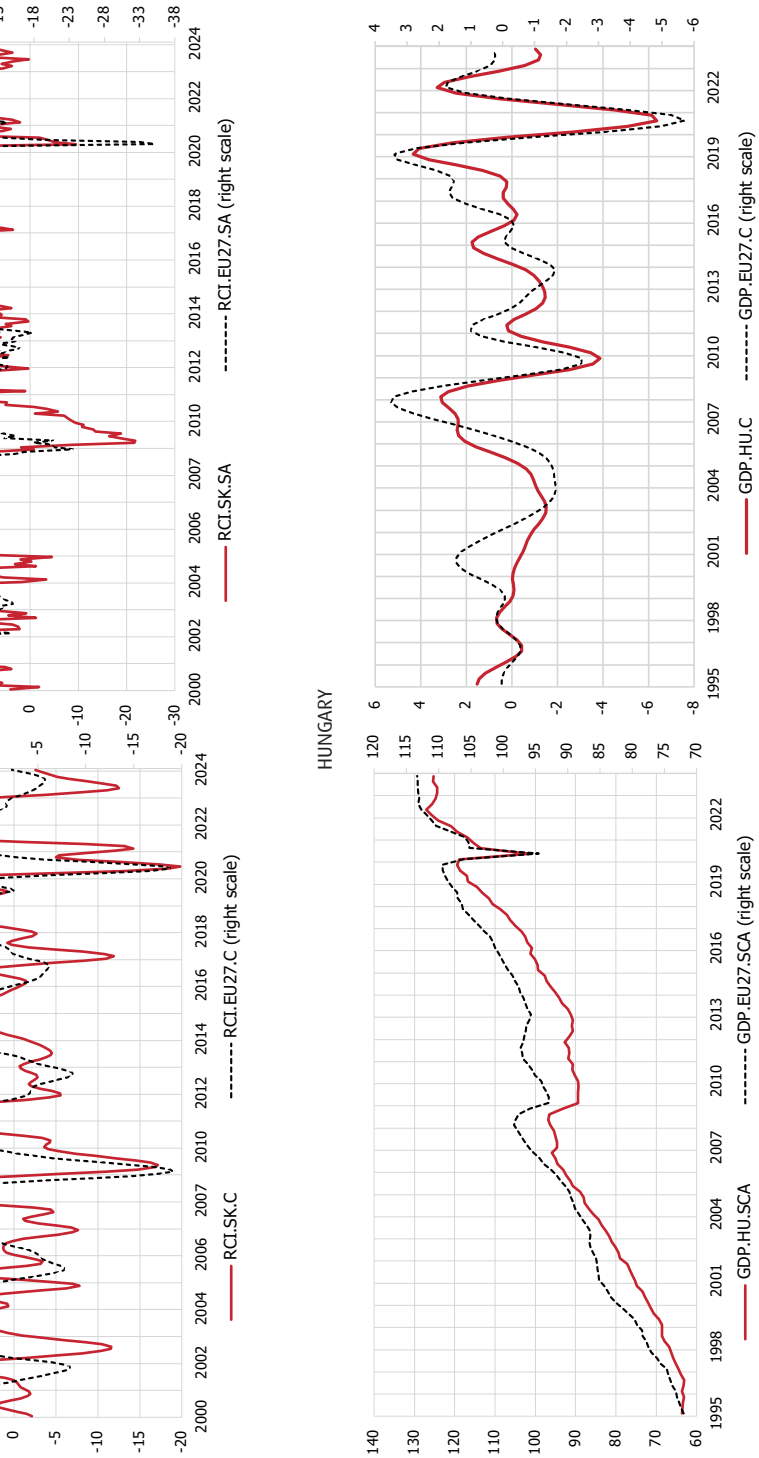
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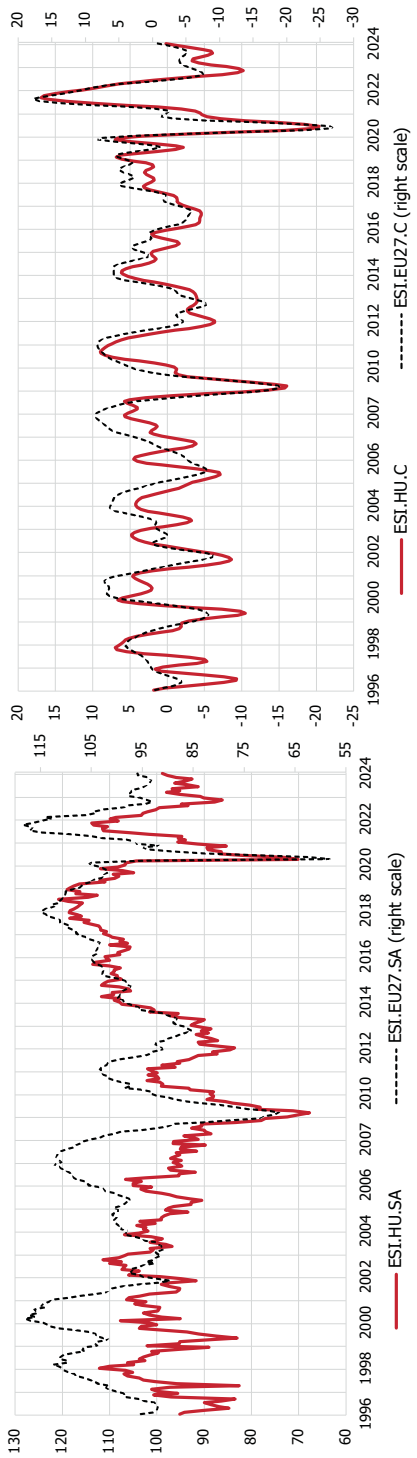
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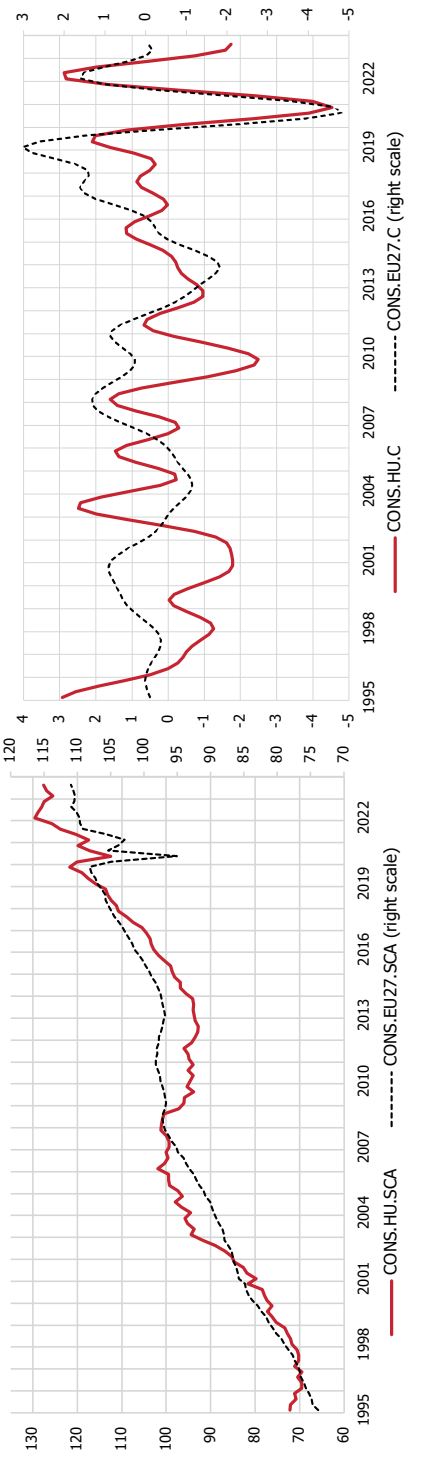
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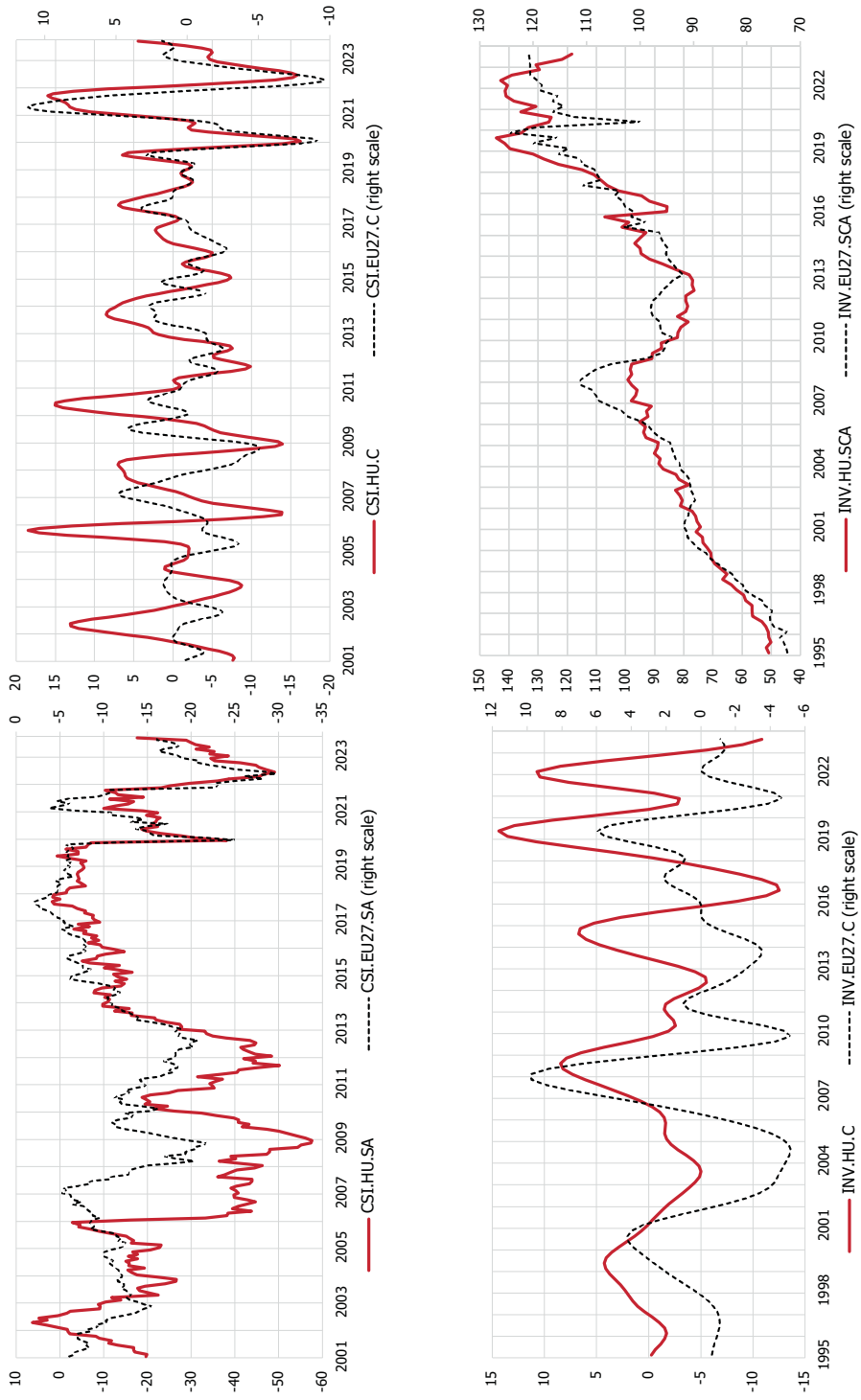
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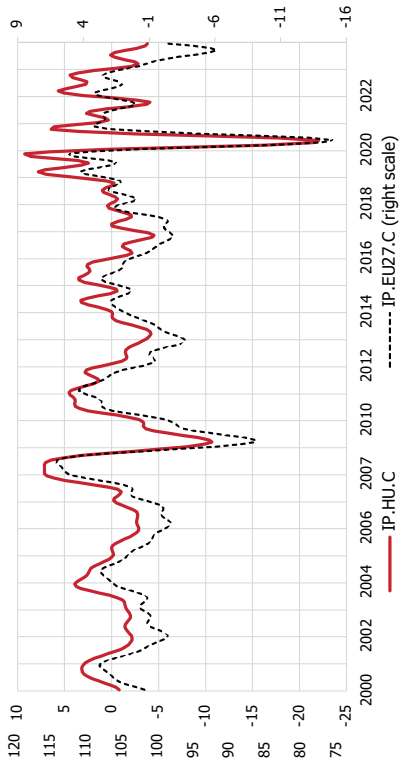
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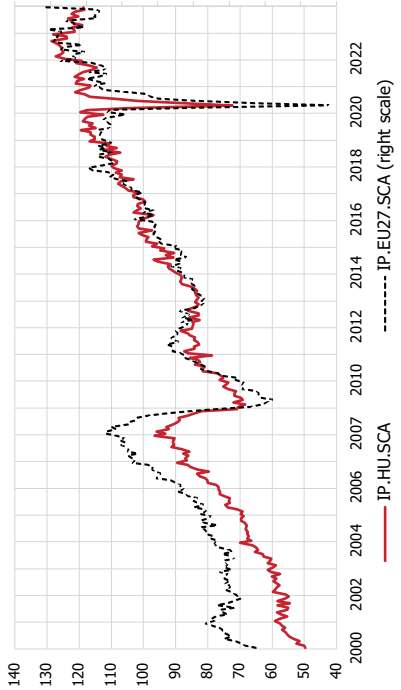
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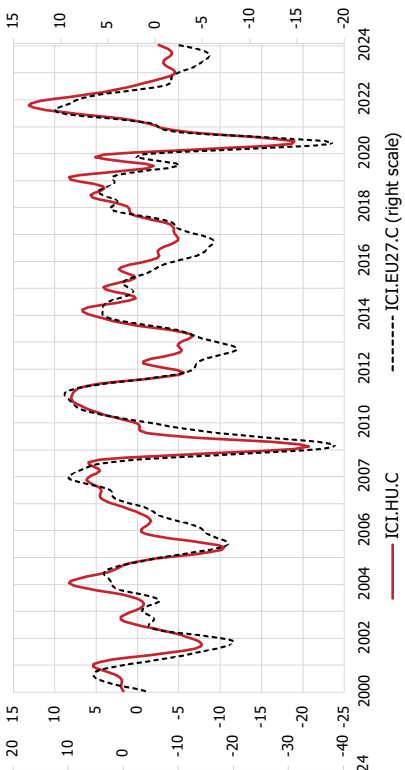
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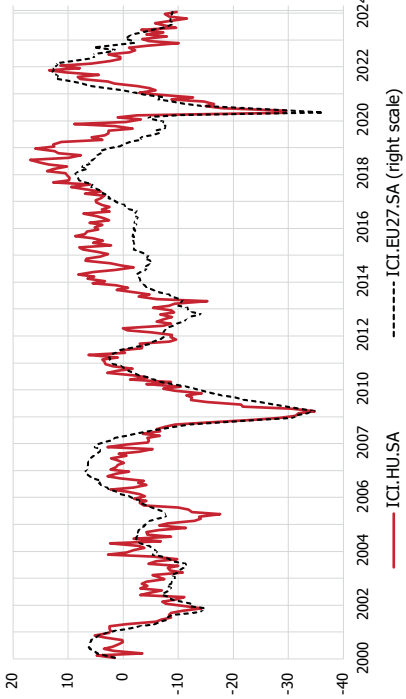
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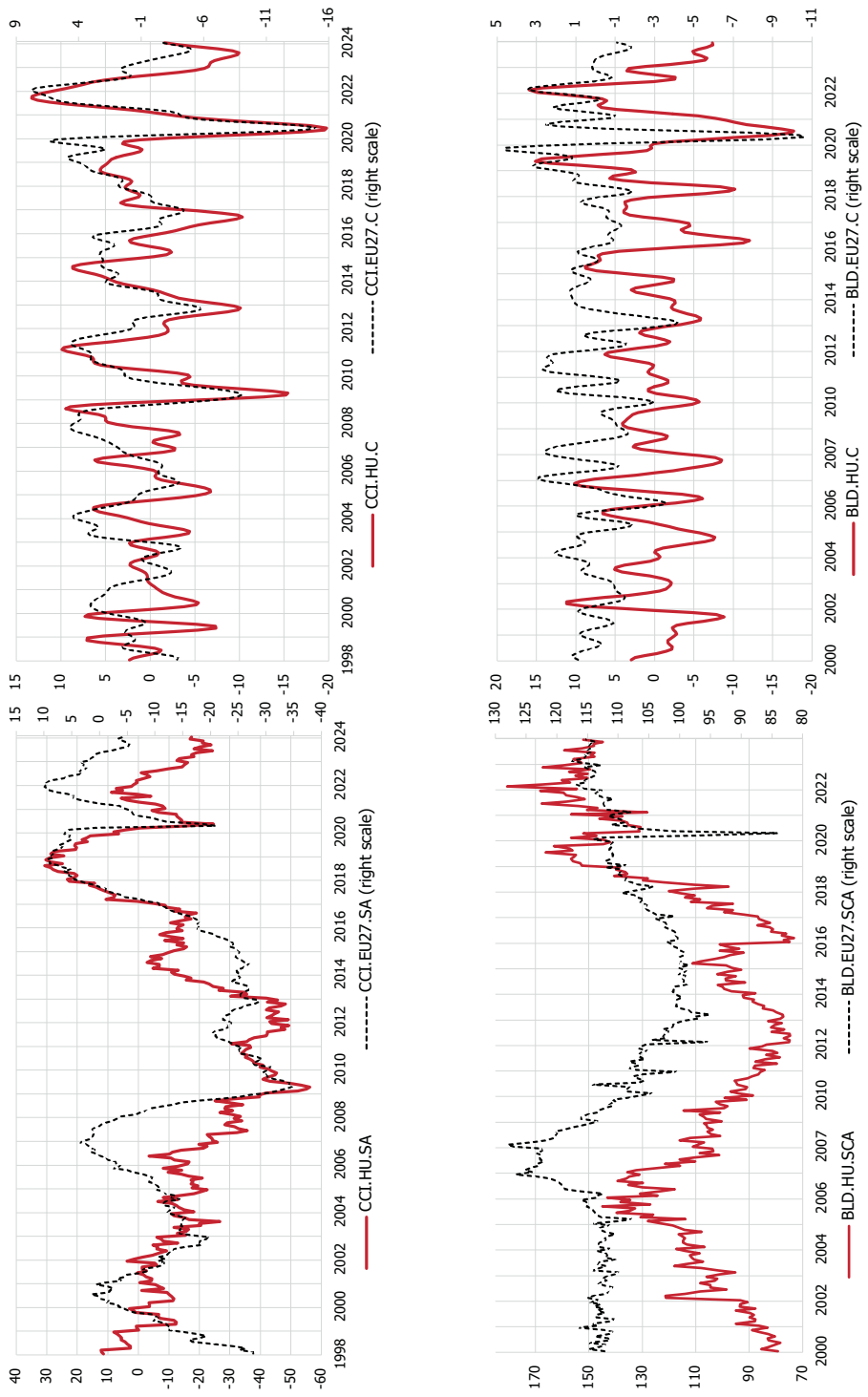
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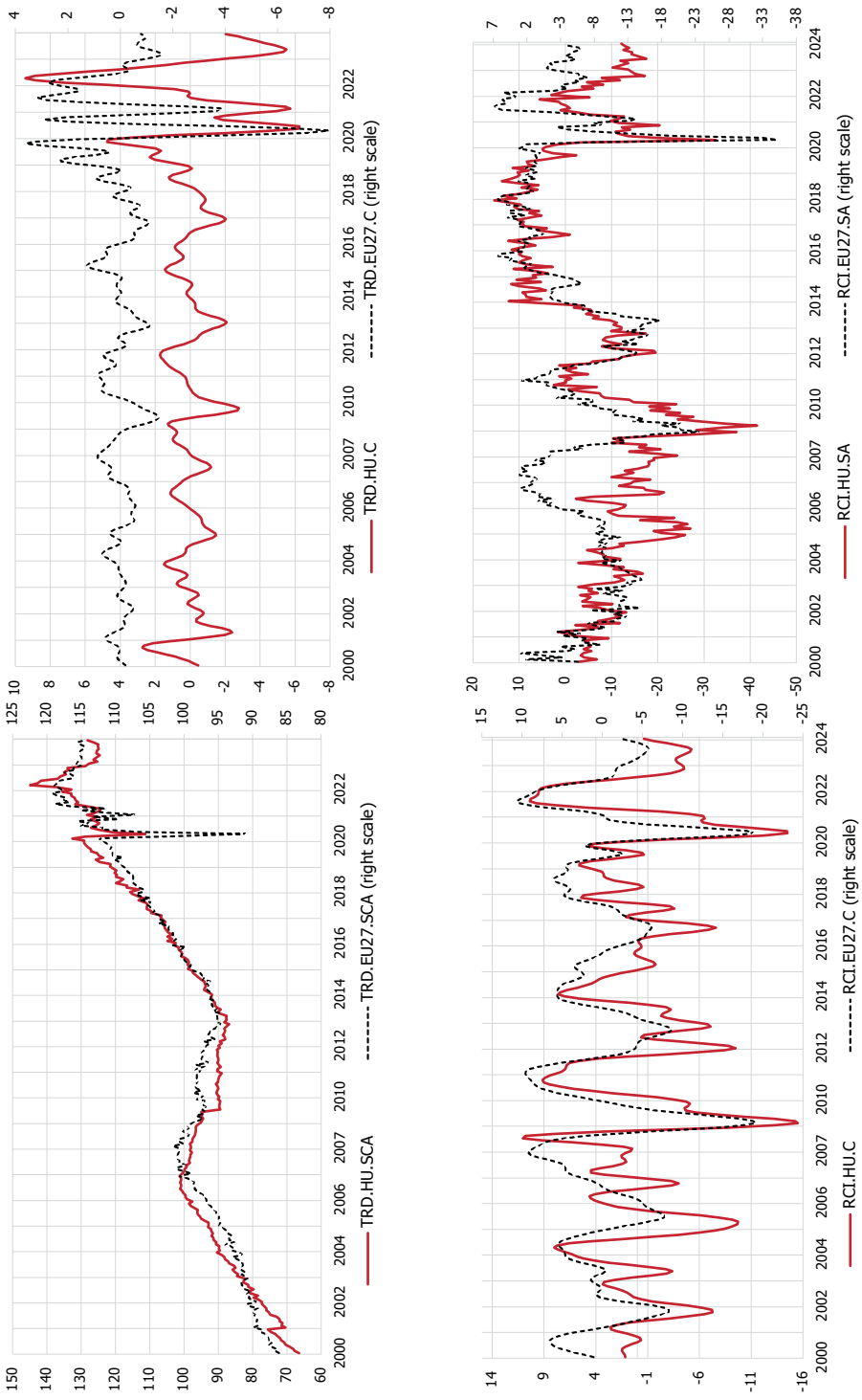

Source: Self-reported data based on Eurostat and RIED WSE data.

RECONFIGURATION OF GLOBAL SUPPLY CHAINS – THE ROLE OF ENTERPRISES FROM CENTRAL AND EASTERN EUROPE

Aneta Pluta-Zaremba
Marzenna Cichosz
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Abstract

This study aims to assess whether the economies and enterprises in Central and Eastern Europe (CEE) have an appropriate potential and how well they are prepared to attract investments in connection with the relocation of global flows in supply chains and growing internal demand in the CEE countries, also to indicate actions that will increase their chances to participate in the reconfiguration of supply chains in the coming years. Research shows that the CEE countries will have the potential to create an ecosystem aimed at enhancing their attractiveness as locations within the reconfigured supply chains, if they support business in the development of factors which are crucial from the perspective of investment: digital transformation of enterprises and the development of innovations, education adjusted to the competences needed in the future, preparation for action to implement the assumptions of the EU climate policy and sustainable development, and creating a framework for the development of circular supply chains, as well as the development of transport infrastructure, which is a prerequisite for the organisation of efficient and environmentally sustainable flows within the EU.

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In the face of changes and threats that have occurred in the global economy in recent years, enterprise managers have realised that there is a need to ensure security and continuity of business activities. Uncertainty and cumulation of phenomena destabilising global supply chains (the COVID-19 pandemic, social unrest and armed conflicts, political instability, increase in transportation costs) have made it necessary to limit risks and disruptions, which has been reflected by decisions to improve supply chain resilience. These decisions are in turn conducive to supply chain reorganisation and moving investments to closer markets (nearshoring), as well as politically friendly markets (friendshoring). An equally important role in shaping future supply chains will be assigned to sustainability requirements, with particular emphasis on environmental matters. European enterprises, especially those from Central and Eastern Europe (CEE), may be incorporated into the reconfigured global supply chains. An opportunity for them is possible participation of the region's enterprises in supply chains directed at the reconstruction of Ukrainian economy. Although it is not known when the armed conflict will end, businesses must already begin preparing to meet the enormous demand of our eastern neighbour.

The team of SGH Department of Logistics, who for many years have been conducting research on supply chains and their reconfiguration in the face of threats, megatrends, environmental challenges, and circular economy principles,[1] have started research on the reconfiguration of future supply chains, together with the team from the SGH Institute of Infrastructure, Transport, and Mobility, who study challenges connected with infrastructure and sustainable transport.[2] The authors aim to evaluate the potential of CEE economies and enterprises and their readiness to obtain investments due to relocation of global flow of goods along supply chains and a growing domestic demand in CEE countries, as well as to indicate measures that would boost their chances for participation in the supply chains reconfiguration in the coming years.

Reconfiguration of supply chains and preparation of the business environment, as well as development of enterprises, resources, infrastructure, and competencies require time, so the authors have assumed a time perspective of ten-odd years. The geopolitical scenario, which is a starting point for the presented analyses, assumes that EU's relations with Russia and Belarus will be regulated, with a limited confidence in business development, and also that the European Community will be enlarged

1 Circular economy is an economy where the value of goods, materials, and resources is maintained for the longest possible time, and the volume of waste is minimised (CEAP 1) It represents a development strategy that entails economic growth without increasing consumption of resources, deeply transformed production chains and consumption habits and redesigned industrial systems at the system level [COM(2014) 0398 final].

2 The team thank doctor Olena Gorlova for their participation in preparing the part about development of the transport infrastructure potential towards Ukraine, especially for collecting quantitative data about international trade in goods (2020–2024) and Ukraine's transportation system.

by new members, including Balkan countries and Ukraine, and that the position of CEE and Balkan countries will be strengthened at the expense of the Western Europe. The scenario also points out to the need to prepare logistics corridors necessary for the integration of the new member states with Poland, Slovakia, Czechia, Hungary, Romania, Bulgaria, and later with Balkan countries.

The research carried out by our team allowed us to answer the following questions:

1) What global factors and measures are crucial to increase the role of CEE enterprises in global supply chains in the perspective of the coming dozen or so years?
2) How should the conditions and determinants of the business environment be shaped to maximise benefits and advantages stemming from resilient, circular supply chains in the CEE countries?
3) How can digital technologies support competitiveness of enterprises, especially small and medium-sized ones, and their supply chains, how can they make logistics infrastructure in the CEE region more available, and how can they influence circularity?
4) What corrections in the European infrastructure development strategy are necessary in the light of geopolitical changes and climate change in order to attract investments to CEE as part of the process of de-globalisation of supply chains?
5) How to shape competencies of present and future managers, considering the changing role of CEE enterprises in a new, unstable economic reality, ubiquitous digitisation, and green business transformation?

The research team analysed trends shaping future supply chains, and they identified factors enhancing the role of economies and businesses in the reconfigured supply chains, on the basis of an analysis of reference literature and reports of international and government organisations of EU Member States and Ukraine. In order to formulate assumptions for the creation of an ecosystem that would be raising attractiveness of CEE countries as locations for supply chains reconfigured due to a combination of key investments factors, we used results of CATI (*computer-assisted telephone interviewing*) surveys on the resilience of supply chains, group interviews with representatives of enterprises, government and non-government organisations (NGO) about the development of enterprises and supply chains according to the principles of circular economy, and individual interviews with the representatives of international goods trade and managers of infrastructure sites.

Supply chains of the future

Several recent years have been a real test for global supply chains and their resilience to unpredictable events disrupting the flow of raw materials, components, and goods (70% of companies surveyed by KPMG experienced such events in 2022–2023) and an increase in raw material prices (71%) and freight transport (62%) [KPMG, 2023, p. 6]. These events disrupted supply chains, thereby blocking production, distribution of goods, and meeting customers' demand all over the world. The events have also shown how vulnerable the modern supply chains are, which have been built as a result of globalisation and related phenomena of offshoring production to low-cost countries and growing distance extending the time of delivery and response to any shocks, with rising transportation costs depending on the global fossil fuel prices. Disruptions of supply and demand in the context of flow of materials affected also the CEE countries (Table 1).

Table 1. Supply- and demand-related causes of disruptions in the CEE countries in 2022–2023

Supply-related causes	Demand-related causes
▪ global delays in deliveries of raw materials, semi-finished goods and components for work-in-process, still active and observed in 2021 ▪ shortage of labour ▪ disrupted plan of infrastructural and suprastructural investments, which should be a natural tool of supply chain recovery and resilience ▪ insufficient pace of technology absorption, especially process automation as an alternative to manpower	▪ short-term, yet dynamic changes, such as surge in demand, which negatively affect the production cycle ▪ overloaded transportation system and increase in global production costs, including so-called price pressure; ▪ sudden increase in prices of consumer durables

Source: Self-reported data on the basis of Eurostat [2023].

An analysis of reports and surveys conducted among EU and US businesses shows that firms experiencing problems caused by COVID-19 restrictions took measures that improve their supply chains resilience, such as modification of supply models, including broadening and diversifying geographical base of suppliers, or producing materials on their own (insourcing) instead of outsourcing production, supported by a policy of increased inventories, as well as better information transparency and visibility of disruptions thanks to investments in digital technology [Aksoy, Baur, Flach, Javorcik, 2022]. A small scale of intervention in supply chain configuration and insignificant withdrawal from cooperation with Chinese suppliers in that time proves, however, that it was commonly believed that everything would come back to normal after the pandemic. The armed conflict between Russia and Ukraine was another impulse to revise global supply chains [Lanv, Malacrino, Mohommad, Presbitero, Shar, 2022], which

meant rejecting suppliers from the Russian territory, and to diversify procurement sources by opting for onshoring and nearshoring, which, according to the research of Kearney [2022], is proceeding slowly, despite the fact that 92% of management staff approve of such changes.

Future supply chains must be a response to challenges faced by economies and business in the perspective of several coming years. First, they will have to deal with an unstable environment and growing risk caused by uncertain geopolitical situation; second, they will have to face up to challenges of sustainable development and climate change mitigation; third, they will have to take advantage of opportunities of the quickly advancing digitisation and customer centricity.

A challenge in the nearest future will still be building supply chain resilience, especially with the participation of enterprises from countries regarded as sources of disruptions. At the same time, resilience should be not only a response to disruptions, but also a concept of improving the resilience of supply chain links (enterprises) to future challenges and events that destabilise flows. Therefore, supply chains should be adaptive and flexible, based on disruption-resilient relations. In the face of contemporary challenges, a resilient supply chain must also be dynamic.

A trend which will set the direction for the EU companies and their supply chains in the nearest several years will be sustainable development and the goal of net zero carbon emissions reached by the EU by 2050. A factor that will conduce to supply chains reconfiguration will be the need to disclose the environmental impact not only from the perspective of companies' own operations, but also within the value chain pursuant to the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards Regulation (ESRS)[3]. Pressure exerted by consumers, employees, investors, and financial institutions[4] will also be important, as it will force companies to de-carbonise their supply chains and make them environmentally friendly.

Another trend consistent with sustainable development principles will be the idea of building circular supply chains. In the next forty years global consumption of materials such as biomass, fossil fuels, metals and minerals will double [OECD, 2018], and the quantity of annually produced waste will rise by 70% by 2050 [Kaza, Yao, Bhada-Tata, Van Woerden, 2018]. Since half of total greenhouse gas emissions and over 90% of biodiversity loss and water shortage is caused by extraction and processing of resources, European Green Deal [COM(2019) 640 final] initiated a strat-

3 Corporate Sustainability Reporting Directive (CSRD) of 14 December 2022 [OJ UE L 322]. Commission Delegated Regulation as regards sustainability reporting standards (ESRS) of 31 July 2023.

4 Requirements provided for by the EU taxonomy and CSRD directive.

egy for climate-neutral, resource-efficient, and competitive economy. At the same time it is assumed that scaling up the circular economy will make a decisive contribution to achieving climate neutrality by 2050 and decoupling economic growth from resource use, while ensuring the long-term competitiveness of the EU [COM(2020) 98 final, p. 2]. Transition to circular economy will encourage businesses to re-think their supply chain models and prioritise recycling, reuse, and regeneration of products. The transformation will require from companies to reconfigure their supply chains and to cooperate, which will streamline effective exchange of resources and information across the product lifecycle. Many new business entities will be needed that will manage products in the last phase of their lifecycle: collect and select them to effectively divide waste stream, as well as recycle and produce secondary raw materials. The research team perceives the circular economy as an opportunity for development of new enterprises in the CEE countries.

Ecosystem conditions boosting attractiveness of enterprises from CEE

Taking a place in newly formed global structures of supply chains by enterprises from CEE is a substantial challenge, so it is worth to take a closer look at conditions that will determine the attractiveness of the region's economies in the coming years. In the allocation of goods and services, key factors, beside legal and political stability and the size of domestic market, include support for innovation development both among technologically developed companies and small and medium-sized firms; approach to climate policy and sustainability principles; quality and availability of infrastructure for the organisation of flows along global and regional supply chains; availability of skilled workers, and access to green energy [EY, 2023]; digital transformation of business. An additional advantage of the CEE countries is their strategic location in relation to Ukraine and related possibilities of developing effective transport corridors for supplies of materials and goods necessary to rebuild the Ukrainian economy after the end of the war.

The attractiveness of the region's economies is also determined by economic factors affecting the costs of doing business, i.e. lower labour costs and higher economic growth potential than in Western Europe. Minimum wages in the CEE countries are between EUR 477 in Bulgaria (the lowest wage in the EU) and EUR 1254 in Slovenia, while in other countries of the region they are not higher than EUR 1000 a month and are by more than half lower than minimum wages in many countries of Western Europe. Forecasted GDP growth rate is comparable for most CEE countries. According to 2024 data it is between 2.1% of GDP in Slovakia to 3.1% of GDP in Estonia [Jóźwik,

2023]. Poland still has one of the most optimal relations between the economic growth rate and economic stability in CEE. It is due to its big market and domestic demand, which is a significant argument for strategic decisions to relocate manufacturing plants and develop new industries. Another advantage is Poland's geographical location on the intersection of north-south and east-west trade routes.

Another group of factors raising the attractiveness of the CEE region in terms of manufacturing relocation covers development of and investments in modern, resource-efficient economy, aimed at supporting innovation. 77% of firms from CEE declare having invested in development. Their major investment goals are production capacity renewal (46%), production capacity upscaling (25%), and innovations (17%). Manufacturers and big companies invest more in innovations (20% and 18% respectively). The biggest shares of funds are allocated for innovations by companies from Poland (22%), Slovenia (19%), and Czechia (17%), which invest in the development of new products or services.

Availability of high-quality logistics (linear, point and information) infrastructure and logistics services ensuring fast and reliable deliveries is another advantage of the CEE countries in terms of quick and effective flows of goods along global supply chains. Poland has a particularly good access to logistics parks with modern storage spaces and manufacturing plants. Its system of transport connections (especially roads and currently developed railway) allows for performing efficient transportation processes. However, the infrastructure that is used for transport and logistics needs to be improved in order to provide territorial cohesion of the European Union and to streamline free flow of people and goods both among the Member States, and between the EU and the rest of the world, taking into account environmental challenges and the transport de-carbonisation requirement.

The choice of place for relocation of production and services will be determined by compliance with sustainability principles and possibility to run a business according to circular economy assumptions, as well as access to green energy, which ensues from the need to de-carbonise in order to reach climate neutrality by 2050 pursuant to the *European Green Deal* and *Fit for 55* package. Sticking to energy from fossil fuels will substantially raise costs of running a business, due to growing prices of $CO_{2,}$ emissions. This may be a threat for further development of enterprises from energy-consuming industry sectors, and may also make it difficult to attract new investments in the process of global supply chain reconfiguration. To make the costs of goods and services attractive, economies of our region have to accelerate the energy transition and investments in renewable energy sources (RES). In Poland RES account for 15.6% of final energy consumption, which is below the EU average of 21.8% [PIE, 2023b, p. 20]. Sticking to coal will double energy costs by 2030. What is more, enterprises

from CEE must invest in technologies that reduce energy consumption. This will make the region more competitive and attractive for investments, compared with the other EU countries, which are the leaders of green energy transition.

Reconfiguration of supply chains towards resilience

CEE economies are facing an opportunity to create an ecosystem that supports businesses in finding place in supply chains reconfigured towards resilience. Specific conditions of key significance are conducive, such as geographical location connecting east with west, shortening flows, and ensuring stability of doing business, as well as relatively low labour costs combined with high skills of human capital.

Employing suppliers from different locations through nearshoring and friendshoring, and de-globalisation may reduce geopolitical risk. Regionalisation of supply chains, making them shorter and simpler, relations based on trust between nations sharing the same values and beliefs [ASCM, 2024b, p. 14] may help to build resilience. This is perceived as an opportunity for further development for enterprises from CEE, even if better security and resilience is linked with a risk of higher costs of business, higher prices, less choice, and innovation on smaller markets. Regionalisation and shorter supply chains also make it easier to response swiftly to fluctuating demand and provide more flexibility with customers' expectations (due to the possibility to include them in co-designing and co-manufacturing, which is in line with the idea of customer centricity), with lower environmental costs of transport.

Such dynamic and flexible supply chains will be proactive in case of potential disruptions, also thanks to digital technologies. Big data analytics, artificial intelligence and automation, better visibility of operations, transparency of information and its identifiability, due to inventions such as Internet of Things, will allow to quickly detect threats and inefficiencies, reduce costs, improve customer service, and improve flexibility, which in turn will lead to better resilience of supply chains. That is why it is worth to pay attention to the need to intensify the use of digital technologies in business in the CEE countries. Especially SMEs are in need of support in access to knowledge and financing from structural funds.

Let us note that even cutting-edge technologies used currently in supply chains, enabling decision-making in real time, are not a tool that would make it possible to fully "predict" all future events, including disruptions. That is why reducing supply chains and multisourcing with the use of CEE economies' potential will improve flexibility and time of response to unpredictable events. Costs of production in CEE, higher than in low-cost countries, will be compensated by reduced costs of inventory

and optimised response to changing customer demand. It is advisable to support the development of those sectors which have strategic significance for the EU and can potentially shift production to the CEE region due to specialisation of individual countries (e.g. chemical industry, production of plastic, automotive sector, construction, heavy industry).

A *sine qua non* condition of effective reconfiguration of supply chains towards their resilience is most of all the allocation and competency potential of CEE countries to create a kind of a hub, capable of transformation based on dynamic business models, using both new management concepts and accompanying technologies, as well as competencies and skills combining digital technology with robotisation, automation, and, most of all, the human.

Resilient supply chains should also include principles of sustainable development, including circular economy. Considering the potential of CEE economies, the region may be a reconfiguration hub for circular supply chains. However, this requires relevant regulatory, formal, and financial support provided to businesses, especially SMEs.

Position and role of CEE countries in green transformation and development of circular supply chains

Green transformation of supply chains

Climate policy of the EU (*European Green Deal*, *Fit for 55* package) aims to implement the principles of sustainable development, which focus on de-carbonisation of business activities and deployment of circular solutions. These goals are supported by CSRD directive from January 2023, which, along with ESRS standards, has imposed the obligation of reporting sustainability measures (ESG) on large business entities in the first years after its entry into force, and then on other enterprise groups. These regulations will also indirectly pertain to small and medium-sized enterprises (SME), which will have to provide relevant data concerning their environmental impact to their supply chain clients in the EU. Emission volumes will be one of the criteria of choice of goods and service suppliers, which should ensure better competitiveness to business entities applying the policy of climate transformation. Enterprises from CEE countries can take advantage of these conditions by undertaking intensive measures to de-carbonise their activities and make them greener [more in: Marzantowicz, Ocicka, Pluta-Zaremba, 2021], which, combined with lower labour costs, may boost their competitiveness, compared with companies from other EU countries. Competitiveness with low-cost countries is supported by, on the one hand, the drive for

reducing supply chains to build resilience, and EU regulations on the other, such as the mechanism of adjusting prices on EOG borders, taking into account CO_2 emissions (Carbon Border Adjustment Mechanism, CBAM), commonly called the carbon tax[5].

Facing up to the EU climate policy challenges will boost the chances of CEE countries to enter the reconfigured supply chains. According to the European Investment Bank, almost 90% of firms located in the region aim to reduce their greenhouse gas emissions (a rate comparable to the EU average). Basic measures undertaken in CEE include minimising recycling waste (67%), and investments in energy efficiency (55%), which recently have turned out to be very profitable [Forsal, 2023]. Large companies more often perceive climate transformation as a chance for development than SMEs. It is therefore necessary to support this sector of enterprises in their access to knowledge, innovation development, and implementation of de-carbonisation solutions, with the possibility to obtain funding from structural funds of commercial loans provided on favourable conditions for environmentally friendly measures. A large potential in terms of enterprise development and development of new business models can be seen in closing the circulation of products in supply chains, in line with the principles of circular economy.

Potential of the CEE region in terms of practical implementation of circular economy principles

Principles of circular economy (CE) applied in the entire EU may contribute to growth of EU GDP by additional 0.5% by 2030, and to the creation of approximately 700 thousand new jobs [European Commission, 2018]. It is also economically reasonable for individual enterprises: manufacturing enterprises in the EU spend on average about 40% of their funds on materials, so circularity models can raise their profitability and at the same time hedge them against fluctuations of resource prices. This translates into a new EU Circular Economy Action Plan [COM(2020) 98 final], which comprises initiatives concerning the whole product life cycle, aimed at, among other things, supporting circular economy processes, sustainable consumption, or ecodesign. EU initiatives and regulations refer to aspects concerning the sustainable character of products. One of them is, in particular, the Ecodesign Directive [OJ L 285, p. 10], which regulates energy efficiency and some circular economy features for energy-related products. At the same time instruments such as EU eco-labels [OJ L 27, p. 1]

5 CBAM is supposed to prevent transferring production from sectors covered by emission trading systems (ETS) to countries where such regulations are not in force. Initially, the tax covered production in energy-consuming industries which generate a lot of emissions.

or green EU public procurement criteria [European Commission, 2024] are broader in scope, but their impact on the functioning of businesses is smaller because they are voluntary. Some of the most important product groups listed in the aforementioned action plan are electronics, ICT, textiles, plastics, packaging, batteries and vehicles, food, water and nutrients, as well as furniture, steel, cement and chemicals, construction and buildings.

CEE countries have shown growth trends in terms of circular material use, but their results in this respect in most cases are still below the EU average. Circularity rate[6] in 2022 for EU states was 11.5% and grew by 0.1 p.p. in relation to 2021. This situation conduces measures of enterprises aimed at development and innovation (product- and process-related) accompanying transformation to circular economy. Entities located in CEE (especially Romania, Lithuania, Bulgaria, Latvia, and Croatia) show the biggest development potential due to the biggest distance to circularity leaders, i.e. the Netherlands, Belgium, France, which had the biggest circularity rates in 2022: 27.5%, 22.2%, 19.3%, respectively). A valuable measure in this case is a relevant best practice benchmark concentrated on the specific character of a given sector and the way of involving stakeholders in circular supply chains built in the countries of Western Europe. However, special attention should be paid to solutions provided for by national strategies in CEE, where guidelines for product ecodesign are supposed to play a key role, in order to both reduce the volume of materials used and eliminate waste as such, and to increase the use of newly generated waste as valuable resources.

Transformation towards circular economy in CEE: perspectives and recommendations

Circularity is a significant part of a broader industry transformation towards climate neutrality and long-term competitiveness due to material savings in supply chains, especially in production and consumption processes. It brings additional value, by stimulating innovation and entrepreneurship among SMEs. Therefore, it has a considerable potential of reducing environmental pressure and provides new, green opportunities for running business activities and creating new jobs, thereby bringing economic benefits to individual regions, including CEE. Considering the single market and the potential of digital technologies, as well wages in the CEE region a few times lower than in the Western Europe, circular economy may substantially enhance both the industry and service providers cooperating with each other in CEE. It is therefore

6 Circular material use rate measures the share of materials recycled and reintroduced into the economy in the total materials consumption.

recommended to intensify the spread of knowledge on circular economy among managers, especially those of industrial companies located in the CEE region.

Low circularity rates in the EU are caused by the fact that entrepreneurs focus on waste management, instead of preventing waste production. Ecodesign of products plays a key role in this process, as it determines a product's environmental impact in 80%. The adopted EU regulations and recommendations are therefore insufficient to achieve the set goals, and must be reviewed to make their effective execution possible. Still, this has not been reflected in the 2021–2027 programming period [European Court of Auditors, 2023].

The low circularity rate is also caused by non-implementation of national circular economy strategies. According to 2022 data, in the CEE region such a strategy was only prepared by Poland. What is more, no effective EU directives are in place that would regulate identification and measurement of product ecodesign. From the management perspective it seems particularly valuable to incorporate ecodesign also in business processes determining circular supply chains and green logistics in an enterprise. It is recommended to intensify works on national circular economy strategies setting the rules of ecodesign and flow of waste to be reused as a resource. It is also advisable to adopt a single circular-economy strategy for CEE, in line with the aforementioned recommendation.

Measures taken as a part of regional transnational cooperation will contribute to the improvement of capabilities of public and private stakeholders in terms of execution of circular economy policies in CEE. Let us highlight that integration within different business models and 'R' strategies (refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, recovery) should comprise both leaders and SMEs creating circular supply chains operating for the benefit of not only CEE economy (*friendshoring*), but EU as a whole (or in broader perspective – intercontinentally). Such cooperation undoubtedly provides opportunities for common success due to mutually complementing competencies and adding diversified value within co-created circular supply chains, and also enhances economic growth of the region. It is therefore recommended to spread knowledge on the possible cooperation among various stakeholders of circular economy in CEE through formal and informal industry institutions, social and development schemes conducted on the national level.

Circular economy actively engages consumers, as prosumers, in closing the cycles, by enhancing their role in creating enterprises and consumer-centric supply chains. Such business models respond better to real market needs, and reduce unnecessary costs, including internal costs incurred by enterprises. It is necessary and recommended to raise awareness of consumers on the impact of their purchasing behaviour on the natural environment and economic prosperity.

While some CEE countries are closer to the achievement of EU waste re-use and recycling goals, others are still lagging behind. To build a more resource-efficient and competitive economy, it is necessary to intensify the transformation to circular economy, taking into account local conditions and adjustment potential to specific needs of urban and rural areas. Let us note that recovery of rare-earth resources, recycling of plastic, etc., result in de-coupling and independence, to some extent, from supplies from geopolitically unstable regions, which in turns reduces uncertainty and business risk, thereby raising the possibility of building resilient, circular supply chains. This is important, considering a growing demand for critical resources, produced mostly by China, and partly by Russia, as well as strong EU's dependence on supplies from these countries. Because of digital and green transformation, demand for rare-earth elements will rise sevenfold, and demand for lithium will rise fortyfold by 2040. Meanwhile, EU imports as much as 98% of rare-earth elements from China, 71% of platinum from South Africa, 85% of niobium from Brazil, 99% of boron from Turkey [PIE 2023a, pp. 4–5]. Cooperation with suppliers of secondary raw materials from CEE countries could help reduce transportation costs (also external costs) and benefit from nearshoring (shorter supply chains are less exposed to the risk of disruption). These factors also make it possible to ensure the EU raw material security in geopolitical terms, which is strategically important.

Transformation designed in such a way requires, however, policy framework for sustainable products, reorganisation of supply chains and material flows (including water and energy), improvement of waste management, and new business models created along circular supply chains. To create incentives for transformation of businesses and their supply chains toward circular economy it is therefore required to make formal institutions' decision-makers more aware of opportunities that it provides for the natural environment and the CEE economy (e.g. through implementing integrated circular economy plans at the local and regional levels, which cover also regional innovation programmes). It is recommended to implement local and regional systems of incentives for cross-border collaboration between different circular economy stakeholders in CEE.

Poland, due to its competitiveness, developed logistics infrastructure, large national market, still low costs of labour, and strategically advantageous geographical location, has an opportunity to benefit from **changes** occurring in the global added value chains and to become a leading place for reshoring, nearshoring, and friendshoring. Since the CEE countries are to some extent similar, the region is an attractive place for creating circular supply chains or closing the supply cycles. It is therefore recommended to review Poland's circular economy strategy, paying special attention to ecodesign in the context of strengths of the Polish market, which should give it the opportunity to become a key area of development of circular supply chains in CEE.

Development of new circular economy models or transformation of traditional supply chains is supported by funds from the National Recovery Plan (EUR 60 billion, or almost 9% of 2022 GDP), which should substantially boost the economy in 2024, including the investment rate. However, all the measures should be carried out fast, as the investments must be completed by June 2026, and settled by the end of the year. It is therefore strongly recommended to apply investment planning aimed at development of circular economy and circular supply chains financed from the National Recovery Plan.

Digital technologies in supply chains

The progressing development of digital economy, particularly so-called Industry 4.0, indicates that manufacturing and inventory management are the most attractive areas for the application of advanced cyber-physical systems. Digital solutions are changing the image of traditional logistics and supply chains, which poses an enormous opportunity for firms and economies in CEE for assuming the role of key stimulators for reconfigured supply chains. Some of the areas with broad, still untapped potential are: predictive analytics – using historical data and machine learning algorithms for forecasting future events and trends, which is especially important for managing resilient supply chains; planning support systems – tools for optimising logistics processes, such as transport planning, and resource management; management systems – platforms integrating various logistics functions, such as warehouse, transport, or supply chain management (so-called control towers); data mining – analysis of big data collections to identify patterns, trends, and relations between variables, as well as advanced analytics supporting events prognoses and decision making; real-time process monitoring – shipment tracking, resource management, and quality control.

European Commission reports show that CEE countries, despite investments in digital technologies they have already made, will face many challenges connected with planning and launching digital technology ecosystem based on mobile 5G network systems, computing cloud, Internet of Things, and artificial intelligence. In terms of integration of digital technologies into business activities, Poland is ranked 24th among 27 EU states. To compare, Czechia is ranked 19th, Slovakia 21st, Hungary 25th, Lithuania 13th, Latvia 23rd, Estonia 15th, Slovenia 9th, Bulgaria 26th, Romania 27th. [European Commission, 2024]. Nevertheless, Poland has the potential to accelerate the pace of digital transformation and to become a CEE leader. Analyses show that more digitally advanced countries achieve better economic and social results, i.e. they are "greener" wealthier, more innovative, and competitive [Fundacja Digital Poland, Microsoft,

2023], so faster digital transformation is important for boosting CEE's chances for participation in reconfigured supply chains in the future.

Cyber-physical systems are not used in an optimal way for logistics infrastructure management, and SMEs included in section C of the Polish Business Activities Classification (industrial processing) are not fully acquainted with technologies used for so-called industry 4.0 (e.g. 60.5% of these enterprises still do not know the term "industry 4.0"), which limits their competitiveness and attractiveness as partners in international supply chains. That is why it is recommended to spread knowledge on the functionality and potential of cyber-physical technologies in production and logistics processes among SMEs, as a part of initiatives taken by the Ministry of Digitisation.

At the same time, SMEs from section C do not fully use the potential of cyber-physical system functionalities because of high costs of their implementation. This is because they do not know about the possibility of co-funding technology-supported product, process, and organisational innovations from external resources, such as operational programmes supporting innovation (technologies are in 90% financed from companies' own resources; only 30% firms obtain external funds for this purpose). Knowledge spread by local governments among SMEs about the potential of technologies and possibilities of their funding from external resources (e.g. operational programmes) will translate into their better competitiveness.

CEE economies have an enormous potential of participation in supply chains reconfiguration, but also being their key actors. In the area of innovation and technology such an element of a reconfigured supply chain may be hub-like organisations, dedicated to the development of innovative digital solutions (software), centralised forecasting and planning of a global supply chain, and data analysis and development of a comprehensive reporting system. It is recommended to create platforms (e.g. within an industry or sector) for collecting and sharing information on available resources (i.e. production capacities, available storage areas and means of transport, allowing for collaboration or combining stored or transported goods), as well as supporting route planning based on available logistics infrastructure in CEE and the EU.

An area with large untapped technology potential is support for green transformation for enterprises and economies, especially in their shift to circular economy. As for the rate of use of information and communication technologies (ICT) for environmental sustainability, in Poland the share of companies carrying out environmentally friendly activities using ICT, which have reached a medium/high rate of ICT use, is 60%, which is below the EU average (66%). For the sake of comparison, the rate in other CEE countries is as follows: Czechia 56%, Slovakia 76%, Hungary 65%, Lithuania 74%, Latvia 65%, Estonia 62%, Slovenia 74%, Bulgaria 68%, Romania 68% [European Commission, 2024]. These two trends – digitisation of economy and running business

in line with sustainability principles – can be beneficially combined, by implementing in production and logistics processes appropriate technologies aimed at reducing external costs (minimising the negative environmental impact of business). Knowledge coming from the business environment, its formal and informal institutions, is necessary for this. It is also desirable to spread knowledge about how cyber-physical systems can reduce external costs of supply chains and how open innovation can be used. More emphasis should also be placed on more common use of digital technologies to support circular solutions and to close product life cycles, and to create innovative business models. Introduction of digital technologies and better data management can also improve resource efficiency, reduce the consumption of materials and energy, thereby limiting greenhouse gas emissions and waste. Access to data and involvement of supply chains stakeholders make it possible to improve ecodesign of products and processes, by reducing the volume of used materials and raising the rate of repair and reuse and sharing, as well as dematerialisation of goods.

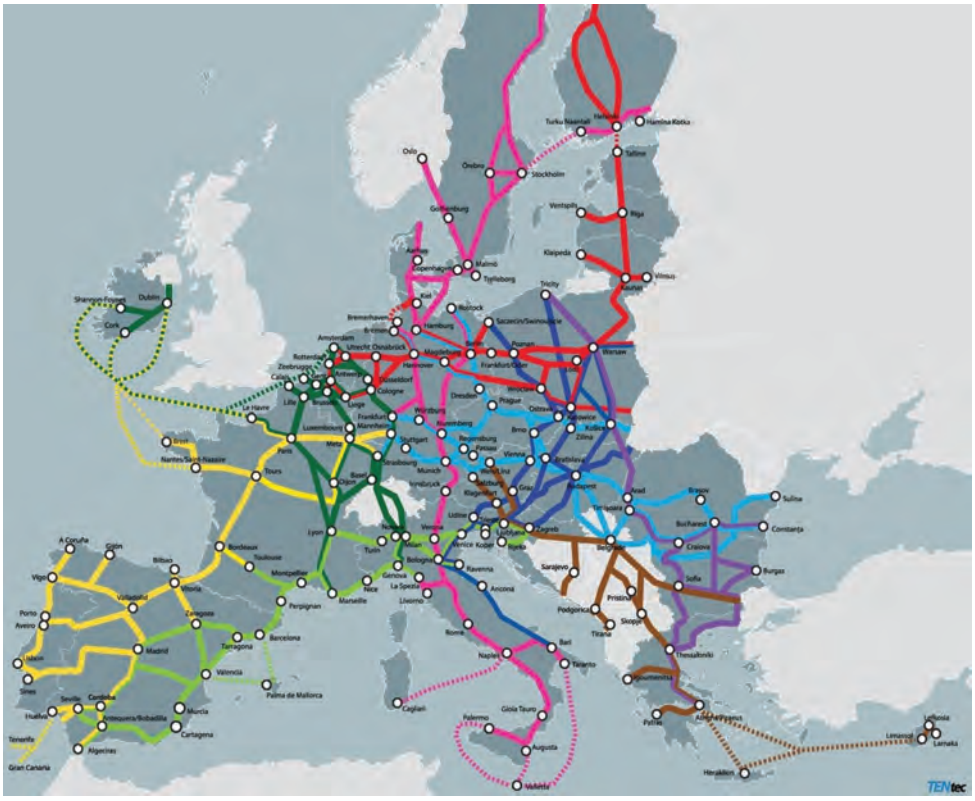
Development of infrastructure along north-south axis with the Ukraine branch line, using environmentally friendly transport solutions

In order to reconfigure supply chains and attract investments to the CEE countries, it is required to plan many years ahead and gradually develop logistics, transportation, energy and telecommunications infrastructure, which will ensure geographical coherence of the EU and streamline free flow of people and goods both internally, between the Member States, and between the EU and the rest of the world, in particular between Europe and Asia, in line with recommendations made under the Belt and Road Initiative.

A starting point for the analysis of directions of infrastructure development is the trans-European transport network (TEN-T), prepared in 1996, reviewed in 2013 and re-reviewed in 2021. TEN-T is composed of roads, railways, air routes, sea and river routes, which are the most important connections in terms of EU development, as well as infrastructure sites such as sea ports, airports, inland waterway ports, road and railway terminals. Additionally, its integral component are smart transport systems, which improve the network capacity, traffic security, and reduce pollution generated by transport. The goal of creating TEN-T was to have a coherent policy of transport network development, which by nature is handled by individual Member States, and to improve the quality and interoperability of the EU transport systems, which entails also making green modes of transport (especially railway) more popular. In 2021, while reviewing the TEN-T policy and adapting it to the European Green Deal (2019)

and to the post-pandemic recovery guidelines, the transformation of the transport system was made a priority, in line with the principle of making it greener, more digitised, and more resilient to the effects of sudden crises, caused by both climate and political circumstances [European Council, Council of the European Union, (2019)].

Figure 1. Trans-European transport network TEN-T



Notes: Yellow – Atlantic Corridor; (dark) green – North Sea and Mediterranean corridor; red – North Sea and Baltic corridor; pink – Scandinavian-Mediterranean corridor; navy blue – Baltic and Adriatic corridor; blue – Rhine and Danube corridor, (light) green – Mediterranean corridor, brown – Western Balkans and Eastern Mediterranean corridor, purple – Baltic Sea and Aegean Sea corridor.

Source: Ziemkowska-Owsiany [2023].

In this study, the analysis of TEN-T development focuses on the movement along the north-south axis, with a branch line to Ukraine. This axis comprises three corridors, significant from Poland's and CEE countries' perspective:

a) Baltic – Adriatic corridor;
b) Baltic Sea – Black Sea and Aegean Sea corridor;
c) North Sea – Baltic corridor.

Some of the major reasons to concentrate the EU efforts on the transport infrastructure development in the CEE region (i.e. the European countries that went through a system transformation after 1989), are the following factors.

First, the economic growth rate in CEE, including Poland, since 1989 and especially after 2004 (after the accession to the EU) has been higher than in the Western and Southern Europe [Eurostat, 2023]. In the coming years, if the economic policy in the CEE countries is conducted well, and if they take the advantage of global supply chains reconfiguration and obtain investments for industry development and business services, the development rate of CEE countries may be maintained. From the perspective of both old EU Member States and the current nine candidate countries (Albania, Bosnia and Herzegovina, Montenegro, Georgia, North Macedonia, Moldova, Serbia, Turkey and Ukraine), it is reasonable to integrate the European Union as EU-36, to which a coherent transport system will contribute.

Second, Russian full-scale invasion of Ukraine launched in February 2022 changed the direction of flow of many groups of goods in Europe. The change was cause largely by sanctions imposed by the EU on Russia and Belarus, which restricted trade with these countries, banned their carriers from access to European roads, railways, airports and sea ports, and excluded Russian and Belorussian banks from international SWIFT system [European Council, Council of the European Union, 2024]. For four months Russia was blocking Ukrainian ports on the Black Sea, through which Ukraine had been shipping its products. Ukraine had been exporting 50% of global sunflower oil, 18% of global corn and 10% of wheat. Between July 2022 and July 2023 an agreement between the UN, Turkey, and Russia was in force (so-called Black Sea Grain Initiative), which enabled Ukraine to send from three of its ports (Chornomorsk, Odessa, and Pivdenne) more than 1000 vessels with grain and other food products, over a safe humanitarian sea corridor. This was, however, only one third of the volume of goods shipped before the war. Other grains and produce were shipped from Ukraine by inland waterways, road, and rail transport over the borders with Poland, Slovakia, Romania, or Hungary [State Customs Service of Ukraine, 2024]. The largest volumes were shipped through Poland, but only a part of the Ukrainian surplus agricultural production could be sent beyond Europe because of insufficient number of available standard-gauge railwagons, exceptionally low grain prices caused by abundant yield in many world regions, short-term inflexibility of offloading capacities in sea ports, insufficient capacities of road and rail border crossings and offloading capacities of railway terminals at the junction points of broad-gauge railway (1520 mm gauge, a standard in the states of former USSR) and standard-gauge railway (1435 mm gauge, most common in the EU). Ill-prepared land transport system was not able to cope with the increased demand for transit of goods through Poland, which, combined with a relatively high absorptivity

of the Polish agricultural market compared to the EU, resulted in a situation where large amounts of goods ended up on the Polish market, thereby causing the prices to drop. Let us note here that, while low prices of agricultural goods are bad for the farmers, after the beginning of the war in Ukraine they were a strong inflation anchor, which prevented the inflation in Poland from reaching enormous rates, despite the loosening of monetary discipline by the National Bank of Poland (NBP). Inefficiency of international transport chains was in this case definitely one of the main sources of the economic pressure, which was strongly felt by farmers. They expressed their frustration by protests, most spectacular form of which was the blockade of border crossings between Poland and Ukraine.

Changes in the directions of food products flows are also a consequence of climate change. This problem concerns also Spain, a producer of 70% of olive oil in the EU and almost 50% of the product globally. Global warming has led to less rainfall in the winter, and in consequence water reservoirs drying up and shortage of water needed to water orchards. A decrease in national production and considerable increase in prices has made in profitable to import sunflower oil from Ukraine, among other countries [Plat-Iglewska, 2023].

While planning transport infrastructure, one should also take into account flows of goods that will reach Ukraine for the purposes of its recovery and reconstruction after the war. In 2024 the World Bank estimated that the value of expenditures for the recovery of the economic and social potential in this country will be USD 486 billion over the next decade [Supernak, 2024].

A significant determinant of the implementation of transport infrastructure development policy is limited availability of financial resources. This is a consequence of increased expenses of the EU Member States for the military in response to Russia's aggression. In March 2024 (after president Putin's address to Russian Federal Assembly, where he once again presented invasion of Ukraine as a defensive war[7]), the European Commission adopted, for the first time in the Community's history, European Defence Industrial Strategy, and related legislative initiatives. The European Defence Industry Programme (EDIP) was prepared. Member States' defence budgets are to reach at least 2% of GDP. The Polish government planned defence expenses of 3.1% GDP in its 2024 budget.

In the situation of growing shortage of public money for investments, investment funds offer their experience and propose to use the capital at their disposal to a larger

[7] The part of the address relating to foreign policy had two goals: one was to scare Western societies and their decision makers and discourage them from continuing or increasing support for Ukraine; the other one was to send a message to those opting for a dialogue with Moscow it is ready to talk, subject to the talks being held only on the Kremlin's conditions [see more: Bartosiewicz, 2024].

extent than in previous decades. Financing reconstruction, modernisation, or new infrastructure from private funds requires, however, creating more advantageous legal and fiscal conditions for domestic and EU investors, as well as those providing capital from other regions of the world.

Private entrepreneurs, as potential investors in infrastructural projects, point out also to an enormous significance of collaboration abilities between national authorities under international structures. Infrastructure investments in transport corridors going through several countries require openness and willingness to find agreement despite different national interests. The issue of including Ukraine in the collaboration is particularly important. It also seems necessary to eliminate the power of oligarchs (with their privileged position gained during the system transformation in 1990 s) and to enhance the position of private investors from the SME sector, both national and foreign ones.

Let us highlight that Polish entrepreneurs have undertaken the effort of adjusting to the EU standards. An equally desirable process is Ukraine's integration with the European system, but the condition of preventing tensions between the EU and Ukraine is decent inclusion of private Ukrainian entrepreneurs representing large asset and capital potential in the convergence process. A change of the Ukrainian entrepreneurs' attitude, which would increase their acceptance of the EU standards, may occur by broadening the dialogue in the business environment comprising representatives from Ukraine on the one hand and those from CEE on the other. Politicians and officials can support the dialogue, bearing in mind the fact that informal agreements are an indispensable element of developing formalised geopolitical relations.

The Economic Forum in Karpacz is a good opportunity to remind Polish entrepreneurs and public authority decision makers that with changing climate conditions and extreme weather events, such as prolonged droughts and rapid storms, and with unstable social and economic environments, investment decisions should be taken with special caution and deliberation. In the last three decades numerous programmes have been conducted at the EU level, which can be regarded as ambitious and reasonable. Still, the experience gained in pursuit of the goals set in the past shows that the decision makers did not appreciate the factors that obstruct introducing changes of strategic importance.

It is worth to note how strongly public authorities in individual EU Member States opposed the implementation of projects leading to interregional convergence. It is conspicuous in the area of infrastructure, including railway transport and power grids comprising both generation and transmission of electric energy. It turned out that decentralisation attempts in these sectors did not bring the expected results. The railway transport saw no significant increase in the supply of international services,

including services of combined transport operators. There are no entities in the electricity grid systems that would service the users of electricity-driven rolling stock equipped with batteries, moving through various countries. The development of hoped-for, highly environmentally friendly and climate-neutral hydrogen railway is still at the initial phase. Despite intensive EU's support for railway transport through infrastructure development subsidies and legal provisions aimed at lowering the profitability of road freight transport, demand for railway transport (including intermodal transport) has fallen, mainly because of worse competitive position of companies that use it [ALICE, 2023], and growing price pressure from road carriers experiencing more and more problems with obtaining transport orders.

Unless the current barriers for structural changes introduction are properly recognised, and solutions to overcome these barriers are found, it will not be possible to popularise the use of low-emission electric vehicles [Paprocki et al., 2022, pp. 109–146] in the mobility systems, as well as interoperational railway rolling stock (electric hydrogen-driven locomotives or multisystem locomotives driven by electric contact line system through pantographs). At the same time, it should be highlighted that without a radical modification of the transport system, the goal of modal shift set at an EU summit by the end of the 20th century will not be achieved.

Another important factor is blocked integration of telecommunications operators, and in consequence maintaining separate systems of wireless data exchange in individual EU states.

One of the ways to implement desirable changes in infrastructure sectors may be launching private investments. However, to achieve this, EU regulations should be amended and national regulators operating in these sectors should change their behaviour, as currently they often focus on blocking the integration of economic processes in the EU, instead of promoting them.

Competencies of the future in supply chain management

Considering the directions of EU policy development and supply chains in the CEE, the most desirable competencies will be those relating to digital and green transformation, managing resilient supply chains that are disruption-proof, adaptive, and flexible in terms of growing customer needs. Supply chain management requires managers to combine the abilities of managing operations, demand, and product flows with the strategic level (building networks of cooperating enterprises, maintaining client relationships). That is why it is crucial to form and develop competencies combining hard (analytical) and soft skills, determining the ability

to communicate, with cognitive skills, necessary to solve advanced problems, make decisions, and steer processes.

Digital transformation of supply chains and technological advancement, covering big data analytics, artificial intelligence, Internet of Things, process automation and robotisation in manufacturing plants and logistics centres, will create new jobs at companies and require new skills and competencies from employees. First, the competencies will play a bigger role in supply chain orchestration than in day-to-day operations that will be gradually automated. Second, they will be an important element of cooperation in multifunctional teams that will be solving disruption-related problems and ensuring adaptation to changeable external conditions. Employees will be expected to know how to use advanced technologies and work with them. Digitisation, automation, and robotisation of production and flow of goods along supply chains will help not only to overcome manpower shortages, but also to reduce costs and boost productivity, thereby facing up to the aspirations of the young generation. This sets the directions for developing skills oriented towards tapping into the potential of automation, robotisation, and artificial intelligence, as well as cooperating with these phenomena instead of competing with them. Digital technologies, in line with the concept of Industry 5.0, called also Society 5.0, are to support employees and management staff in their work, not replace them [Szelągowska, Pluta-Zaremba, 2021].

Equally important in the coming years will be competencies connected with sustainable development, especially green transformation with its goal of carbon neutrality by 2050, circular economy, and social matters. Surveys and interviews with respondents from different stakeholder groups prove that it is necessary to educate managers, especially from small and medium-sized firms, on the potential and benefits of green and circular solutions, and to encourage investments in innovations connected with closing product life cycles.

Considering the changing conditions of doing business in the nearest future, the most important management skills and competencies include [GE Hunter, 2024; ASCM, 2024a]:

1) adaptation skills, which involve the ability to act in uncertain circumstances and to manage risk, combine analytics with experience and observations [PIE, 2022]; effective identification of risk sources and their management are crucial for building competitive advantage;
2) effective team management and comprehensive approach to project execution; the holistic dimension of a manager's competencies comprises a new approach to multitasking;
3) communication skills for building long-term relations with suppliers based on trust, openness, and flexibility;

4) skills of implementing, exploiting, and appropriate approach to the use of digital technologies in the management, planning, and analytical dimensions (use of AI to prepare reports and advanced analyses for the purposes of decision-making by management staff) as well as in the physical aspect (cooperation and coherence between a human and a robot in manufacturing plants, warehouses, and transportation);
5) competencies of security and cybersecurity management in the face of alarming rise in cybercrime, which poses a threat for operations continuity, data security, production, and logistics systems, and which in consequence may lead to a loss of trust and reputation;
6) management competencies compliant with environmental, social, and governance-related responsibility of business and sustainability reporting (ESG).

In order to alleviate talent shortage and competency gaps in the situation of growing demand, the CEE countries should modify their youth education systems, support vocational education, develop lifelong learning and programmes for employees aimed at upskilling or reskilling, and nurture their talent (by promoting so-called talent incubators). Apart from digital and special skills, soft skills (social skills connected with group work, such as emotional intelligence and leadership) should also be developed. This requires continuous tracking of enterprise needs, changes on the job market, and more flexibility in introducing upskilling education programmes, as well as programmes providing competencies useful in professions of the future, many of which have not yet been known.

Summary

CEE countries have the potential to create an ecosystem that would be boosting their attractiveness as a location for reconfigured supply chains due to a combination of key investment factors: (1) development of innovation and implementation of modern technologies, (2) development competencies that would be useful for employees in the future, (3) preparation for measures implementing EU climate policy and sustainable development, as well as creation of framework for building circular supply chains, and (4) expansion of transport infrastructure that determines the organisation of efficient and environmentally sustainable flows of goods in the EU. Research conducted by the team of experts from the Department of Logistics and the Institute of Infrastructure, Transport, and Mobility allowed us to formulate recommendations for public authority policy decision-makers and those who deal with economics in practice.

Recommendations for public authorities:

1) it is necessary to boost the attractiveness of the CEE region in terms of global supply chains reconfiguration, by supporting innovation development and digital transformation, especially in the SME sector, and to introduce a modern education system developing skills and competencies indispensable for managing future supply chains;
2) there is a need to raise awareness among formal institutions (regulations) about the impact of climate transformation and circular economy on the economic and environmental competitiveness of CEE; intergovernmental cooperation should be initiated and tightened, to incentivise business entities to build, as a part of their cross-border cooperation, circular supply chains in the region, with the participation of all industrial companies; apart from incentives such as financial and non-financial support (through regional funds) it is advisable to build a knowledge sharing platform "CE in CEE" on the availability of entities interested in cooperation aimed at closing material and waste flow cycles for stakeholders form the industrial and non-industrial sectors located in CEE;
3) it is essential to support the centralisation and spread of information on the capacity of logistics infrastructure in CEE (e.g. in the form of control towers), and to take measures to reduce digital exclusion of SMEs by educating managers on technology functionalities used in production and logistics processes and funding possibilities for their implementation at the national / regional and municipal level;
4) reconfiguration of supply chains in connection with the reconstruction of Ukrainian economy requires quick preparation of infrastructure ensuring stable, environmentally sustainable flows of goods with the support and coordination from public authorities and business;
5) as for infrastructure, it is crucial to focus on the development of planned European transport corridors (North Sea – Baltic Sea with a branch line to Ukraine, Baltic Sea – Black Sea and Aegean Sea, Baltic Sea – Adriatic Sea); this will allow for managing bigger flow volumes along the north-south and west-east axes with the participation of CEE countries; development of potential of intermodal transport is also important in this context, as it requires strategic cooperation between public authorities, infrastructure managers and owners, and logistics operators, under international structures.

Recommendations for business:

1) enterprises from CEE, especially SMEs, must understand that avoiding digital and green transformation will not only prevent them from entering reconfigured global supply chains, but also entails the risk of being eliminated from supply chains leaders, who will look for business partners that will help them pursue

sustainability goals and raise transparency, responsiveness, and efficiency in management based on digital technology ecosystems;

2) maximising advantages for business in circular economy consists in retrieving value from waste and products at the final stage of lifecycle; strategies must therefore be revised to change the approach to project and business process design and shift them to ecodesign; newly built or reconfigured supply chains receive new supplier and distributor bases, and consumers become active partners in their cooperation with an enterprise, they are a key link in a circular supply chain; such a change in the way of thinking about business is a huge opportunity for the business environment in the CEE region, which is attractive in this respect;
3) due to the enormous potential for streamlining production and logistics processes of enterprises in CEE countries, it is recommended to increase investments in digital technologies (implementation of management systems, predictive analytics and data mining, automation and robotisation of assembly lines and warehouses), invest in employee competencies (trainings on new technologies), and in competitiveness development through open innovations;
4) logistics services for national and international trade are continuously adjusting to changing geopolitical conditions in the global and regional scale; this process will tighten cooperation between industrial and trade companies on the one hand and transport and logistics operators on the other hand; associations of employers from various economy sectors should assume a more pro-active approach, and public authorities should engage more in the dialogue with the business environment.

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SIGNIFICANCE OF RENEWABLE ENERGY SOURCES FOR SHAPING CONTEMPORARY ENERGY SECURITY OF CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract

The objective of this study is to diagnose the level of energy security across countries of Central and Eastern Europe (CEE) in the context of growing importance of renewable energy sources (RES). The analysis focuses on the electricity mixes of the CEE countries, examining key aspects of their energy security such as the level and volatility of electricity prices, as well as the emissions of the electricity sector in view of increasing share of RES. The study employs a comparative approach based on high-frequency statistical data. The conclusions drawn from the research relate to identifying the determinants of energy security in the CEE countries, determining the role of RES in their electricity mixes and providing short and long term recommendations for these countries, considering their diverse situations.

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The study strives to diagnose the level of energy security of Central European countries' (CEE) economies using a comparative approach which accounts for the multi-dimensional nature of energy soundness in the face of today's numerous challenges. It focuses on the rising importance of renewable energy sources (RES) and attempts to determine their impact on ensuring energy security in the region, as well as to assess the moderating role of RES and other energy sources in this respect. The findings may be employed to formulate relevant recommendations for CEE countries divided into specific groups (reflecting the extent to which the development of electric power sectors is diversified in particular countries).

The adopted specific goals involve:

1) analysis of the growing relevance of RES as a key component of the contemporary economies' energy mix in the context of the fundamental role played by the electric energy sector and electrification of particular economic sectors;
2) comparative analysis of electricity mixes in CEE countries;
3) review of crucial aspects of energy security in the era of numerous short-term and long-term dilemmas;
4) comparative study of the selected measurable aspects of energy security discussed in section 3 – including both the level and volatility of electric energy prices, as well as the emissivity of electric energy sectors among particular CEE countries;

5) determining potential discrepancies between the share of RES in the electric energy mix and the measurable aspects of energy security from section 4, such as the share of RES vs the level of electric energy prices, the share of RES vs volatility of electric energy prices or the share of RES vs emissivity of the electric energy sector among CEE countries.

The study applies statistical tools and metrics to establish the level and volatility of electric energy prices in particular CEE economies. The presented analysis relies on high-frequency data (hourly data), particularly relative to the prices of electric energy.

The study emphasises a comparative analysis of CEE countries in terms of modern factors for ensuring energy safety. Moreover, it determines the relationship between the share of RES in the electric energy mix and the measurable aspects of energy security, as well as outlines the potential moderating role of RES or other energy sources in providing energy confidence. The above mentioned study along with the presentation of a rising relevance of RES as a key energy mix component in the context of decarbonisation of economies, as well as electrification of particular sectors and transformation aimed at boosting the economies' energy efficiency have contributed to the creation of this unique paper. It may inform and inspire a more in-depth examination of the energy security levels in CEE countries facing the growing role of RES.

These findings should be also viewed as critical for Poland where the electric energy sector as compared against the world and the EU economies is excessively reliant on highly emissive sources with a simultaneously tiny share of flexible conventional low emissive sources, Polish electric energy sector is also characterised by a limited capacity of its distribution and transmission networks, which implies a transition of the Polish economy to RES to be a rational choice.

The presented study aims to:

- indicate key aspects determining the creation of energy security in CEE countries,
- assess the role of RES in building energy security in CEE countries,
- outline potential differences between the share of RES in the electric energy mix and aspects of energy security,
- assess the position of Poland versus other CEE countries in terms of energy safety,
- provide, based on the conducted study, guidelines for CEE countries, both in a short-term and long-term perspective, accounting for their diverse situations,
- evaluate energy price volatility in particular CEE countries,
- determine the levels of electric energy prices in particular CEE countries.

Comparative analysis of the electric energy mixes in CEE countries

Energy mixes[1] of CEE economies are characterised by a rising share of RES. The phenomenon of a growing significance of RES has been observed since the beginning of the 21st century. The structural change of abandoning fossil fuels across all energy mixes of CEE countries has been caused by the arrival of effective renewable energy sources which over the last dozen years have reached a level of 7% (a general notion of the energy mix in 2022). This direction of structural changes in economies should be seen as a high-profile manifestation of the ongoing energy transformation which aims to achieve net zero-emission energy mixes through decarbonisation of the energy sector and other sectors.

Table 1. Share of RES in the electricity mixes of CEE economies in the years 2004–2022 (%)

RES	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	**CAGR**
BG	0	0	c. 0	c. 0	c. 0	1	1	2	3	3	3	3	6	6	6	6	7	6	6	–
HR	0	c. 0	c. 0	c. 0	c. 0	c. 0	1	2	3	4	6	8	9	11	10	12	14	15	17	–
CZ	c. 0	c. 0	c. 0	c. 0	c. 0	c. 0	1	3	3	3	3	3	3	3	3	4	4	3	4	**38**
EE	c. 0	c. 0	1	1	1	2	2	3	4	4	5	7	5	6	5	10	18	15	14	**32**
HU	c. 0	c. 0	c. 0	c. 0	c. 0	1	1	2	2	2	2	3	3	3	4	7	9	12	14	**41**
LV	1	1	1	1	1	1	1	1	2	2	3	3	2	2	2	2	3	3	4	**8**
LT	0	0	c. 0	1	1	1	5	12	13	16	21	22	35	43	45	51	37	37	48	–
PL	c. 0	c. 0	c. 0	c. 0	1	1	1	2	3	4	5	7	8	9	8	10	11	11	16	**33**
RO	0	0	0	0	0	c. 0	1	2	5	8	12	14	13	14	13	14	16	14	16	–
SV	c. 0	c. 0	c. 0	c. 0	c. 0	c. 0	c. 0	1	2	2	2	2	2	2	2	2	2	2	3	**27**
SI	0	0	0	0	0	0	c. 0	c. 0	1	1	2	2	2	2	2	2	2	3	3	–
EU-27	**2**	**2**	**3**	**4**	**4**	**5**	**6**	**7**	**9**	**10**	**11**	**13**	**13**	**14**	**15**	**17**	**20**	**19**	**24**	**15**
World	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**3**	**3**	**4**	**5**	**5**	**6**	**7**	**8**	**9**	**10**	**6**	**38**

Notes: RES understood as the wind and solar power production; hydropower and biomass have not been accounted for as RES production capacity in this study because some of them are not renewable and may be emissive as well.

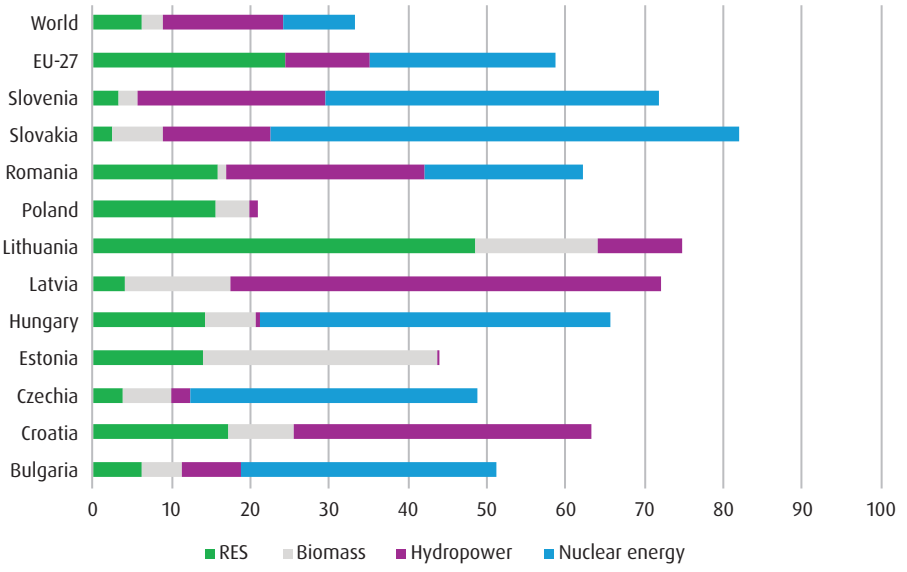
Source: Self-reported data based on Ember [2023].

[1] The energy mix studied based on the data published by Ember [2022] in *Yearly Electricity Data* using the applied taxonomy comprises: (1) conventional sources based on fossil fuels, i.e. coal, natural gas and, in trace amounts, crude oil, (2) renewable energy sources including solar and wind power, as well as (3) nuclear energy, (4) hydro energy and (5) biomass combustion energy. In this study, an energy mix is referred to mostly as the electric energy mix, being a structure generating electricity, which should be distinguished from a general energy mix representing a total use of energy in the economy, including non-electrified transport and industrial production.

While examining the significance of RES in the energy mix, special attention should be paid to an increasing importance of these energy sources to electric energy production in recent years. In the energy mixes of CEE economies and the world economy renewable energy sources (wind and solar power production) accounted for 5% and 6% respectively (in 2022), however, their share in the EU electric energy mix stood at 24% in the same period [Ember, 2023].

The share of RES in the electric energy mixes of CEE economies has grown from 0% or close to 0% in 2004 up to even 48% in 2022 (in Lithuania). Half of the other CEE countries have achieved a growth of about a dozen per cent in this area. The lowest share of RES in the electric energy mix was recorded in Slovakia and Slovenia (of about 3%). An analogical change in the world economy showed a rise in the share of RES from 1% to 6%, and from 2% to 24% in the EU electric energy mix. Currently, according to the data of 2022, an average increase in the share of RES in the EU electric energy mix has been driven chiefly by a high share of these sources in the electric energy mix of Lithuania. Five countries (Croatia, Romania, Poland, Hungary and Estonia) managed to reach the share of about a dozen per cent energy production from RES, yet the share of these energy sources in Bulgaria, Latvia, Czechia, Slovenia and Slovakia accounted for a mere 3–6%.

Figure 1. Electric energy mix of CEE region economies in 2022 (the share of RES and other energy sources not based on fossil fuels)



Notes: RES are understood as the wind and solar power production; hydropower and biomass have not been accounted for as RES production capacity in this study because some of them are not renewable and may be emissive as well.

Source: Self-reported data based on Ember [2023].

It should be pointed out that Estonia, Lithuania and Latvia are countries with a significant share of biomass in electric energy production (30%, 16% and 13% respectively), additionally the Latvian economy, along with the Croatian one, are characterised by a high share of hydro energy in energy production (55% as compared to 38% in Croatia). Nuclear energy is strongly represented in the electric energy mixes of Slovakia (59%), Hungary (45%), Slovenia (42%), Czechia (36%) and Bulgaria (33%), as well as Romania (20%).

Analysis of the rising significance of RES in the context of the pivotal role played by the electric energy sector and electrification of particular economic areas in CEE countries.

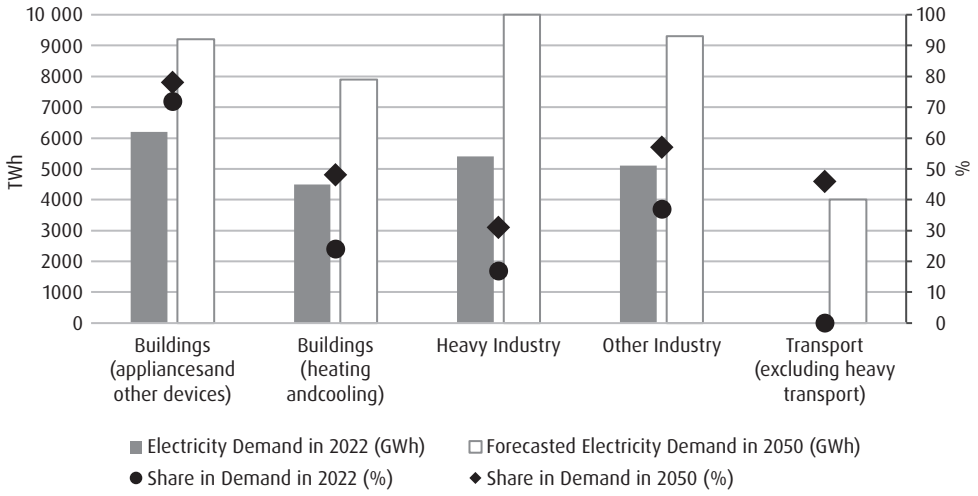
Examination of the relevance of RES in the electric energy mix leads to a conclusion that at present renewable energy sources are primarily used to provide electric energy to buildings, including households and widely understood industrial production. Efficient use of RES does not, however, include transport which in majority is not electrified. This implies that one of the key aspects of decarbonising economies will be transport electrification, which may cause fossil fuels to be replaced by electric power generated from renewable energy sources. This constitutes a new paradigm of energy transformation which has become a vital foundation for energy and climate policies of the EU. The core assumption of EU energy policies was that electrification should be a way to address challenges of Europe's dependence on crude oil and fuel imports, in terms of climate change, electrification was viewed as an efficient strategy for a significant reduction in carbon dioxide emissions into the atmosphere [European Commission, 2024].

A rise in the significance of electric energy in CEE economies is by no means an isolated trend. Parallel tendencies may be observed in the global economy. What is more, forecasts indicate that the increasing role of electric energy in particular sectors of the world economy may be of paramount importance. According to one of the forecast scenarios[2] issued by the International Energy Agency (IEA), the largest spike in the share of electric energy in the total energy consumption is to be expected in the transport sector, excluding the heavy transport. Presently, this share stands globally at around 0%, while in 2050 it may account for as much as 50%, and generally in all sectors studied by IEA the share of electric energy in the total energy consumption

[2] The Announced Pledges Scenario is deterministic in nature and relies on the declarations made by particular countries' governments. The scenario assumes that all pledges will be fully delivered within the declared time frame.

keeps rising, which is a result of the transformation and electrification of these economic areas. Currently, the largest demand for electric energy comes from industrial production (circa 10,500 TWh) – over a half of this demand is from the heavy industry. Industrial energy demand is followed by buildings (about 10,700 TWh), some 6,200 TWh of which is generated by household appliances and 4,500 TWh by heating and cooling of premises [IEA, 2023].

Figure 2. Current and forecast demand for electric energy in selected world economy sectors



Source: Self-reported data based on IEA [2023].

The importance of RES in terms of electrification of particular economic sectors is crucial, specifically for CEE economies where regional economic growth has been historically correlated with increasing emissions of carbon dioxide [Lazar, Lazar, 2019]. Electrification as such is not, therefore, a part of the previously mentioned paradigm of energy and climate policies of the EU (apart from delivering a possible rise in energy efficiency which may result from a higher productivity of electric equipment and engines). The rationale of energy transformation, including electrification of particular economic sectors, is rooted in the belief that electrified sectors may be using electric energy generated from zero-emission or low-emission sources (employing the capacity of RES as well as the nuclear power). Taking into consideration the EU energy policy, moderated by the international climate agenda, it should be stated that electrification based on using electric energy generated by the increased capacity of conventional energy sources would violate the goals of electrification and the entire energy transformation.

Review of key aspects of energy security in the era of modern challenges

The notion of energy security as uninterrupted and stable supplies of conventional energy sources (fossil fuels) has been redefined by the increasingly volatile and turbulent circumstances of the world economy.

Economic recovery after the COVID-19 pandemic and a rapidly increasing energy demand in the conditions of a low supply and demand elasticity, being a natural characteristic of the hydrocarbon market, brought about a surge in energy prices which was further wound up by the war in Ukraine and sanctions imposed on Russia. All EU member states, due to their considerable dependence on the imports of energy sources, particularly of natural gas from the East, had been put in a new and uncertain situation[3]. The situation grew even more complex for CEE countries due to their much stronger dependence on the imports of primary energy sources, as well as the emergence of a simultaneous tendency to abandon the supplies of crude oil and coal from the locations which to that point had been deemed completely safe[4]. The hardship of high energy prices and a clearly excessive dependence of EU member states on the imports of natural gas and coal from Russia had escalated the risk of losing energy security.

The notion of energy security has been widely discussed in the source literature. This study defines energy security as a condition which ensures meeting the current and future demand for fuels and energy at socially acceptable prices, supplied in a technologically sound manner, bearing minimum impacts on the natural environment and living conditions of the society. Thus, energy security may currently entail uninterrupted supplies, continuous energy provision and resilience of the electric energy systems to unpredicted shocks, ability to buy energy at rational and socially acceptable prices as well as environmentally friendly and sustainable energy management. Consequently, sustainable energy security involves economic, environmental and social aspects.

In order to achieve this sustainability today, in the face of current geopolitical circumstances, a growing energy demand, climate change, and dynamic technological

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3 According to Eurostat data, the EU in 2020 imported from Russia 28.9% of crude oil and petroleum products (with a dependence on imports at about 97%), 43.6% of natural gas (with a dependence on its imports at about 83.6%) and 53.7% of coal (with a relatively low dependence on imports totalling at about 35.9%) [Wojtkowska-Łodej, 2024, p. 39].

4 Demand for imported crude oil and petroleum products in member states of the CEE region amounted in 2020 to 96.5%, demand for natural gas stood at 83.6% and for solid fuels at 35.8%. At the same time, in the recent two decades of 2000–2020, the dependence on total energy imports rose by 1.6 p.p., as compared to the same category in the EU amounting to 1.3 p.p. The dependence on total energy imports to EU in 2020 reached 57.5%, and to CEE countries – 49.9% [Mróz, Niedziółka, Witkowski, Wojtkowska-Łodej, 2022, pp. 183–185].

developments, the existing energy systems and relations between countries must be properly adjusted. At the same time, it may be argued that switching nowadays to renewable energy sources creates a pathway to ensuring sustainable, safe and price-competitive energy supplies which can guarantee our energy security.

Increasingly more often, the definition of security includes the elements of self-sufficiency and independence. Both of these ideas are complementary to the definition of energy security by adding the aspects of sufficient production capacity, using local resources of solid fuels or developing mechanisms maximising the efficient use of energy. Efficiency may be achieved by activating users to manage the demand, as well as by further developing the energy transmission, distribution and storage capacity. Moreover, energy security is also shaped by market transparency.

These multiple definitions of energy security prove that it may be viewed not merely as a necessity, goal or process, but also as a value able to determine economic competitiveness of countries.

Contemporary determinants of energy security in the CEE region

External circumstances, particularly the international political situation, including the war in Ukraine, pose currently the biggest threat to the security of Europe along with CEE countries. Owing to the aforementioned strong dependence on fuels supplied from Russia and due to the implementation of joint EU resolutions on abandoning hydrocarbon imports, there occurs an urgent need to promptly meet domestic demand with new supplies and then to develop a novel energy production system capable of ensuring energy security to CEE countries in the future.

The emerging threats to energy security should be considered, on one hand, in the light of the existing circumstances and international agreements binding CEE countries, and on the other, in the context of possible contract termination and developing alternative long-term strategies. CEE countries as EU member states are parties to many international agreements, accords and organisations concerning economic cooperation, climate or energy management. These countries constitute a large number whose economic and social growth potential, geographical location as well as a solid leapfrogging potential may predispose them to implement a new energy security architecture, a project which is crucial not only to this part of Europe but also to Western Europe and other countries outside of the old continent.

It is therefore both these internal and external expectations that constitute the most vital determinants of shaping energy security in CEE. Climate challenges are by all means among the critical concerns.

The European Union as an entity recognised by international law, pursuant to its treaty resolutions (TFEU), takes part in the UN General Assembly, acts on the international scene as a leader in climate activities, actively participates in debates and initiatives aimed at reducing greenhouse gasses, such as the Paris agreement and in other actions.

Following the sustainable development action plan adopted in 2015 by the UN General Assembly, the EU pledged to deliver on 17 Sustainable Development Goals (SDGs) in the most vital areas of modern life by 2030. The most vital development actions comprise energy and climate initiatives, and declarations in these areas have become European Union's target objectives. Sustainable energy development assumes striving to ensure price-competitive, reliable, sustainable and modern energy to all (SDG 7), climate declarations relate to fighting climate change and its consequences (SDG 13). Monitoring changes and target implementation levels is subject to annual EU reporting by supervising the consumption volumes of primary and final energy, tracking energy efficiency, the use of energy sources including RES, and dependence on energy imports as well as scrutinising energy poverty of EU member states. As far as SDG 13 are concerned, the following actions are being monitored: mitigating climate change, accommodating climate change consequences and financing these initiatives, assessing net volumes of greenhouse gas emissions, tracking greenhouse gas emissions from land use, farming and forestry, assessing the share of RES in final energy consumption.

Another vital issue in terms of energy security are regulations applied at the EU and national levels. CEE countries, being objects to this study, are member states of a European community, they take part in the EU law-making as well as are obliged to implement EU law into their national legislations. The recently adopted and currently implemented development strategies of EU (such as the European Green Deal or Fit for 55 package) and regulatory tools (EU regulations and directives on liberalising energy markets or trading emission permits – EU ETS) aimed at transforming economies into low-emission economies by 2050, set out a clear path for change and key conditions for building sustainable energy security. Implementing climate policies constitutes a reference point for domestic strategies of ensuring energy security.

Investing in new energy sources does not only account for a full energy transformation, but involves also the refurbishment of existing energy production entities as well as diversifying the energy sources they employ. CEE countries are laggards in terms of investing in new energy production facilities and turning around their electric energy mixes. As a consequence, their decisions of building better energy security accompany the reconstruction of energy markets. It is supposed to diminish the dependence on energy carrier imports and enhance sustainable energy security. However, it requires

massive public spending and private investment which must be supported by banks and financial institutions. Sustainable development investments are to be encouraged by the recently implemented system of qualification for the financial support of investments, known as a taxonomy.

Implementation of initiatives for energy security and cooperation in the region requires infrastructural connections. Recently (since 2022) within the framework of EU infrastructural projects, inter-system gas connections between Poland and Lithuania, as well as Poland and Slovakia have been created, inter-system connections on the Baltic countries market (connecting Estonia, Finland, Latvia and Lithuania with the EU gas market), connections built by the countries of the region (e.g. Baltic Gas Pipeline between Poland and Denmark), as well as new LNG terminals or warehouses.

Additionally, an important role in ensuring safe energy supplies in CEE is played by gas corridors connecting Turkey, Bulgaria and Romania, Greece and Bulgaria as well as Romania and Bulgaria, as they facilitate gas deliveries from third countries in the region [European Commission, 2022].

Next to the above mentioned determinants of shaping future energy security in Europe, a growing significance of increased demand for electric energy in the economy should be noted (electro-mobility, electrification of the economy or advancing urbanisation). These processes will be encouraged by the currently observable dynamic technological progress and development of manufacturing technologies alongside supporting technologies.

Building energy security will also depend on domestic conditions, including the factors of resources, the conducted energy policies, investment potential and reforms implemented within energy systems.

Threats to energy security

In the increasingly volatile and uncertain environment, particularly in terms of the ongoing war, a large share of fossil fuels in the energy mix poses a steadily growing and severe risk to the economy, making it impossible to maintain a safe and sustainable demand for energy sources. Moreover, due to the location of these resources and their supply directions, when political turmoil occurs and energy carrier prices fluctuate, the stability of energy deliveries and socioeconomic development may be seriously exposed.

Uncertainty is also exacerbated by high volatility of various forecasts and scenarios as to how the energy transformation, climate adjustments or energy market restructuring (e.g. the power market) will proceed. At present, a vital role in these processes is

played by the environment. Decisions of individual countries are the product of their neighbouring countries' behaviour in terms of joint infrastructural projects, but also joint contracts to purchase hydrocarbons or equipment for RES production, as well as a consequence of the conducted policies. The multitude of determinants undermines decision-making and drives risk levels.

Key threats to the energy security of countries are [Ślusarczyk, 2008]:

- worldwide depletion of fossil fuel reservoirs, particularly of crude oil and natural gas,
- some energy resource-rich countries abusing their position of power to create an economic and political tyranny in relations with importers,
- strong dependence of countries' economic development on the prices of energy sources,
- insufficient logistical infrastructure necessary to diversify energy sourcing and establish new routes for oil and gas supplies,
- military conflicts, economic crises and instability of the regions which are critical to mining and transporting resources,
- strong dependence on the imports of components used in the solar and wind power equipment,
- threats to the natural environment and the necessity to reduce CO_2 emissions.

Premises for strengthening the energy security in the EU and the CEE region

REPowerEU is a plan outlining actions aimed at enhancing and balancing the supply and demand on the energy source market. It provides for a replacement of the imported primary energy sources from Russia with new suppliers and energy sources by accelerating diversification, increasing renewable gas supplies, reducing energy consumption and striving for energy efficiency as well as electrification [European Commission, 2022]. According to the plan, actions aimed at reducing energy consumption should be accompanied by restructuring of industrial processes based on replacing fossil fuels with renewable electric energy and hydrogen from other than the existing sources, as well as taking initiatives on the supply side to increase the production of renewable energy. It is expected that effective actions on the supply and demand side in the conditions of international cooperation, including energy diplomacy, should lead to an incremental creation of independence from Russian deliveries and accelerated transition to clean energy.

A rising share of RES in the energy mix is of great significance to those processes. Increased volumes of energy obtained from local sources diminish the demand for

imports (and costs of those imports), as well as stabilise energy supply, allowing to limit polluting emissions and create more job openings by encouraging economic and social activity at the local level[5]. In the long term, the recommended share of RES in energy systems of the member states translates into reduced energy dependence and boosts economic growth in the conditions of the occurring environmental transformation.

Thus, increasing the scale and dynamics of using renewable energy in the production of electric energy, in industrial sectors, transport and construction will determine the scale of replacement of previously imported primary energy carriers. As a consequence of the observed internal changes and consistent climate policies, the European Commission proposed to raise the indicative target concerning the share of RES in the final energy consumption to the level of 45% by 2030, which should translate into an increase in the production capacity from RES in the EU up to 1236 GW, as compared to the current goal of 40% and 1067 GW [European Commission, 2022].

The structure of new powers will include technologies which employ mostly solar power, then wind power (including offshore wind power), as well as heat pumps, "renewable" hydrogen, biomethane and biomass.

As follows from the conducted research, increasing share of RES in the energy mixes of CEE countries is stimulated by national strategies for RES development, as well as by external circumstances such as rising prices of fossil fuels and market mechanisms regulating energy and climate policies, in particular increased prices of CO_2 emission permits under the European Emission Trading System (EU ETS) [Mróz, Niedziółka, Wiśniewski, Witkowski, Wojtkowska-Łodej, 2023, pp. 119–238].

It also allows to state that actions implemented so far under Fit for 55 package should be conducive to achieving higher goals in terms of RES, energy efficiency and greenhouse gas emissions, which in turn will help reduce demand for natural gas and other fossil fuels.

The process finally aimed at boosting delivery security and abandoning fossil fuels will require an adjustment in the planned investments, particularly in terms of energy sourcing, use of RES, electric energy and hydrogen networks as well as energy storage.

It should be borne in mind that the EU regulations conducive to developing RES may at the same time pose a serious challenge to countries in the region, as their energy mixes are characterised by a large share of fossil fuels [Adamczewski, Wójcik, 2023].

A decisive factor in the process of implementing a new economic model based on clean energy systems and safe, price-competitive energy will be the technological progress.

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5 EU regulations strongly advocate developing RES and the amended Renewable Energy Directive (RED III) adopted in October 2023 establishes a new mandatory target to be achieved by 2030 for RES energy at the level of 42.5% in the final energy use (as contrasted against the previous target of 40%).

In the conditions of increased volatility and uncertainty, what remains necessary is both cooperation to ensure future development and energy security and integrated actions in various areas to encourage change in energy production, transmission, distribution, trading and consumption. These actions will also support technological advancements at particular stages of managing the sustainable energy chain.

Analysis of the share of RES in the electric energy mixes of CEE countries as compared against the levels and volatility of electric energy prices and the levels of electric energy sector emissivity

The purpose of the empirical study was to determine whether CEE countries with their diverse shares of RES in energy mixes are characterised by a higher/lower:

a) level of electric energy prices,
b) level of electric energy price volatility,
c) level of emissivity of the electric energy sector.

The analysis of these interdependencies was based on the data collected between the beginning of January 2018 and the end of January 2024 (concerning electric energy prices) for 11 CEE countries. The study used data from three data bases: ENTSO-E Transparency Platform (prices of electric energy), Climate Watch (electric energy sector emissivity) and Ember (structure of the electric energy mix in terms of electric energy production).

Electric energy prices accounted for in the study are stock market day-ahead prices with a high frequency: hourly data contain 53,952 observations for each of the 11 CEE countries in the survey. These prices have been set within the so called bidding zone and reflect the actual distribution of supply and demand in the EU, thus providing a basis for electric energy trading (trading efficiency maximisation[6]). The data have been calculated and expressed in the single currency (EUR), using average daily exchange rates of local currencies (relating to Poland, Croatia, Bulgaria and Romania).

The share of RES in the electric energy mix versus the level of electric energy prices

At the first stage of the study economies were classified in accordance with the share of renewable energy sources in their electric energy mix structure. The share

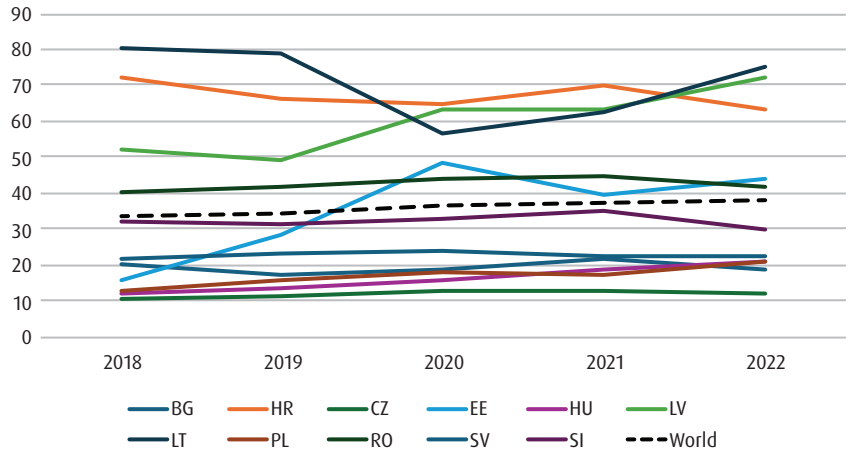
[6] In line with the concept of the European Commission "market areas which reflect the supply and demand distribution constitute a basis for trading electric energy on market terms and are a necessary condition for achieving a full potential of transmission capacity allocation" [Official Journal of the EU L 197].

was estimated based on the average share of RES in the years 2018–2022 (Table 2), which finally led to the following classification:

- Group I: countries with an average share of RES in the electric energy mix accounting for over 40%,
- Group II: countries with an average share of RES in the electric energy mix accounting for below 40%,

The level was established based on the average share of RES in CEE countries in 2022 accounting for 38% (Figure 3).

Figure 3. The share of RES in CEE countries in the years 2018–2022 (%)



Notes: The initial observation in a given period (year) was marked on the horizontal axis.
Source: Self-reported data.

The performed study finds out that among the surveyed economies a lower average level of electric energy prices entails a higher share of RES in the electric energy mix (Group I: 94.08 EUR/MWh), and conversely, this price level is higher in those countries which have a relatively lower share of RES in their energy mixes (Group II: 104.08 EUR/MWh). The difference between these two groups of CEE countries at the level of 10 EUR/MWh may be perceived as major in the context of the average price of electric energy in CEE economies reaching almost 100 EUR/MWh, which means that in the long term, economies with a lower average electric energy price, focusing on developing RES, may increasingly take the lead.

However, it should be noted that this correlation is not a firm rule because the Polish economy, based predominantly on fossil fuels, in 2018–2022 at the level of 83% (including the share of coal of 72%), had the average electric energy price at one of the

lowest levels in CEE (85.99 EUR/MWh). Cheaper electric energy price was traded only in Estonia (83.32 EUR/MWh), where fossil fuels are widely used to obtain electric energy (mostly in the form of oil shale). The most expensive electric energy was distributed in Bulgaria where in the studied period its price stood at 136.21 EUR/MWh (with an average share of RES in the years 2018–2022 at the level of 19%).

Table 2. Structure of the electric energy mix in CEE countries along with the average level of electric energy prices in the years 2018–2024 (January)

Group	Country	Average share of fossil fuels (%)	Average share of nuclear energy (%)	Average share of RES (%)	Average price in individual countries (EUR/MWh)	Average price in the whole group (EUR/MWh)
I	LT	29	0	75	90.49	94.08
	LV	40	0	72	90.14	
	HR	33	0	63	104.26	
	EE	65	0	44	83.32	
	RO	38	19	42	102.18	
II	SI	30	38	30	104.43	104.08
	SV	22	55	23	98.80	
	HU	37	46	21	104.73	
	PL	83	0	21	85.99	
	BG	44	36	19	136.21	
	CZ	52	36	12	94.30	

Notes: The values of components of the electric energy mix do not add up to 100% due to their averaged levels in the years 2018–2022.

Source: Self-reported data.

Interestingly, countries which employ nuclear power to produce electric energy (with the exception of Romania it pertains to Group II) have a higher average electric energy price in the period of the survey. It seems, however, that this conclusion remains in contradiction with the findings of research and analyses to date, as nuclear power plants are in principle characterised by almost the lowest average internal unit cost of generating electric energy [Strupczewski, 2016]. This discrepancy may be caused by the fact that the time period of the study was relatively short and high efficiency of nuclear power plants is usually revealed over the span of several dozen years.

The share of RES versus volatility of electric energy prices

In order to study electric energy price volatility in CEE economies, the survey used variables of hourly electric energy prices of a given day in particular countries. Following these, time sequences consisting of daily/monthly/annual volatility coefficients were determined. The daily volatility coefficient was calculated by dividing the average obtained from hourly observations on a given day by a standard variation in energy prices, for each country separately. An analogical operation was performed for monthly data, where these records were expressed as an average or a standard variation based on average daily values of electric energy prices, foregoing the inter-day variation. Annual volatility coefficients were determined in a similar way, i.e. as an average price of electric energy or a standard variation based on average monthly prices, foregoing the inter-day and inter-month volatility. While establishing the value of volatility coefficients, the study made an assumption of a financial month and financial year, the time periods lasting 30 and 365 days accordingly. Therefore, observations presented in the study include the monthly data recorded until 28 January 2024, and the annual data until 28 February 2023. The averages of the daily/monthly/annual volatility coefficients for both groups established in this way have been set out in Table 3.

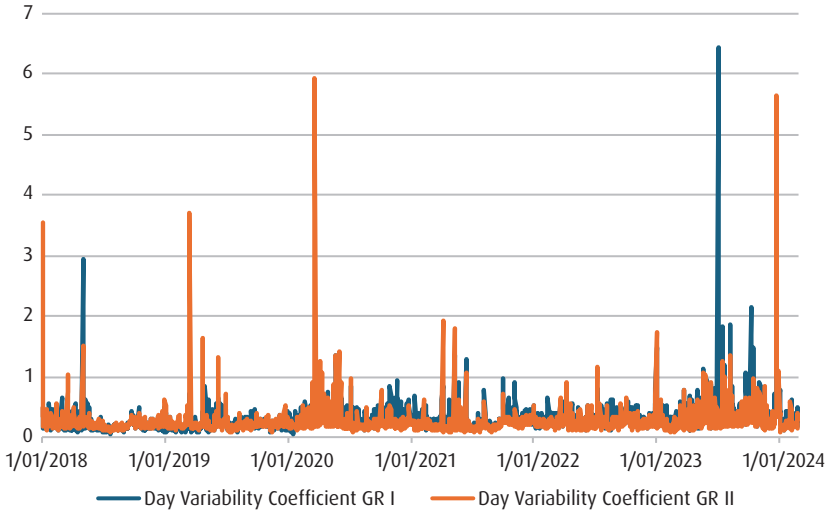
Table 3. The value of arithmetical averages for volatility coefficients of countries in Group I and II

Group	Average daily volatility coefficient	Average monthly volatility coefficient	Average annual volatility coefficient
I	0.31593	0.25603	0.31187
II	0.26313	0.22090	0.29517

Source: Self-reported data.

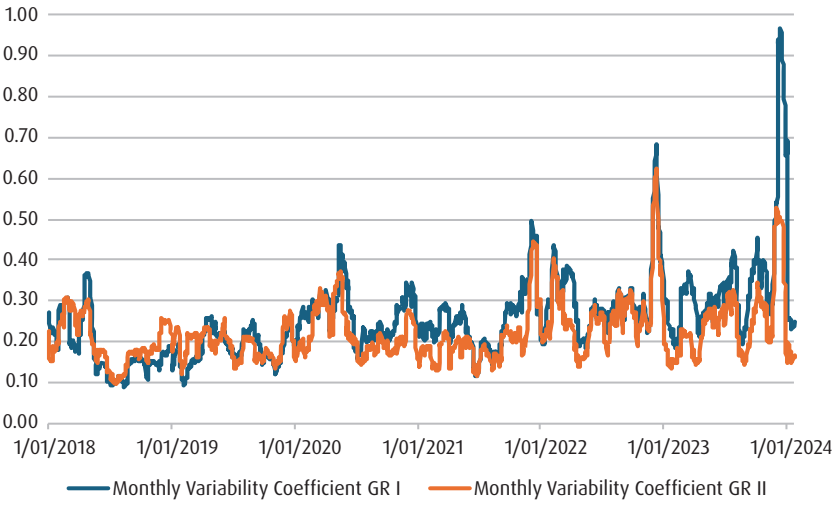
Volatility analysis indicates that the countries characterised by a higher share of RES in their electric energy mixes recorded a slightly higher volatility of electric energy prices in the studied period than the countries relying on fossil fuels. This result may come as a surprise, as the period of the study encompasses shock events which dramatically affected the energy source market, i.e. the COVID-19 pandemic, war in Ukraine and Hamas attack on Israel. The volatility coefficient for Group I reached 0.31593 for daily volatility, for monthly volatility – 0.25603 and 0.31187 for annual volatility, whereas Group II recorded lower values of the volatility coefficient which amounted respectively to: 0.26313, 0.22090 and 0.29517 (Figures 4–6).

Figure 4. Daily variability coefficient for Group I and II



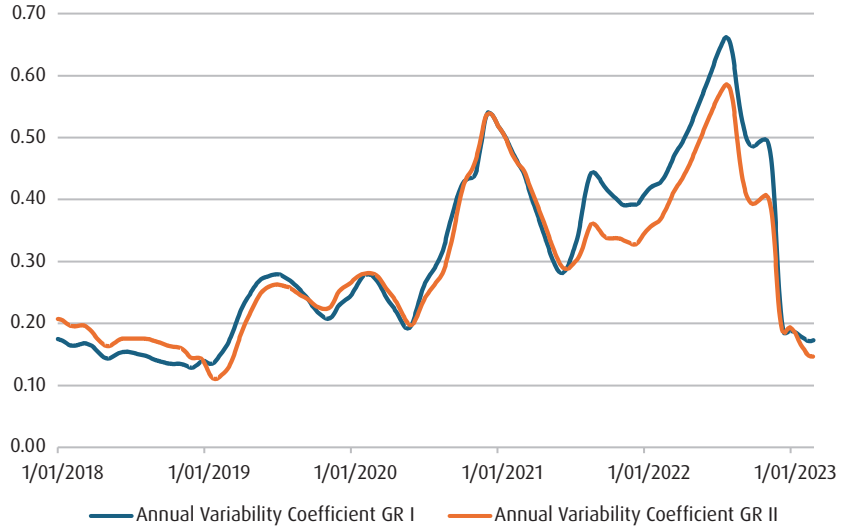
Source: Self-reported data.

Figure 5. Monthly variability coefficient for Group I and II



Notes: The initial observation in a given period (month) has been marked on the horizontal axis.
Source: Self-reported data.

Figure 6. Annual variability coefficient for Group I and II



Notes: The initial observation in a given period (year) has been marked on the horizontal axis.
Source: Self-reported data.

Thus, it may be expected that a rise in the share of RES, pushing fossil fuels out of the electric energy mix, will result in a relative decrease in electric energy prices in CEE economies which are currently in the process of decarbonisation and energy transformation. Most probably due to this, apart from gaining a larger energy independence (particularly from third countries), CEE economies (especially from Group II) could become more competitive and strive to boost their energy security. This would be manifested in gaining a considerable independence from energy sources, the supply and prices of which are tightly bound to the geopolitical situation. A potential "cost" of raising the share of RES in an electric energy mix is increased volatility of electric energy prices in the economy.

The share of RES versus the level of emissivity of the electric energy sector

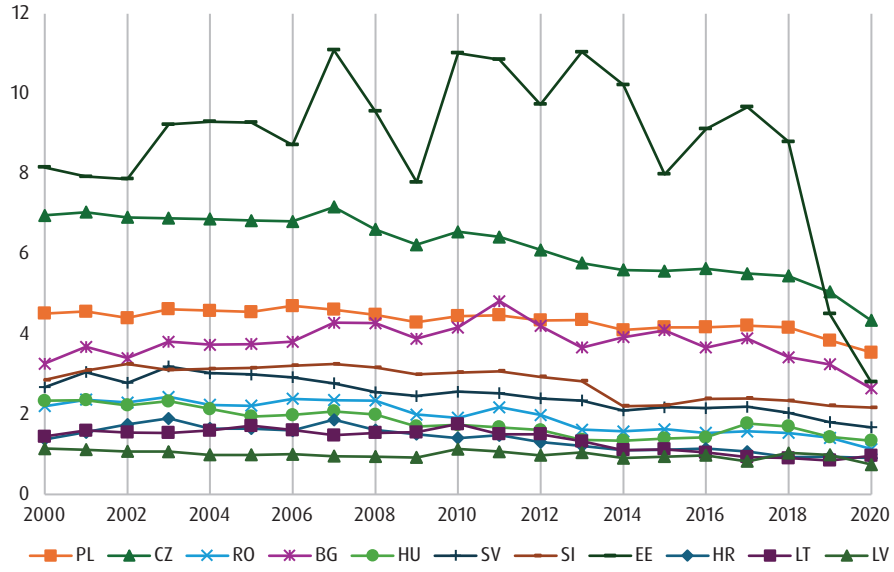
The scale of CO_2 emissions is strongly dependent on the structure of the electric energy mix. In the countries which possess a high production capacity of renewable energy sources emissivity is visibly lower, apart from Estonia which on top generating electric energy from RES uses also fossil fuels. The lowest emissivity is found in Latvia (close to 1 tonne CO_2 per capita), where the share of renewable energy sources reaches 75% (Table 4, Figure 7).

Table 4. Emissivity of the electric energy sector in CEE countries in the years 2000–2020 (in tonnes CO_2 per capita)

Group	Country	Average emission level of the power sector in the country	Average emission level of the power sector in the group
I	LV	0.9971	2.9019
	LT	1.3676	
	HR	1.3881	
	RO	1.9533	
	EE	8.8033	
II	SV	2.5000	3.5811
	SI	2.8162	
	BG	3.7990	
	PL	4.3481	
	CZ	6.2152	
	HU	1.8081	

Source: Self-reported data.

Figure 7. Emissivity of the electric energy sector in CEE countries in the years 2000–2020 (in tonnes CO_2 per capita)



Source: Self-reported data.

The presented analysis leads us to claim that renewable energy sources, apart from causing less dependence on external suppliers and some volatility in energy source prices, should have a positive impact on the economies of CEE countries and the EU. One of the presumed reasons may be lower prices of electric energy. A potential risk faced by economies based on RES may be higher variability of electric energy prices. These findings should be further verified by increasing the number of countries analysed and extending the study period, which could also help restrict the impacts of shock events on the study findings.

Summary

Increased share of RES in the electric energy mix may be considered a form of manifesto of CEE countries in their effort to enhance energy security. This security, currently viewed through the lens of price stability and energy supplies generated from the most climate and environment friendly sources, seems a high-priority concern in the context of CEE countries' social and economic development. Steadily rising share of RES at the expense of fossil fuels may help bring down energy prices in the countries of the region which are currently in the process of decarbonisation and energy transformation. Simultaneously, a rising share of RES in the energy mixes of CEE countries is an expression of the currently occurring process of convergence. These countries, while facing the necessity of removing differences in the standards of modernisation and development of energy markets, including technical and technological changes in the employed energy carriers and the production infrastructure, make numerous decisions on diversification of the power generating entities. At the same time, in order to comply with legal requirements of the implemented climate policies, they strive to reduce CO_2 emissions, thus meeting the goal of achieving a zero-emission economy.

Raising the share of RES plays a crucial role in the modernisation processes of production facilities, as well as lies at the heart of all policies aimed at the energy transformation.

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STATE IN THE BLOCKCHAIN NETWORK

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Abstract

In addition to the popularity of blockchain technology in the private sector growing for several years now, there has recently been an interest in implementing it also in public administration in many countries around the world. The blockchain technology may prove to be a very useful tool in the public sector – either of revolutionary significance or to affect the efficiency of public tasks. However, its application requires some political will, in-depth analysis and preparation of the state, with the participation of all the stakeholders of this solution. In this study, we sum up the findings of conducted analyses and reports on the cases of blockchain technology use in the public sector and provide an overall picture of them, exemplified by 78 countries which have taken various steps towards using the blockchain technology in practice. We also point to the institutional challenges faced by the countries that want to take advantage of the potential of this technology. Eventually, we present recommendations, mainly for the decision-makers responsible for the public policy, conducting public tasks and providing public services, allowing them to prepare in the right way for the use of blockchain technology.

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Demand for public services in the world has been rising rapidly, which is partly caused by a widespread availability of new technologies and higher expectations of citizens who use digital technologies on a regular basis [Bharosa, Lips, Draheim, 2020, p. 1]. Owing to this fact, alongside the growing popularity of the blockchain technology in the private sector, there has been a strong interest in implementing this technology in public administration in the countries around the world.

This study attempts to show that the blockchain technology potential may be successfully employed in public processes, however the effectiveness of its implementation depends largely on the political will, good preparation and ability to cooperate with the society – the citizens who are the main, and at the same time, the ultimate recipients of public processes.

The aim of this paper is the analysis of opportunities and institutional conditions, as well as the recognition of benefits resulting from the implementation of solutions based on the blockchain technology in public services and public administration in Poland and Central and Eastern European (CEE) countries.

The following sections will elaborate on the blockchain technology specifics and potential. We have analysed some of the existing instances of using this technology in the public sector which come from various authors and institutions. We have also studied potential (described in literature) solutions in the public sectors of 78 countries which decided to develop strategies, organise working teams, pilot projects and production implementations. We indicate institutional challenges faced by the countries which would like to tap into this technological potential. We conclude by offering some study findings and recommendations provided in the literature of the subject. We have also presented recommendations addressed to public decision makers who run public policies, set public policy goals and provide public services, as well as those directed to law-makers and regulators, journalists, scientists doing research in this field and the society at large, looking for a synthetic study into the problems of the blockchain technology application in the public sector.

In order to illustrate the level of engagement of different countries in implementing the blockchain technology in public processes we have analysed about 100 literature items, including scientific publications, reports of international organisations and public institutions, as well as information from industry magazines and websites of selected projects. We focused on the quoted examples and studied cases, as well as conclusions formulated by the authors. Drawing on those data, we have created a list of countries with a documented history of experience in developing pilot projects or blockchain technology project implementations in the public sector and in public processes (services).

Blockchain and its uses

In the literature of the subject a lot of room is devoted to the basics of the blockchain technology functioning, [Antonopoulous, 2018; Bashir, 2020; Kopeć, Sobiecki, Piech, 2022; Sobiecki, 2021] thus in our study we endeavour to focus on its key qualities and specifics, as well as utility features and main applications. Although some of its determinants may be questioned, all of them are generally perceived as characteristic of this technology.

Blockchain constitutes a culmination of the development of cryptographic technologies, digital means of payment and IT infrastructure (speed of processors, traffic capacity of telecommunication connections, capacity and speed of hard discs and random access memories). Blockchain is both a database technology which maintains records and a computer network which gives these records a decentralised character. Records include the information on the number of units of a new class of goods –

crypto-assets. These, in turn, are allocated in the records to various addresses of the blockchain network which users[1] operate in the same way bank account numbers are operated. The difference being that crypto-assets in the blockchain record are not limited to the payment function (value transfer). There might be different qualities, parameters and rights assigned to them, e.g. the right to make decisions within decentralised autonomous organisations (DAO), to receive a steady income, to use issuer's services, discounts or to swap the associated resources.

The existence, utility and, as a result, market value of these units is determined by the rarity of crypto-assets, the fact that it is impossible for users to change the number of units in the systems. A fixed demand and any alterations to it may result from the programmed rules or ensured by the ultimate, immutable and durable nature of the records saved, which, on the other hand, is attained by multiplying copies of the entire record and saving them as a "block chain", according to which the subsequent incoming data (transactions) are assigned to the formerly saved ones in a cryptographic way. Modification of the historical data through singular nodes is thus the more difficult, the larger the network – the older the blocks we want to modify; it also remains dependent on the adopted rules of saving and synchronising data in the network (consensus rules). The ability of building a blockchain technology ecosystem by entities which have a common goal but make sovereign decisions gives the systems based on this technology a politically decentralised character. Blockchain allows for a joint supervision of service operations without a central decision-maker, and automatically puts users and infrastructure providers on the level playing field. Those qualities make it a "3D" technology, offering value digitalisation in a decentralised and democratic economic ecosystem.

Blockchain technology is a new "value layer" of the Internet which brings about a "3T" quality of Trust, Transparency and Traceability to each class of assets (information, data and physical goods) [Reddick, Rodríguez-Bolívar, Scholl, 2021]. Durability and immutability of the saved blockchain records provides a guarantee of the units' origin, an ability to evidence various economic events and makes them resilient to manipulation or different kinds of infrastructure assaults. Crypto-assets are forms of value which users handle, in principle, personally and bear all risks involved.

Expanding the utility of database blockchain technologies with an option of automation and flexible processing of incoming transactions in smart contracts has created many additional applications, beyond the simple crypto-asset transfers among users. Smart contracts allowed to automate business (economic) relations between

[1] Actual users of the blockchain network are crypto wallet owners, i.e. owners of special applications (web, mobile, or browser add-ons) which store private keys connected to addresses allowing to use crypto-asset units assigned to these addresses.

users and resulted in a "social" provision of service platforms, an emergence of new business models or decentralisation of process supervision, including value, rights, data and document transfers. Although originally blockchain was used as a tool for value transfers, it later started to be employed in a new type of services – decentralised finance, involving goods tokenisation, stock exchange decentralisation, lending services, liquidity pools, investment services, prediction markets, insurance services, etc. Increasingly, it is being employed by the traditional private sector of the economy, e.g. in payment systems, organising supply chains, decentralised exchange of tokenised goods and financial instruments, in the Internet of Things (IoT) services, intelligent homes, intelligent cities, education and healthcare systems [Elisa, Yang, Chao, Cao, 2023], as well as in processes supporting traditional financial services (a durable medium in banking, shareholder voting systems).

Practical application of the blockchain technology is accompanied by setting increasingly more standards and good practice (systematically repeated actions) benchmarks. Both the potential of this technology and its significance are still fervently debated. On one hand, its enthusiasts ("evangelists") argue that "everything that can be decentralised, will be", particularly as far as public and open networks, not controlled by public institutions, are concerned. Yet, on the other hand, more critically-minded observers underline a key role that should be played by overriding institutional coordination, occasionally also supervision or top-down initiatives which can prevent adverse market trends, monopolisation, technocracy, fraud, exclusion or polarisation, and thus facilitate ecosystem development. At the same time, the possibility of using private and supervised blockchain networks is often brought up [Semenzin, Rozas, Hassan, 2022].

Blockchain in the public sector

Public sector and digitalisation

Apart from blockchain technology applications in the private sector, its potential for use in the public sector is rarely mentioned. In public administration blockchain constitutes the next step in developing digitalisation in a wide sense, the process which public administration has been undergoing for a few decades now. Digitalisation is a long term process of transforming countries, it is not a one-off, fragmented action, it requires engagement of multiple entities – public and private institutions, citizens, as well as calls for the employment of relevant technologies. The process is oriented towards meeting specific goals expected by the society [Koppenjan, Groenewegen, 2005].

In this study, the public sector is understood in its wide meaning, as all processes performed by central state institutions or local government bodies, involving administrative processes and public services, law-making, electing authority representatives, the law enforcement system, etc.

Digital technologies have been employed in the public sector for a long time now and are aimed at automating public services and facilitating access to citizens (G2C), entrepreneurs (G2B) and institutions (G2G). Traditional digital services are utilised for safe data transfers, e-orders, filing tax return forms, identity management, electronic voting, asset or company registration, etc. The purpose of these actions is to integrate public services in the electronic channel to provide them in a way which is safe, transparent, based on trust and automated, at the same time eliminating red tape. Digitalisation is viewed as a new source of growth, productivity and significance in today's increasingly more digitalised world. Governments and public sector organisations apply new technologies to create innovative concepts of doing politics, providing services and building public value. The emerging solutions like Artificial Intelligence (AI) and blockchain offer a potential of making the public sector "smarter", i.e. more agile, productive, user-friendly, and consequently more trustworthy. If blockchain finds the right application in the public sector, it may render benefits in the form of better transparency and accountability, as well as increased safety thanks to higher data integrity and their immutability during inter-agency transfers. Another advantage of this solution is higher productivity owed to a reduced time and cost of data processing, resulting from relation automation.

Governments around the world experiment with new technologies to better meet public needs and manage coherent use of resources in order to maximise public value. Public authorities may play different roles in these processes by being their:

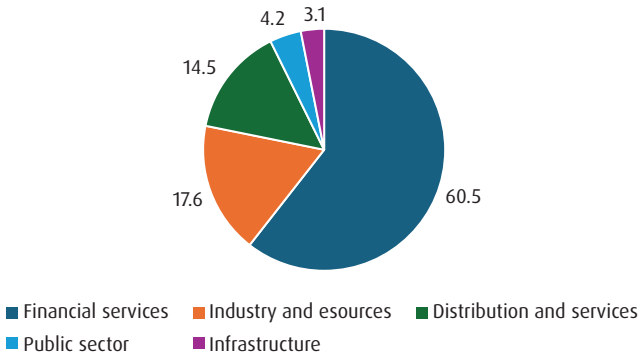
1) organisers, adopting a general strategy in terms of universal and public application of technologies;
2) financing entities, providing direct or indirect funding to support research, development and adoption of new technologies;
3) direct users and co-developers;
4) regulators and supervisors [OECD, 2019].

Frequently, actions taken by authorities are multi-dimensional and may incorporate even all of these roles. One thing is certain – keen state inolvement seems indispensable in this respect.

Blockchain technology market in the public sector

Thanks to its special qualities, blockchain allows to tackle the problems emerging in many public processes. The public sector, however, makes up only a fraction of the global blockchain technology market – in 2020 its share was estimated at 4.2% (Figure 1) [European Union, 2020, p. 84].

Figure 1. Global blockchain technology market divided into sectors in 2018 (%)

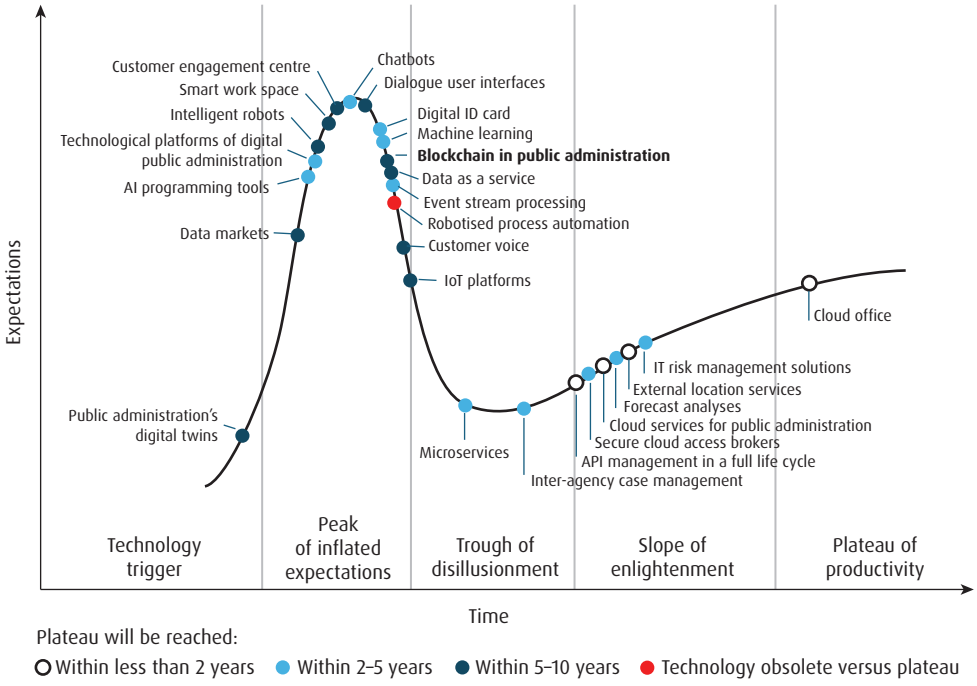


Source: European Union [2020, p. 84].

In 2019 the analytical company Gartner presented a hype cycle[2] graph for digital technologies in public administration [Moore, 2019] which revealed that the development of the blockchain technology in the public sector was at the stage of a "trough of disillusionment" – excessively high expectations coinciding with insufficiently positive results of tests and experiments, which caused solution providers to withdraw from projects (Figure 2). Simultaneously, Gartner forecast that blockchain will achieve the stage of productivity within 5–10 years. Hype cycle is merely an illustrative tool, with no sound scientific underpinning and not many empirical applications, yet its graphic representation implies that after a period of the public sector's intense interest in the blockchain technology and its initial negative empirical verification, some higher activity geared towards employing this technology in the public sector is to be expected.

2 [2] Hype cycle created by the Gartner company is a conceptual graphic presentation of the emergence, development, maturity, social adoption and application of specific technologies in five stages: *technology trigger, peak of inflated expectations, trough of disillusionment, slope of enlightenment and plateau of productivity.*

Figure 2. Hype cycle of digital technologies employed in public administration in 2019



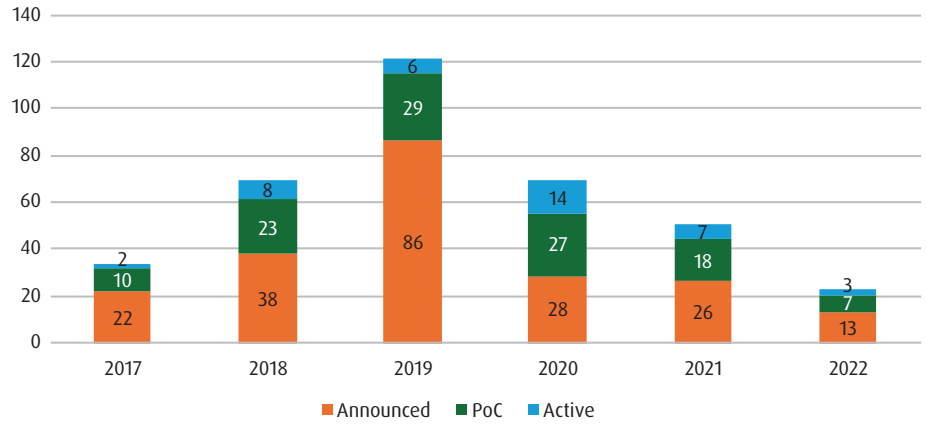
Source: Moore [2019].

According to the Gartner 2019 CIO Survey, 7% of government organisations in 2019 implemented the blockchain technology or distributed ledger technology, or were planning on implementing them within one year. In the same survey, 43% of respondents indicated no interest in the blockchain technology, which as compared to 2018 results (35%), may confirm the thesis of a slumping interest in this solution [Moore, 2019]. Similar findings were obtained by Righetti [2023] in the analysis of 367 initiatives related to the area: adoption of blockchain technologies in the public sector was continuously on the rise until 2019, only to show a downturn in the following years.

However, Righetti observed also that the proportion of operational projects grew slightly in 2020 (Figure 3), which implies that these initiatives have started moving from the stage of initial interest and analyses to more mature stages of testing prototypes and implementations, which are time-consuming processes. Findings of this study reveal that most of these initiatives have a local reach and are limited to the country in which they were conceived. Blokchain projects are implemented mainly by the central and local public administration, more and more often some multi-entity initiatives are also taken (within consortia). The state of maturity of the studied initia-

tives was assessed by Righetti in 58% of cases as the announcement stage, in 31% as the proof of concept stage (PoC), and in 11% it was the operating phase.

Figure 3. Number of projects in the public sector employing the blockchain technology



Source: Righetti [2023].

Other available data suggest that there exists still a keen interest in this area. Bank of International Settlements (BIS) estimated that in 2023 over 80% of central banks either had adopted or considered adopting a Central Bank Digital Currency (CBDC) [Shiva, Matsu, Ishibashi, Rosenbach, 2023]. In 2018, OECD [2018, p. 20], basing on the data collected by the Illinois Blockchain Initiative, indicated that government authorities in 46 countries were engaged in at least 200 initiatives related to the implementation of blockchain technologies. They usually comprised research, less frequently prototypes, incubations or pilot projects and developing solutions. Having verified the source data [The Illinois Blockchain Initiative, 2024], in some cases we could not confirm the projects existed, and in some instances it was not clear that they applied blockchain technologies. Having contrasted these findings against other sources, we created a table of results set out in the Annex to this study.

Alessie et al. studied seven projects involving the application of blockchain technology in the public sector (a register of the land chain of title in Georgia, academic certificates in Malta, real estate transactions in Sweden, decentralised identity in Switzerland, management framework in Luxembourg, retirement infrastructure in the Netherlands and intelligent vouchers in the Netherlands). The conducted study led them to the following conclusions:

1) the services using blockchain's "notarial" capacity are more mature, whereas more breakthrough projects are still waiting to be implemented;

2) projects at higher levels of maturity are characterised by a lower complexity of stakeholders and more centralised management;
3) services based on the blockchain technology that are already in operation meet very specific business needs and attract active public entities, as well as strong technological partners;
4) private data are always stored outside of the chain of blocks;
5) traffic capacity of transactions does not cause any serious bottlenecks in this case;
6) projects based on the chain of blocks generate special cost categories, but the general implementation costs should not exceed the costs of centralised projects.

Joint Research Centre (JRC) of the European Commission performed an analysis of 167 instances of public service provision based on the blockchain technology in 23 countries of Europe [JRC, 2022]. The study did not specify, however, what the "instance of use" was. Most of the disclosed instances were found in Italy (31), the Netherlands (26) and Great Britain (13). Some instances were classified as "EU instances" due to action taken at the EU level. In this set of data 54% of instances were at a pilot stage, 19% at the development stage, 16% had been implemented, 10% had been scrapped and 2% were planned. Looking at the study from the public sector point of view, majority of cases referred to general public services (46%), 17% were economic affairs, 12% were cases in education, 10% in healthcare, 8% in social security, 5% in environment conservation, 1% in public governance and security and 1% in housing. As far as the type of process implemented is concerned, majority of instances of use referred to: certification and validation (30%), data sharing management (27%), data notarisation (17%), financial management and support (15%), internal process management (14%), certification and digital identity (14%), and the lowest proportion – policy monitoring and implementation (1%), forecasting and planning (1%) or improving cybersecurity (1%) [JRC, 2022, p. 24]. The organisations responsible for implementations were mainly central authorities (44%), then local authorities (20%), scientific institutions (11%), regional authorities (11%), the private sector (6%), non-government organisations (4%), consortia (3%) and grass-root communities (1%).

Activities connected to implementing blockchain technologies in the public sector

Based on the publicly available information and literature of the subject we have identified 78 world economies (including the EU) which have taken action to employ blockchain technologies in the public sector. These are the countries that possess a documented record of experience in developing pilot schemes, experiments or project implementations, as well as ready-made strategies, policies, guidelines and roadmaps, organising regulatory sandboxes or working groups (attended by public administration

entities) in order to collaborate on the application of blockchain technologies in the public sector. This set of data does not involve theoretical deliberations, conceptions or potential analyses. It should by no means be treated as final and complete, as not all information can be verified at source, and some of it does not contain full technical, organisational or work status data. Also, the very fact of employing blockchain technologies is not always unambiguous, due to the lack of a precise and commonly used definition of this term.

Based on the collected information, we have identified 54 public processes which were performed by at least one out of 78 countries (including the EU) while implementing blockchain. These applications are not strictly separated, they may overlap with other areas, e.g. public registers may be also used in public service provision. Within one country activities in a given field may be performed in a few sub-areas and simultaneously under more than one project. The following countries have experience in the highest number of public processes while implementing blockchain technologies: The United States (12), the Netherlands (9), Estonia (8), Romania (8), Austria (7), Switzerland (7) and Australia (7).

In 30 economies (38%) some activity was observed related to developing strategies, policies, guidelines and road-maps for utilising the blockchain technology in the public sector or organising working teams (with participation of public entities) appointed to collaborate on the implementation of this technology in the public sector. As many as 34 countries (43%) launched fintech regulatory sandboxes involving implementations using the blockchain technology.

1) Multi-sector solutions help provide services using blockchain both in the public and private sector, e.g. by building a domestic blockchain network (cloud, platform) or a smart city platform. These solutions allow to reduce tensions occurring when the private sector interacts with government organisations. Among 78 world economies (including the EU) which took action to employ blockchain technologies in the public sector, we have identified six which had a documented record of experience in developing pilot schemes or project implementations in this area. These are: Austria, Croatia, Liechtenstein, Russia, Romania and Slovenia. Some countries have systems of information exchange which ensure a uniform and safe data migration between organisations from the private and public sectors, but are not strictly based on the blockchain technology, an example might be the X-Road system used in Estonia and about a dozen other countries.
2) Inter-institutional services supporting digitalisation of public administration and public service provision that use blockchain include systems of document and information circulation, timestamping documents or integrating records and public services. They guarantee data durability and immutability of document

contents in the system, allow a greater interoperability between data silos of independent institutions, as well as offer a safe, monitored data exchange, reducing the share of excess information. It helps institutions operate productively and effectively without having to centralise tightly or use burdensome standards. The conducted study allowed us to identify six countries which have experience in this area. These are: Austria, Estonia, Gibraltar, Romania, Argentina and the United States of America.

3) Creating and managing digital citizens' identities, including the provision of mechanisms of self sovereign identity may include the systems of digital identity documents or digital management of citizenship. Digital identity is not limited to natural persons, it may also be granted to organisations (legal persons). Identity management lies at the core of public services, yet older tools for data management do not ensure a safe, easily accessible and regularly updated identity. Managing identity and its derivatives (vital records, passports, visas), based on the application of the blockchain technology, offers citizens the possibility of a sovereign identity protection, which means that they have a close control over accessing their identity documents and data carried by them. It allows to share e.g. information about age without revealing any other confidential information, as well as ensures a more efficient authentication of citizens in public services or smoother data exchanges between institutions. The digital ID based on the blockchain technology is basic to the safe use of such services, particularly those that require a "human proof" or personal data sharing. It may also prevent identity theft, which is key to the security of public systems. We have identified six countries with experience in this field. These are: Austria, the Netherlands, Switzerland, Italy, Australia and Bhutan. Some countries, like Estonia, possess digital identity systems which are not directly based on blockchain technologies, but make use of common for many public processes inter-institutional services (in Estonia it is KSI Blockchain).
4) Election systems based on the blockchain technology may be used to organise voting at the central or local level, as well as help hold referendums or internal votes in government institutions. This technology may be more effective than its centralised counterpart (both traditional paper-based election, and the centralised electronic one) in resisting cyber-attacks and vote falsification, thus ensuring a safe, transparent and fast vote counting, at the same time preserving voters' privacy [Vladucu, Dong, Medina, Rojas-Cessa, 2023]. In as many as 13 countries from the list, experiments, pilot projects and implementations of this type of systems were carried out. The following countries performed them: Austria, Estonia, Germany, Norway, Portugal, Russia, Romania, Switzerland, Great Britain, Australia, South Korea, Sierra Leone and the United States of America.

5) Application of the blockchain technology in direct relations of public bodies with the private sector entities may involve access to public services, sale of public assets (auctions) or supporting public procurement processes. Thanks to the blockchain technology these processes gain transparency, complete auditability and a growth potential in delivery efficiency. Countries with proven experience in this area are: Austria, Estonia, Georgia, Spain, Ukraine, Argentina, Chile and Columbia.
6) The document recording potential offers a possibility of implementing certification services: certification of equipment, certification of various qualifications (e.g. driving licence) or authenticating professional competencies and higher education. We have identified 10 economies which have experience in this field, particularly in certification of competencies. These are: EU, Belgium, Denmark, Malta, Romania, Hungary, Italy, Australia, Kenya and the United States of America.
7) Another area of application of the blockchain technology are public records which serve as the main source of knowledge about everything: from land titles through the registration of corporate entities and civil registry deeds to criminal records and more. Decentralisation of those records may increase their effectiveness, slash the costs of acquiring and editing information, ensure better data transparency and cohesion, and, in some countries, also help eradicate corruption and fraud. Registers may guarantee not only immutability of the recorded changed status, but also record the changes themselves (transactions). The very process of transformation provides a motivation to sort out the relevant data and clarify their legal situation, e.g. land status. The records which were considered for the implementation of the blockchain technology in the related processes are: digital asset records, unemployed records, records and systems of tracking invoices, real estate records, land records, claims records, registers of companies and business activity, vehicle records (vehicle passport) or public archives. Medical and court registers are considered in a separate category. Most implementation practices are related to land and real estate registers (11 economies). As many as 15 countries have already taken action in this area. These countries include: Denmark, Estonia, Georgia, the Netherlands, Russia, Romania, Sweden, China, India, Jordan, Ghana, Honduras, Canada, the United States of America and the United Arab Emirates (Dubai).
8) A separate area of the blockchain technology application, present in the implementation practice of some countries, is the system of healthcare which may involve storing and sharing medical data between healthcare entities, dealing with partner chains of healthcare service providers, tracking medicine delivery systems, monitoring epidemics, or managing medical contracts with healthcare facilities. Employing the blockchain technology in this case allows to increase

on one hand the effectiveness of providing healthcare services, and on the other, raise the security and public health levels thanks to eradicating medicine-related fraud or a more efficient exchange of dispersed medical history information, at the same time ensuring patient privacy and patients' rights to decide about sharing their medical records. It offers patients more freedom in choosing medical facilities, allows to eliminate repeat medical tests and registration procedures, facilitates multiple prescription issuance, automated settlements and implementing additional health-promoting initiatives. We have identified six countries that take action in this field. These are: Austria, Estonia, the Netherlands, India, the United States of America and the United Arab Emirates (Dubai).

9) Public finance can also benefit from using the potential of blockchain technologies. Implementation of blockchain in the tax collection system (automating tax payments, settlements and refunds) gives a chance to harmonise domestic and international actions to prevent money laundering and VAT fraud [PwC, 2019a; Sobiecki, Szwed-Ziemichód, 2019]. Accepting tax liability payments in cryptocurrencies may stimulate the development of a decentralised service industry and lift the obligation to exchange payment crypto-assets for national currencies. The solution implemented in Poland allows to track the life cycles of financial instruments (a system of reporting transactions in savings bonds) and ensures data security as well as facilitates the generation of full reports of current transactions. In other countries, some effort is made to tokenise treasury bonds or other public financial instruments. We have identified 10 countries which implement such solutions. These are: Poland, Austria, Denmark, Switzerland, Australia, China, Israel, Kazakhstan, the United States of America and United Arab Emirates (Dubai).
10) Areas in which most countries are actively seeking to implement blockchain technologies are the payment systems and digital money (Central Bank Digital Currency, CBDC[3]) which allow to pay for public services, effect any type of payment (actual digital retail money), conduct Real Time Gross Settlements (RTGS) or distribute transfer payments (benefits) and public help. In the field of payments, blockchain is the solution which, in a complete but simple way, combines the potential of technology and service utility, it allows to make instantaneous, international and high-volume payments as well as micro-payments at a relatively low cost. Digital money, as a public response to cryptocurrencies, may help central banks facilitate money supply management, using the so called money programming – imposing constraints on the use of money cashed for a specific,

[3] There exist numerous models of implementing CBDC, some of them not involving blockchain. Nevertheless, in most cases this technology is being considered.

predetermined purpose, running a more effective monetary policy or boosting the security of the financial system. Simultaneously, CBDC can ensure a higher level of money supply transparency, potentially even set hard limits on money issuance and public expenditure, which allows for an effective supervision of government spending by the society. A total of 30 economies, including the EU, are taking action in this area (30 of them only in the area of digital money).

11) Some public solutions are also oriented towards market regulation. They are focused on creating markets, market operations, supervision of entities and processes, decentralising processes (e.g. supply chains) or prevent fraud. These solutions involve mostly private security markets (registers, stock exchanges), energy markets (trading green certificates), digital asset markets (exchanges) or food markets. We have identified seven economies that have taken action in this field. These are: Romania, Ukraine, Italy, Australia, Quatar, Singapore and the United States of America.
12) Blockchain technology may also support the judiciary system in such processes as registration of the sentence execution (for juvenile delinquents, in petty crime cases), exchange of data between institutions during the court procedure or keeping the court file record. Interest in this area is not particularly popular among the studied countries, only Estonia and the Netherlands take action in this respect.
13) Similarly, blockchain is rarely applied in security and defence systems, e.g. to protect smart devices (only Estonia undertakes some activities), however, this may also be due to data confidentiality in defence technologies.
14) Managing public processes and systems is another aspect in which only a few countries take supportive action, including such initiatives as project process coordination, the process of awarding legal aid, credit information coordination, managing public information or crisis management. Four countries possess some experience in this area: Belgium, the Netherlands, Italy and Columbia.
15) Apart from the above mentioned groups of processes, there are a few more domains based on the blockchain technology: public metaverse or metaverse's public applications (five economies: Saudi Arabia, China, Japan, South Korea and the United Arab Emirates), a public NFT platform allowing for a secure digital asset generation, management and exchange (Hungary), education support systems (Romania) or smart legal contracts automating contract performance in a publicly approved way (Bahrain).

On top of these already discussed domains in which blockchain technologies are employed for public sector activities, literature indicates also some additional potential fields, such as:

- supporting copyright management and dealing with copyright disputes;
- supply chains of private goods and raw materials using public solutions based on the blockchain technology, increasing trust in their country-of-origin data, facilitating certification and audits;
- in the area of public processes: managing public contracts, administration of public assets, pension funds [Lykidis, Drosatos, Rantos, 2021];
- flash company service, allowing for a super fast registration of a temporary company, including opening a bank account, registration in the register of companies with terms of association and completion of temporary organisation processes;
- monitoring student loans and scholarships;
- planning, monitoring and auditing government budget revenue and expenditure;
- planning surgeries in the public healthcare system;
- public, digital notary service (timestamping documents) [Deloitte, 2018];
- digital signatures (authentication) using digital identity [Healthcare IT News, 2022; Lykidis et al., 2021];
- tax payment refunds [Anomah, Ayeboafo, Aduamoah, Agyabeng, 2024];
- social security [Tang, Wang, Dong, Ma, 2022];
- public statistics, censuses;
- policy implementation monitoring;
- customs clearance automation.

Implementation benefits and motivations

Employing solutions based on blockchain technologies in public processes may be motivated by some clearly defined needs, deficiencies or worries, but also by searching for additional applications, efficiencies or other benefits which can boost the value of the public sector.

According to Sabbagh [2019], there are three dimensions of the public sector's value: These include:

1) improved public services,
2) improved management, including:
   - higher administrative efficiency,
   - possibility of Open Government (OG),
   - improved ethical behaviour and professionalism,
3) improved social value, including:
   - improved social value and wellbeing,
   - higher trust towards the government.

It is only in the behavioural dimension (involving improved ethical behaviour and professionalism) which depends strictly on human conduct that the results of implementing the blockchain technology may not be visible. Technology may, however, boost the public sector's value in the other domains.

Electronic administration in many countries employs ICT technologies in order to effectively, productively and in a transparent manner provide public services to individuals and organisations. E-administration systems collect, store and process immense amounts of confidential data, e.g. information about citizens, employees, clients, products, research, financial status, and in a wider perspective including all public processes, also data about companies, vehicles, financial instruments, real estate, etc. Disclosure of such information usually leads to a loss of trust among users. Most of the existing e-administration systems, such as websites and electronic identity management systems, are stored on duplicated servers and databases. Centralised management and validation systems may be prone to the problems of a single point of failure and become targets for cyber-attacks in the form of malicious software, denial of service (DoS) or distributed denial of service (DDoS) attacks. It is estimated that over 80% of e-administration websites worldwide were at some point exposed to cross-site scripting (XSS) or structured query language (SQL) attacks due to a lack of proper authentication mechanism applied on input user data. Therefore, preserving the security, privacy, confidentiality, integrity and accessibility of the electronic administration systems is of paramount importance [Elisa et al., 2023; Moen, Klingsheim, Simonsen, Hole, 2007].

Authorities around the world have digitalised many public processes – digital identity, electronic records, e-taxes or getting business done online. Almost all processes employ special, dedicated digital technologies – e-mail, www portals or office software. Each government body and each institution are an information silo which collects and processes information for its own purposes, often generating redundant processes and requiring citizens to perform the same actions multiple times (enter the same data). Versatile systems of different countries lead to problems in communication outside of the network when inter-agency and international information exchanges are needed.

Based on the analysis of 53 articles, Sabbagh [2019] identified 118 potential benefits arising from the specifics of blockchain technologies implemented in public processes, which were then used to create over 51 groups. The most significant of them are:

1) process transparency,
2) fraud reduction and identification,
3) elimination of corruption,
4) e-democracy,

5) reduction of red tape
6) increased trust towards authorities
7) facilitation of inter-agency and inter-sector processes,
8) social innovation,
9) property ownership unambiguity,
10) increased resilience to spam and DDoS attacks,
11) better quality and integrity of data,
12) reduction of human error inside processes,
13) digital reflection of sovereign identity,
14) permanence and immutability of records,
15) elimination of redundant intermediaries,
16) potential new public services.

Righetti [2023] highlighted that the most frequently expected benefits of implementing the blockchain technology in the public sector are: verifiability (55%), effectiveness (52%0, transparency (47%), security (47%), immutability (40%), as well as decentralisation (19%), trust (18%), disintermediation (16%) and programmability (2%).

Not many studies discuss the actually attained benefits of implementing the blockchain technology. Some of them have been presented in the works of Shahaab, Khan, Maude, Hewage and Wang [2023]. They include:

- improving the efficiency of data exchange and transparency, estimated cost-savings of over 720 million USD in healthcare and social security (US);
- better identifiability and supervision in American Centres for Disease Control and Prevention (CDC);
- reducing the average time of land title confirmation from one year to three months and access to data in real time (Ghana, Georgia);
- reduction in operational costs due to the elimination of manual processes and increased data cohesion and integrity in the Danish tax administration or in the United Arab Emirates;
- reducing dependence on intermediaries and improved reputation of the pharmaceutical industry thanks to higher transparency, efficiency and cooperation with medicine supplies (India);
- increased transparency in the public sector and limited corruption as well as higher citizen engagement (Columbia);
- more efficient, service-oriented administration and higher trust towards public institutions (Italy).

Cagigas, Clifton, Diaz-Fuentes and Fernandez-Gutierrez [2021] have quoted the case of a land title register based on the blockchain technology in Georgia where the registration of data is currently 400 times faster and over 90% less costly than before.

Estonia is often indicated as a country where solutions based on KSI Blockchain technology have streamlined tax, court, healthcare and commercial register processes.

Despite a slim pool of data available on the effects of blockchain technology applications in the public sector, it seems that achieving positive results of implementations and delivering on expectations is at least partly viable.

Blockchain in the public sector in Poland

The main actions related to the application of blockchain technologies in the public sector taken in Poland involve:

1) creating the first blockchain sandbox in November 2020 in cooperation with KIR, PKO BP, IBM, the National Cloud, UKNF, Fintech Foundation Poland and Cyberium Foundation [Grendys, 2022];
2) developing a blockchain-based system of reporting saving bonds transactions, a joint project of Ministry of Finance, PKO BP and the National Clearing House (KIR) [Mózgowiec, 2021];
3) establishing a Working Group for Distributed Ledgers and Blockchain in the Ministry of Digitalisation [Szafrański, 2020], the group will resume its activity in 2024.

The list does not include other interesting projects from the private sector which should be distinguished as a complementation of the private sector's initiatives:

- e-Voting system, developed by the Central Securities Depository Services (KDPW) in cooperation with Asseco and launched in 2021, it allows to hold a remote vote at Annual General Shareholder Meetings [Wilanowski, 2021];
- Blockchain Platform for the Capital Market, created also by KDPW, allows to design dedicated, independent applications and services based on the blockchain technology application [Panasiuk, 2019];
- durable KIR medium, a solution offering to clients permanently recorded public documents (regulations) and private files (version 2.0) created by PKO BP, the National Clearing House (KIR), National Cloud Operator and technological partners (Hitachi, IBM, Accenture), a combination of blockchain (private network) and WORM matrix [Supernak, 2020];
- durable medium of the Credit Information Office (BIK), it allows to publish public and private documents; a blockchain-based tool prepared by BIK in cooperation with a Polish-British company Billon [Uryniuk, 2020];
- durable medium by Alior Bank, the first and only case of applying the blockchain technology in the public sector in Poland (Ethereum); dedicated to public documents;

- pilot project of the letter of credit transaction using the blockchain technology conducted by ING Bank Śląski;
- SIRA, the Standard of Shareholder Register Interface, an initiative of a group of entities which keep electronic shareholder registers, with a purpose to develop uniform technical conditions of system operation, allowing shareholders to manage their shares in electronic registers, particularly in the case of non-public shares, including a simple joint stock company situation [Ministry of Digitalisation, 2021].

Poland is also a signatory of the European Blockchain Partnership and takes part in developing the European Blockchain Service Infrastructure (EBSI) – a universal EU project aimed at implementing an energy-saving and security-enhancing infrastructure based on blockchain technologies to provide cross-border public services which can be used now by national and local authorities, and also by private companies in the future. The Polish node of EBSI network is operated by the National Research Institute (NASK).

Under the EBSI project some other blockchain technology applications are being developed: e-Diploma, sovereign identity, social security and verifiable references. The following organisations participate in those projects: The National Information Processing Institute, selected Polish universities and the National Health Fund.

The case of Estonia

These days, Estonia is often referred to as the "digital republic" [Heller, 2017; PwC, 2019b] – one of the most digitalised administrations in the world. In many ways it is a truly unique country – it is a relatively small economy, its language (Estonian) belongs to the same group of Uralic languages as Hungarian or Finnish, which makes it incomprehensible to all of its neighbouring countries. Its geopolitical situation is similar to Poland, positioned between two much more robust economies and military powers. Since the 11the century, Estonian territory has been conquered by Russia five times. In recent decades, Russian air forces have multiple times violated the air space of Estonia. Currently, the greatest threat of a virtual nature it is facing is the hybrid warfare. In 2007 the Russian cyber-attack on Estonia wreaked havoc across its entire economy, from banks to the media. Following these events, Estonia went on a path of a digital revolution. In 2008 Estonian government launched a project called "e-Estonia", an ambitious scheme aimed at digitalising all kinds of citizen actions in the public sector. Research and development programmes were implemented in the field of digital forensics and cyber-defence strategies and massive investments were made in technological solutions, infrastructure and education. In the years 2009–2012 at the invitation of NATO's Cooperative Cyber Defence Centre of Excellence with a seat

in Tallinn, an international group of about 20 experts produced the so called Tallinn Manual on the international law applied in the cyber warfare. In April 2013 it was published by the Cambridge University Press. In 2017, the 2.0 version was released, and in 2021, 5-year work on the Tallinn Manual 3.0 started [CCDCOE, 2024].

Thanks to a considerable investment in the cyber security infrastructure, Estonia acquired vast specialist knowledge in the field. A higher level of digital skills and preparation in the entire digitalisation sector helped Estonia successfully implement the blockchain technology in public services.

Estonia developed also, almost simultaneously with the emergence of Bitcoin, a technology based on a similar idea to blockchain, aimed at ensuring data integrity which is believed to be a more urgent priority in the situation of an emergency than data privacy. Common worries focus usually on data security ("who can see my data"), but pieces of personal data can rarely be compromising and in most cases they do not become attack targets. Greater chaos can be caused by data modification. As remarked by Heller [2017], "It does not really matter who knows what your blood group is, but if your blood group gets altered in a confidential record, your next visit to ER may kill you". Detecting data security breaches is extremely time-consuming, (it may take dozens or hundreds of days). In Estonia such breaches are identified almost in real time. That is why ensuring data integrity in public records containing sensitive information about all citizens was of such importance.

The available official files on "e-Estonia" project explain that it rests on three mutually complementary digital systems, i.e. three technological pillars of a digital state: e-ID, X-Road and KSI Blockchain [Semenzin et al., 2022].

X-Road is a technological and organisational environment allowing for a safe data exchange between IT systems on the Internet. X-Road is based on an inter-operational ecosystem. It facilitates automatic data exchange, also of sensitive data, between institutions and countries (X-Road is currently being implemented in Finland, Azerbaijan, Namibia and the Faroe Islands) [PwC, 2019b].

Estonia was the first national country in the world to have implemented the blockchain technology in production systems – in 2012, along with the probate registry kept by the Ministry of Justice, although the first version of this solution (at that time, not referred to as "blockchain") was created in 2007. KSI Blockchain[4] is employed also by NATO and the US Department of Defence. Contrary to traditional methods used in the digital signature (e.g. public key infrastructure, PKI) which are based on the cryptography of the public key, KSI applies exclusively the cryptography of the hash function, thanks to which verification depends solely on the security of the hash

4 Keyless signature infrastructure, KSI – signature infrastructure which does not require the use of keys.

function and accessibility of the public book, commonly known as blockchain. KSI Blockchain is a solution for timestamping data to ensure their integrity. Key benefits of this tool are: a vast reach, portability, quantum resilience, independent verification and data privacy. Data never leave the system, the blockchain service receives only the hash (result of the cryptographic hash function). As no data are stored in the KSI Blockchain, it is scalable and can ensure immutability of petabytes of data per second.

The third fundamental element of Estonia's digitalisation is e-ID – electronic identity cards, used also for accessing digital services. Each Estonian, irrelevant of the place of abode, has a national digital identity. Analysts estimate that Estonia has one of the most developed national ID card systems in the world. The scope of functions of e-ID is larger than that of a traditional identity document with a photo. It ensures also access to all Estonian e-services, and the qualified electronic signature using e-ID is equivalent to a handwritten signature or stamp. All Estonian offices are obliged to honour this signature [PwC, 2019b]. Over the period of 15 years in Estonia over 400 million digital signatures were used, more than in all other EU member states in total. The digital ID card is also a legitimate document for Estonian citizens travelling on the territory of the EU.

Thanks to the implementation of these three fundamental solutions it was possible to launch a digital access to public services [Kshetri, 2021]. Services based on these tools are: healthcare with a medical documents record (e-Health Record), a real estate register, a commercial register, a register of entrepreneurs, a probate register, a digital court register (electronic files) and an official journal. Estonia has also developed services which allow citizens to easily gain access to own data, but also to check who else inspected these data and when. It increased data transparency and efficiency as well as boosted citizens' trust towards public services. It is estimated that 99% of public services are provided to citizens in the form of e-services. Almost all public administration deeds, except marriage, divorce and real estate transactions, may be performed digitally. Filing a tax return form takes less than 5 minutes, public elections are held online and all patients have electronic medical records. It is easy to start a business online and sign documents digitally. Officials estimate that Estonia saves over 1400 years of work and 2% of GDP annually thanks to digitalised public services. What is more, it is not the only area in which all citizens (not only the public infrastructure) may use the solutions offered by the digital state.

Estonia is pointed out as the first country to have held electronic polls during a public election [Vladucu et al., 2023]. Implementation of this tool started in 2005. In 2013 Estonia made it possible to its citizens to choose between electronic and traditional polls which lasted 7 days. About 21% of population decided to apply the e-Voting system. The system is equipped with partly centralised software which ensures anonymity

and voter verification. In order to cast a vote, one needs the Internet and an electronic identification card which is used for authentication, coding and signing. Voters need to download a polling application, authenticate themselves using e-ID, if they are eligible, they will see a list of candidates displayed on which they may cast their vote.

In order to ensure online access to public services to people worldwide, Estonia launched in 2014 an e-residence programme. E-residence is not a travel document, proof of citizenship or right of residence, but a transnational digital identity which can provide to anyone, in any place worldwide, an opportunity to succeed as a businessperson in Estonia. Just like citizens and residents of Estonia, e-residents receive a government-issued digital identifier and a full access to Estonian public e-services. It allows them to start an Estonian company and manage it online, apply for a company bank account, use safe online banking, gain access to international payment service providers, use digital signatures and send scrambled documents or file tax returns. At the beginning of 2023 Estonia issued an e-residence card to the one hundred thousandth person, having at that moment a total of 63 thousand active e-residence cards in over 176 countries worldwide [Sapiton, 2023].

It should be borne in mind that among the three pillars of the digital republic, it is only KSI Blockchain that is based on a decentralised solution. There is no clear information indicating that X-Road, e-ID or online services for citizens directly use the blockchain technology. Public services may partly base on this technology utility when they employ KSI Blockchain. It is being debated also how much this solution is decentralised (how centralised the supervision is, if there exists a chain of nodes, or if it is just blockchain as a structure of cryptographically connected data) as there are not many official documents which present the above mentioned mechanisms in detail [Semenzin et al., 2022]. Despite semantic doubts about whether the term "blockchain technology" may be used to refer to decentralised technologies or data chain structures, the applied tools provide critically important solutions to the economy, public administration and society in Estonia.

Risk and constraints

The research and development experience of companies and institutions to date shows that blockchain may help solve a narrow class of problems in which more important than potential costs are the following aspects: systemic assurance of data exchange security, durability of event records, transparency, decentralisation of process control and democratisation of automatically (and autonomously) performed processes. Nevertheless, blockchain is not a technology for universal application. It also cannot tackle all problems – many issues may be dealt with faster, cheaper and

easier without the blockchain technology, also in the public sector [Wüst, Gervais, 2017]. Solutions based on blockchain, as compared to centralised tools, usually have a lower traffic capacity in terms of data transfer, they may experience longer lags and have a higher demand for data space, require a different approach during design and implementation, both of the technical solution and the business model, as well as then during the monitoring stage. Due to the fact that they involve numerous, often independent parties, they require great coordination effort. They can also generate many potential formal challenges verging on various branches of law. Benchmarking of those projects is currently difficult, as there are not many implementations worldwide, and the ones that are available are either in the early stages of development or have a short history of operation [Batubara, Ubacht, Janssen, 2018].

If the central service provider is trusted and properly secured, and in the process of service development only solutions of digitalisation and process automation are required, blockchain may not be an efficient solution.

Findings of the survey conducted by Shiva et al., [2023] in which 85% of respondents were in local or central authorities, indicate that the key challenges of implementing the blockchain technology are:

- lack of skills and resources in the organisation (44%),
- lack of inter-operativeness with the existing infrastructure (33%),
- lack of organisational engagement (22%).

Decentralisation – the new privatisation

It is difficult to separate public projects from private due to the fact that many private initiatives try to "replace" the state at the grassroots and offer services delivering similar tools to public services, such as: digital identification, digital identity, payment and banking solutions, healthcare systems, stock exchanges (including digital assets), notarisation (authentication, certificates). At the core of developing blockchain technologies lie anti-system and decentralisation ideas. The technology allows to perform the previously centralised processes, imposed and supervised top-down, in a decentralised environment, initiated and developed bottom-up. Thus, many of the solutions proposed on the market assume the performance of processes previously carried out by public institutions. The trend is not entirely new because the private sector in many areas has complemented the public sector's tasks, e.g. the banking sector together with the central bank have created a double-level monetary regime lasting for a few decades, the public healthcare or insurance have performed the tasks which might be unprofitable for private establishments. Inter-bank settlements are conducted by public-private entities (National Clearing House, KIR); the same goes

for regulated markets, e.g. betting and gaming markets, commodity or energy markets. It seems that there occurs a kind of equilibrium between the private and public service provision, and markets have been split between the private and public sector.

Blockchain with its potential of process decentralisation may disrupt this balance and lead to "d-privatisation". Technological decentralisation of public processes may appear as a new form of privatisation and democratisation. This is an altogether new concept with new characteristics, free of many of the downsides of the "wild privatisation" – untransparent sales processes or consolidation of public and common goods in private hands, providing encouragement for other illegal practices (e.g. corruption or fraud). Decentralisation by its very nature helps ensure transparency, increase access, inclusion and direct public control. Combined with the potentially higher efficiency of the private allocation of resources, it may make advantages of the public service decentralisation outweigh the costs of investment. This form of decentralisation requires the application of special tools, so that the community of recipients or their delegates may, like in a participative budget, be simultaneously in the role of recipients, providers and decision-makers.

This could be the way to decentralise e.g. public registers (Central Vehicle and Driver Register – CEPIK, medical records, organisation registers, land registers, etc.), the payment sector (means of payment: stablecoins, cryptocurrencies, CBDC), digital identity (KYC, "humanity" proof), digital asset and security exchanges, notarisation (authentication, authorisation, certificates, digital signatures), local administration tasks (road and common property management) and other previously mentioned processes. If a given activity being in the competence of government authorities may be successfully handled in market conditions, there is no need to only leave it to the public bodies and their mechanisms [Izdebski, Kulesza, 2004, p. 377]. The same applies to performing their tasks in the conditions of effective and decentralised coordination of these processes.

As remarked by Husein [2020], technological decentralisation may depoliticise citizens to the same degree as power centralisation. The state may hand over power only to someone who is reliable and can be trusted. In order for a decentralisation of public tasks coordination, monitoring and process performance to happen, a revolutionary step in the development of any country which would to some extent change its political system, there must not only exist conceptions, but also sound technological solutions and institutions, both formal, legal and informal.

The previously discussed implementation areas do not reach that far and focus on the application of other than control decentralisation functions offered by blockchain. It should be noted, though, that they also require considerable effort and activity on the part of the government.

Institutional conditioning

Regulations, institutions

Employment of the blockchain technology in the private sector is increasingly more regulated, however regulations are made with a delay of a few or even over a dozen years after the technology starts operating. Entities in the private sector which engaged in ventures employing technology, so far have acted on a rule that: "what is not forbidden, is allowed". This implies that they have been operating in the circumstances of high volatility and uncertainty as to the outcomes of their actions, but despite a lack of specific regulations, it is possible to apply the existing legal norms to new activities by properly classifying the consequences of these actions, based on the general law.

This does not apply to the public sector. Administration operates in ways which are strictly regulated by law, in Poland, Art. 7 of the Constitution applies – the principle of legalism. Consequently, in order for any action to be taken in the public sector, regulations must be made beforehand, as "the government bodies shall act on the basis and within the limits of the law". In the same way they must implement public tasks and provide public services [Prawo.pl, 2009]. It is not only characteristic of the Polish legal order, many other countries have undertaken to establish legal regulations, an institutional environment for private sector entities, as well as to ensure a smooth running of their own administration, effective implementation of its tasks and provision of public services.

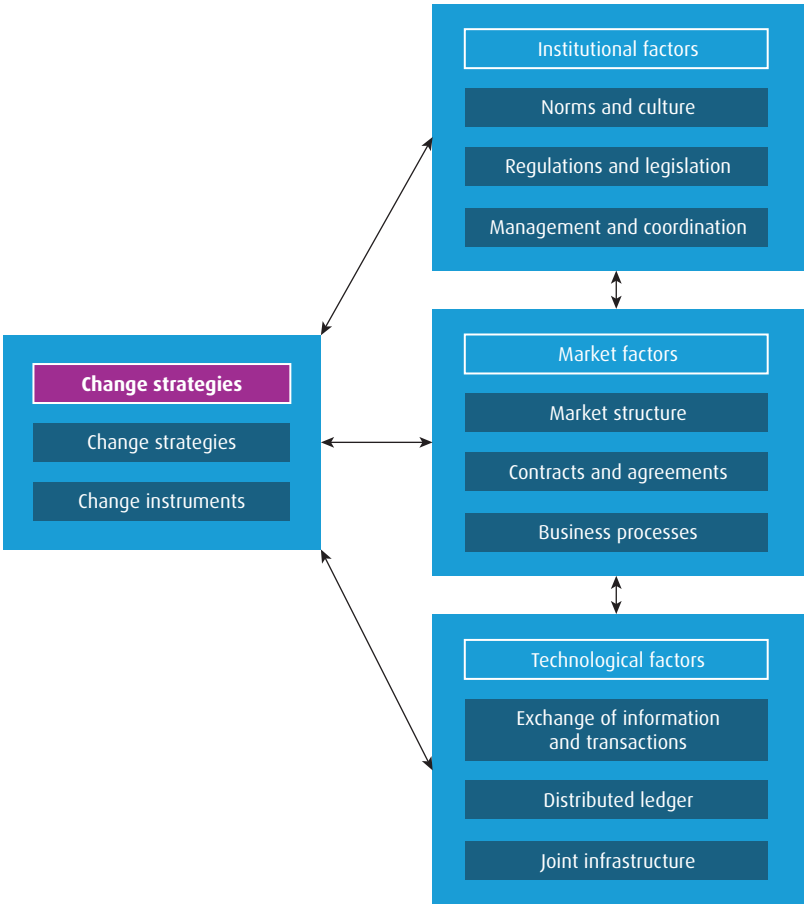
According to OECD and KDI the purpose of developing regulations and institutions is to reduce legal uncertainty and mitigate risks involved in the application of blockchain technologies. When these technologies are being applied by the public administration to implement public tasks and provide public services, special responsibility of administration should be recognised to ensure the safety and protection of the entities, citizens in particular, who are affected by these actions.

Blockchain, similar to other new technologies, develops faster than the regulations, social structures or institutions providing the right environment for these technologies [Marchant, 2011]. The law follows reality, yet the distance between them may vary and depends on particular jurisdictions. Despite a continuously strong interest in the blockchain technology, there exist no uniform regulations on the use of this technology even in the EU, although a few legal acts have been created there in reference to the financial markets at large (MiCA, DLT) and the digital identity (amending eIDAS ordinance) [Wiliński, 2024] as well as the problems of AML in the context of cryptocurrencies. Moreover, DLT technology area is also affected by the regulations pertaining to smart contracts set out in Art. 2.39 and Art. 36 of the Data Act [European Commission, 2024].

Recommendations for building institutions in the context of blockchain

Establishing regulations in reference to the new phenomenon of blockchain technologies and the related ecosystem of services calls for a fresh approach, as the consequences of developing this ecosystem will be observable in many areas controlled by various branches of law, as well as in those fields which so far remain unregulated, posing new, serious legal challenges.

Figure 4. Integrated process, institutional, market, technology (PIMT) framework in favour of adopting blockchain



Source: Self-reported data based on: Janssen, Weerakkody, Ismagilova, Sivarajah, Irani [2020, p. 307]; Koppenjan, Groenewegen [2005].

The process of creating an institutional framework is conditioned by institutional, market and technology factors (Figure 5). While building institutions, it is necessary to consider specific factors affecting the adoption of the blockchain technology in the three following areas [Janssen, Weerakkody, Ismagilova, Sivarajah, Irani, 2020, p. 306]:

1) Institutional factors:
   - cultural resistance,
   - change resistance,
   - lack of understanding of the blockchain institution,
   - need for implementing a new law,
   - ability of the law enforcement bodies to handle fraud cases,
   - decision-makers mistaking blockchain for crypto-currencies,
   - necessity to account for the tax system,
   - regulations accounting for the nature of blockchain technologies,
   - risk of losing control by authorities,
   - choosing the right management framework,
   - risk of market manipulation and unfair practices;
2) Market factors:
   - high level of computerisation resulting in market volatility,
   - mutual interconnections,
   - applying the existing contracts to the methodology (platform) of the blockchain technology,
   - lack of clarity about smart contracts,
   - confusing smart contracts with e-contracts,
   - inadequacy of the existing business processes to the specifics of blockchain technologies,
   - cost of adoption and implementation of the blockchain technology in a company;
3) Technology factors:
   - transaction processing time,
   - block size,
   - scalability,
   - standardisation,
   - DLT system design,
   - cybercrime,
   - novelty,
   - development of standard elements of the joint infrastructure.

Several international organisations issued their recommendations on creating new institutions which are most often legal institutions.

OECD [2022] in the recommendations acknowledges that the national and international political, legal and regulatory framework should apply to the blockchain technology and its adequacy should be regularly revised. Dynamic growth of this technology and its applications generates demand for clear and consistent guidelines concerning innovations and the adoption of blockchain. The organisation calls on regulators and other ecosystem agents to:

1) implement mechanisms ensuring the assessment and compliance of the blockchain application with the relevant political, legal and regulatory requirements;
2) adopt an inclusive and versatile stance and ensure accountability in using blockchain and its applications, also in the event of their liquidation;
3) facilitate inter-operativeness between chains and also with other technologies;
4) ensure digital security and privacy protection;
5) promote education in blockchain technologies, develop competencies and prevent exclusion due to a lack of knowledge and skills in applying this technology;
6) encourage sustainable use of blockchain, at the same time identify and mitigate negative environmental consequences.

While targeting recommendations at the entities which create and implement regulations, OECD recommends:

1) a coordinated approach in creating regulations, particularly through:
   a) an integrated approach at all levels of administration,
   b) considering an application of the blockchain technology as a tool of administering and implementing public services;
2) supporting the environment conducive to innovation: cooperation with the public, private and academic sector and using the technology by SME, as well as in infrastructure and service provision;
3) building human potential by encouraging education and training for all blockchain stakeholders;
4) establishing a political environment conducive to innovation and developing mechanisms to research potential applications of this technology (ensuring compliance, risk management, supporting R&D, creating regulatory sandboxes and innovation laboratories);
5) international cooperation aimed at using the potential of blockchain technologies and minimising its risks, knowledge sharing and versatile work towards developing global technological and ethical standards of using blockchain technologies.

Among recommendations directed to political decision-makers, European Union Blockchain Observatory and Forum has designed eight rules that should be used to solve regulatory dilemmas (first at the EU level, then the national level):

1) developing a simple and functional definition of the blockchain technology;
2) as fast as possible announcement of the formulated legal interpretations;
3) choosing the right regulatory approach by regulators;
4) unification of the law and regulatory interpretations in relation to blockchain;
5) enabling regulation authors to understand specifics of this technology;
6) starting work from the application of the most vital solutions (with greatest impact);
7) monitoring less developed applications and encouraging their self-regulation;
8) engaging regulatory bodies in the newly emerging blockchain platforms in order to monitor and further regulate them.

Joint Research Centre of the European Commission in its recommendations for policy-makers in the public sector stated that administration should [Martin Bosch, Tangi, Burian, 2022]:

1) by experimental application of the blockchain technology raise the institutional awareness, as well as reveal its potential and advantages;
2) assume a project approach to the adoption of this technology, assess its utility, scalability, feasibility, conduct pilot schemes, estimate its risks and impact;
3) conduct experiments and use-cases in close cooperation with the private sector, at the EU level apply EBSI infrastructure;
4) promote inter-operativeness (avoid digital silos), which should facilitate cross-border collaboration;
5) identify and consider legal aspect in the early stages of experiments and implementation, also spot barriers to shifting from the concept stage to production.

Recommendations on establishing an institutional framework formulated to date involve a wide range of activities. All of them, however, at their very foundations, state that the blockchain technology calls for an active engagement of regulators, particularly to create an institutional environment conducive to its growth and ensure the security of users, financial markets and other markets, as well as to enable its application in the public sector.

Establishing national institutions

The transnational or union level in recommendations is aimed at harmonising, unifying, promoting good practice and creating conditions for collaboration and interoperativeness, rather than indicating specific solutions or models. Specific regulations (e.g. MiCA) are quite exceptional. Despite the global reach of technologies and ecosystems, the most adequate norms are created at the national and local level, as this ensures more relevance to particular economies' specifics. Each country should devel-

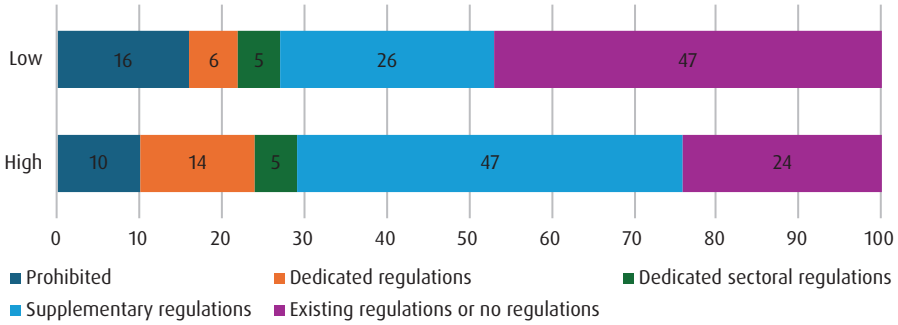
op its own strategies of building systems based on the blockchain technology in the public sector [Triana Casallas, Cueva Lovelle, Rodríguez Molan, 2020].

Researchers of the Cambridge Centre for Alternative Finance, in their report on the global cryptocurrency [Blandin et al., 2019, pp. 41–42] regulatory landscape, have singled out four types of regulatory response to the development of crypto-assets:

1) existing regulations: applying the existing legal or executive acts, issuing guidelines related to the existing regulations and explaining how they should be applied if necessary;
2) supplementary regulations: interfering in the existing regulations to the extent that makes it possible to achieve specific cryptocurrency goals in a lawful way;
3) dedicated regulations: tailor-made law regulating the cryptocurrency activity;
4) dedicated sector regulations: a separate regulatory framework encompassing a set of deeds, in which the crypto-asset activity constitutes just one of the aspects (e.g. fintech activity).

In principle, real-life regulations tend to include a mix of those types. Based on the study of 108 jurisdictions (Figure 6), scientists proved that in those countries where the crypto-asset activity was keener (a larger number of companies or a larger number of fundraisers in tokens), more often the existing regulations were complemented, and in the economies characterised by a lower activity in this respect, the existing regulations were maintained.

Figure 5. Regulatory response according to the level of cryptocurrency activity in selected jurisdictions (%)



Source: Self-reported data (translation) based on: Blandin i in. [2019, p. 42].

Bharosa et al. [2020, p. 7] identified two models of the public and private sector coexistence in terms of the institutional, technological and process perspective while implementing e-administration.

In the Estonian model there exists one, centrally managed data exchange infrastructure used jointly by the public and private entities. In this instance, it is the government that implements innovation for the entire society and is accountable for the risk involved. Innovation and service provision by government agencies is strongly highlighted. Experiments conducted by the government are stimulated in order to gain knowledge, social understanding and access to the technology. Due to its economy-wide scope, economies of scale play a vital role: government electronic identification, national registers and X-Road are applied in public and private services. Institutions are designed and tailored to match the e-administration ecosystem. There is also an open interaction between public organisations and the private sector.

In the Dutch model, the institutional structure creates a clear divide between the public and private infrastructure, which results in the establishment of several data exchange institutions. In this model of the public infrastructure, innovations cannot be used to exchange data between companies or citizens. They are, to a large extent, left to the market, with some innovation support tools being applied through outsourcing and grants (e.g. startups). The government is risk-averse and does not build knowledge or potential in the public sector. Different levels of government enjoy high autonomy. Economies of scale are moderately important (using Digipoort by four government agencies, but not by banks or to exchange data between companies).

Bharosa et al. [2020, p. 11] have identified the following factors of e-administration success:

- consistent national policies, based on the knowledge of user needs;
- integrated approach at various levels of administration and government agencies;
- support from the high-level political will;
- creating a collaboration framework ensuring smooth service provision to citizens and entrepreneurs;
- joint data exchange infrastructure ensuring inter-operativeness in the entire public sector;
- personnel's qualifications, knowledge and organisational talents.

Developing institutions at a national level requires the creation of a coherent strategy which accounts both for the international and union conditions as well as the specifics of a given country, i.e. its market situation, needs of citizens and entrepreneurs as users. The strategy should delineate a path of consistent regulatory response in the public sector, to the extent necessary for achieving goals and providing public services, in the conditions ensuring security and protection to individuals and building trust towards administration and its actions, at the same time holding it accountable for the process. The pace of technological growth dictates that action must be taken in stages, the experience of individual countries points out that the best results are rendered by

an active engagement of regulators and decision-makers, creating solutions in cooperation with the entities possessing the latest knowledge and experience in this technology and its implementation.

International institutions

Establishing an institutional framework requires to account for regional circumstances and specific situations of individual countries. International collaboration is also necessary, as blockchain, by its very nature, is a transnational technology [OECD, KDI, 2021]. Many actions in this respect have been taken by OECD. They include issuing recommendations and guidelines, publishing analyses encouraging the harmonisation of regulations in various countries, knowledge sharing and promoting good practice. Financial Action Task Force, FATF, operates at an inter-government level and focuses on establishing international standards geared towards preventing money laundering and financial terrorism. At the EU level, apart from the main decision-making institutions responsible for the EU administration which determine EU policies and have a role in the law-making process, a few initiatives have been taken targeted at developing institutional collaboration in the field of blockchain technologies:

1) European Blockchain Partnership, EBP;
2) European Blockchain Services Infrastructure, EBSI;
3) European Blockchain Sandbox;
4) Blockchain Observatory and Forum;
5) European Digital Innovation Hubs, EDIH;
6) Blockchain in Government (BLING);
7) TOKEN Project.

European Blockchain Partnership (EBP) is a joint initiative of the European Commission and 29 countries aimed at creating an EU strategy of the blockchain technology application and a related public service infrastructure, as well as establishing the European Blockchain Services Infrastructure (EBSI) and ensuring that it meets the needs of public services across the entire EU.

The purpose of the European Blockchain Services Infrastructure (EBSI) is the provision of universal EU, cross-border public services using the blockchain technology. EBSI is fully compliant with the EU law in terms of privacy, cyber-security, inter-operativeness and energy efficiency. It constitutes a network of dispersed nods with applications focused on particular use cases. Originally, in 2019 four sample variants of the technology application were selected (notarial authentication, diplomas, sovereign identity and data sharing), in order to characterise each of them, different prototypes were built. One of the first reasons for developing EBSI was the

coordination of various European initiatives contributing to the implementation of the European digital agenda – a uniform policy of data processing, management and communications made to avoid problems of coordination and collaboration between various countries.

European Blockchain Sandbox was launched to ensure secure and confidential environment in which blockchain market innovators may test their products and services, collaborating with relevant regulatory and supervisory bodies and identifying this way legal and regulatory hurdles. The outcome of this work is expected to be increased legal security of innovative technological solutions, including blockchain applications, as well as expanding knowledge on the newest solutions employing the blockchain technology by regulatory and supervisory bodies and an exchange of best practice by way of a dialogue. The sandbox stays open to entities from all sectors of the economy and public organisations in reference to the projects that go beyond the stage of conception verification and are close to a market implementation or find themselves at an early stage of exploitation.

Blockchain Observatory and Forum is an EU initiative aimed at accelerating innovation in blockchain technologies and developing the connected EU ecosystem, thus helping Europe gain the position of a world technological leader.

Other initiatives in Europe promote and accelerate the application of blockchain technologies in the public sector. One of them are the European Digital Innovation Hubs (EDIH), playing a crucial role in supporting public administration in motivating the adoption of blockchain technologies by encouraging experimentation [JRC, 2022].

Blockchain in Government (BLING) project is implemented as part of the Interreg North Sea Region Programme. It strives to accelerate and mitigate the risk of implementing services based on the blockchain technology in the public sector in the North Sea region. It engages public bodies, research institutions and SME to develop and implement public services based on the blockchain technology, focusing on identity, direct democracy and customer service.

Transformative Impact of Blockchain Technologies in Public Services (TOKEN) Project is a private initiative of a Polish company financed with EU funds (Horizon 2020 programme). It aims to create an experimental ecosystem which will enable to run pilot projects and launch public services based on the blockchain technology. It focuses on ensuring access to open-source tools based on DLT currently applied in four countries (Belgium, Greece, Spain and Poland).

Summary and recommendations

The above study of the use of blockchain technologies in the public sector allows to draw the following conclusions.

1) Usually the first applications of new technologies are developed in the private sector. Then they will be adopted by government (public) institutions to meet their needs. This happened before with formerly emerging technologies and general conceptions of a widely understood digitalisation, rise of the Internet and mobile technologies. We expect the same to be the case for the blockchain technology which, sooner or later, will most certainly be adopted on a larger or smaller scale, due to its unique and irreplaceable applications (process decentralisation, coordination, new class of assets). The areas in which it will be implemented are yet to be specified.
2) Blockchain carries a potential of a revolutionary transformation and reorganisation of many public processes, similar to digitalisation or the arrival of the Internet – through decentralisation and creating a democratic directness in coordination, supervision and public process performance. As a useful technology it may also provide specific functions, boosting public service provision efficiency and cybersecurity of the administration foundations and delivering more utility to citizens (access to tokenised money, decentralised markets, automation and process transparency). Employing solutions based on blockchain technologies may be valuable with implementations both at the global and regional level.
3) Over 70 countries have some experience of using the blockchain technology in the public sector: ready-made strategies, policies, work teams, launched regulatory or technological sandboxes and activities taken to implement this technology in different processes. We have identified 55 processes in which at least one country has taken such type of action. Simultaneously, most economies are working on using blockchain technologies in at least several processes (the United States – 12, the Netherlands – 9, Estonia and Romania – 8 each).
4) Blockchain may, but does not have to, bring about the expected benefits. In reality, its application may be effective in some specific circumstances which are likely to occur in the public sector.
5) No country has implemented already or is considering implementing revolutionary changes in many aspects of social and public life by basing them on decentralised chains of blocks, e.g. in the form of decentralised voting (elections), completely conducted using the blockchain technology, or a decentralised privatisation.
6) Countries rarely prepare joint blockchain platforms: a nation-wide blockchain, a blockchain for the purpose of public services or other inter-agency or inter-sector

solutions allowing to create a framework structure for the exchange and notarisation of data or authentication of users (citizens).

7) Lack of compatibility between solutions based on blockchain and the existing legal and organisational framework constitutes a significant barrier in unleashing the transformational potential of this tool.
8) Blockchain may, but does not have to, be visible to users, technical users should be able to verify and perform the functions offered by this technology, but a regular user should focus on the basic service functionality.

Recommendations

Deliberation of the problems involved leads us also to the formulation of some recommendations for decision-makers responsible for public policies, achieving public goals and providing public services, which can help them better prepare for the adoption of the blockchain technology.

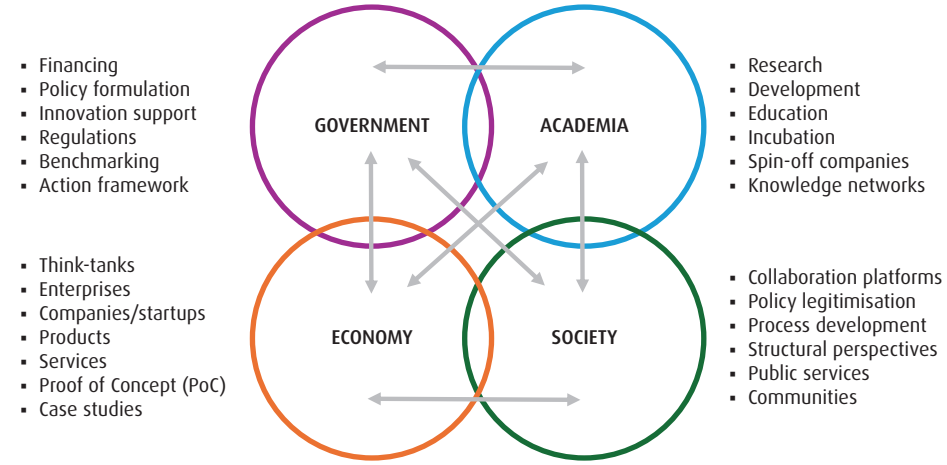
1) If public authorities are looking for an opportunity to:
   a) increase efficiency, reduce red tape and more effectively provide public services;
   b) boost the engagement of citizens in the national community;
   c) raise the cybersecurity of public institutions;
   d) increase the transparency of public processes;
   e) improve the stability of the financial system (reduce the impact of such phenomena as money laundering, corruption or tax fraud);
   f) reduce the scale of product fraud in socially significant industries (food, medicines, etc.);
   g) increase tax collection efficiency;
   h) mitigate the risk of attacks on public data centres being single points of failure;
   i) strengthen social trust towards public institutions by reducing corruption;
   j) catch up with the implemented global changes, and potentially become an innovative change leader (as a country);
   k) shift responsibility for meeting common social needs onto the private entities, at the same time retaining some control and limiting negative consequences of privatisation;
   l) support the development of blockchain technologies in the private sector

– **they should take action aimed at tapping into the potential of the blockchain technology in the public sector.**

2) Implementing the blockchain technology should be treated as a complex project which must involve: the assessment of utility, scalability, feasibility together with pilot schemes, a clear plan of implementation, as well as a risk and impact anal-

ysis. In the case of the public sector, it requires first of all to determine strategic assumptions and general goals for employing blockchain technologies, which may be a part of the bigger digital strategy and should comply with the internationally approved institutional framework. Processes designed for the public sector should be clearly separated from private sector regulations. Blockchain in the public sector should facilitate the operation of public institutions and create institutional conditions conducive to implementations in the private sector. Its assumptions should be based on the needs and recommendations voiced by entrepreneurs and citizens, like in Belgium, where a dedicated platform is used for that purpose [European Union, 2023].

Figure 6. Quadruple helix innovation ecosystem



Source: Carayannis, Campbell [2012, 2009]; Lindberg, Lindgren, Packendorff [2014]; Naqvi [2023].

3) Formulating assumptions and implementing subsequent actions will bear the best results when the needs and abilities of all stakeholders are taken into account, which will be enabled by applying the quadruple helix innovation ecosystem (Figure 6), based on the collaboration of four stakeholder groups:
   a) public entities and institutions from different sectors, regulators, central and local government authorities and politicians who represent the universal public interest, take care of compliance with regulations, the national law and the international implementation framework; a key role is played by top level decision-makers, as without an integrated political will of all echelons of power a common set of assumptions is impossible to be established;

b) business sector representatives – implementers, analytical and rating agencies, investors, digital service operators, banks with their relevant experience of implementing technologies and ownership of resources enabling not only implementation but also consultation;
c) science, research and education representatives able to make objective judgements of implementations, perform in-depth analyses of solutions, draw conclusions from the existing literature of the subject and create new knowledge as well as educate;
d) community representatives – customers and citizens in one, who are the main recipients of public services, aware of their own needs and capabilities.

By engaging in collaboration, almost all challenges involved in the implementation of blockchain technologies can be successfully dealt with, incorporating both some theoretical ideas as well as business and public experience of actual user needs.

4) Another vital group while preparing for the creation of institutions may be the moderators, process animators, who can mediate in communication and harmonise work between the previously named groups possessing different levels of knowledge, using different professional languages (terminology), and having different needs, goals and capabilities. Animators can be the selected representatives of the private and public sectors or representatives of any of the four groups.
5) Having performed a debate and a relevant study, the following questions should be addressed:
   a) What are the needs and problems of the society and the economy? Which of them are the most crucial and urgent to satisfy (solve)? The question should be particularly considered in reference to the areas in which blockchain may constitute significant added value, such as: cybersecurity, transparency, social inclusion, financial system stability (money laundering, corruption, taxes) or public process efficiency.
   b) Which problems can be effectively resolved using the blockchain technology [Setiawan Wibowo and Yazid, 2023]?
   c) Which public processes should stay centralised (in terms of supervision), and which can be decentralised (marketised)?
   d) In which public processes can it be beneficial to apply the blockchain technology?
   e) Which available know-how and resources can be employed to solve problems?
   f) How to overcome or bypass barriers stifling adoption and solve the existing implementation problems?
   g) Should we focus on the local (national) solutions or on an international (regional) perspective?

h) Should we allow and support grassroot initiatives (e.g. regulatory sandboxes) to later incorporate them in the public sector and tailor regulations to them so that they can operate smoothly, or should implementations be coordinated top-down and centrally supervised?
i) What are the necessary legal modifications resulting from this process?

6) When working on specific blockchain projects in the public sector the principle of "compliance by design" should be adopted. Absence of particular regulations allowing for the implementation of a given technology before the concept is developed must either lead to making changes in the law, or scrapping the project.
7) In the process of this decision-making, education of all stakeholders is key, in particular of the decision-makers, regulators, law-makers and executive bodies as well as of researchers in the field of blockchain technology utility, technical, legal, tax and economic aspects; the communities of target customers will not always be interested in a detailed description of the implemented solutions and may care more about their utility, companies, on the other hand, have their own ways of acquiring and generating knowledge. They should not, however, be skipped in the practical education, so that they know what changes they should expect, following the technology implementation.
8) Only after strategic assumptions have been established, some of the other tasks indicated by the EU should be performed: creating guidelines and knowledge sharing, developing roadmaps and pilot schemes, defining standards, building final technical components according to core assumptions, combining components in a tailored infrastructure, monitoring.

Adoption of the blockchain technology is the process which requires a wide range of actions and should be preceded by thorough analyses allowing to clearly address vital questions and then develop strategies with adequate roadmaps, formulate a conception, build prototypes and test them, carry out pilot implementations and finally effect the ultimate production implementation. Still, more importantly, the process needs to begin now.

APPENDIX

Table 1. Summary of self-reported country activity in implementing blockchain technology in the public sector

Types of public/economic processes (services)		Poland	European Union	Albania	Austria	Belgium	Bulgaria	Croatia	Cyprus	Denmark	Estonia	Finland	France	Gibraltar	Georgia	Spain	Netherlands	Ireland	Lithuania	Liechtenstein	Luxembourg	Latvia	Malta	Germany	Norway	Portugal	Russia	Romania	Slovakia	Slovenia	Switzerland	Sweden	Ukraine	Hungary	United Kingdom	Italy
A	Strategies (*)	›	›	›			›		›		›	›	›				›	›			›		›	›	›											
B	Regulatory Sandboxes (**)	›	›		›	›				›							›		›				›		›						›					
1	Cross-sector solutions				›			›												›							›	›								
1.1	National blockchain network (cloud)				+			+												+							+	+								
1.2	Smart city platform				+	+																														
2	Inter-institutional (digitisation of administration)				›						›			›														›								
2.1	Document and information circulation systems										?																									
2.2	Timestamping documents																																			
2.3	Integrity of public data and services				+						+			+																						
3	Digital identity / SSI				›	›											›																			
3.1	Digital identity documents				+												+																			
3.2	Digital citizenship																																			
4	Voting systems				›						›														›											
4.1	Central and local elections										+														+											
4.2	Public voting, referendums				+																					+										
4.3	Voting systems in public institutions/ agencies																							+												
5	Public relations					›					›				›																					
5.1	Access to public services										+																									

Types of public/economic processes (services)		Poland	European Union	Albania	Austria	Belgium	Bulgaria	Croatia	Cyprus	Denmark	Estonia	Finland	France	Gibraltar	Georgia	Spain	Netherlands	Ireland	Lithuania	Liechtenstein	Luxembourg	Latvia	Malta	Germany	Norway	Portugal	Russia	Romania	Slovakia	Slovenia	Switzerland	Sweden	Ukraine	Hungary	United Kingdom	Italy
Sale of public goods (auctions)	5.2																																+			
Public procurement	5.3					+									+																						
Certification (certificates)	6		›			›				›													›											›		
Device certification	6.1																																			+	
Support for obtaining a driver's license	6.2																																	+		
Certification of professional competencies, university diplomas	6.3		+			+				+													+													
Public registers	7									›	›				›		›						›				›	›			›					›
Register of digital assets	7.1																											+								
Unemployment register	7.2																															+				
Invoice register and tracking system	7.3																																			
Land and property register	7.4										+				+											+						+				
Claims register	7.5																																			
Register of enterprises and business activities	7.6										+						+															+				
Vehicle register (vehicle passport)	7.7									+							+																			
Public archives	7.8																																			
Healthcare system	8				›						›						›																			
Health registers / medical data	8.1										+					+																				
Partner network of healthcare service providers	8.2				+																															
Tracking medication deliveries	8.3																																			

cont. Table 1

Types of public/economic processes (services)		Poland	European Union	Albania	Austria	Belgium	Bulgaria	Croatia	Cyprus	Denmark	Estonia	Finland	France	Gibraltar	Georgia	Spain	Netherlands	Ireland	Lithuania	Liechtenstein	Luxembourg	Latvia	Malta	Germany	Norway	Portugal	Russia	Romania	Slovakia	Slovenia	Switzerland	Sweden	Ukraine	Hungary	United Kingdom	Italy
8.4	Tracking epidemics																																		
8.5	Contract management																																		
9	Public finances	›			›					›																					›				
9.1	Tax collection				+					+																									
9.2	Acceptance of tax payments in cryptocurrencies																																		
9.3	Tracking the life cycle of financial instruments	+																																	
9.4	Government bonds or other public																														+				
10	Payment system and digital currency		›										›				›				›						›				›	›			
10.1	Digital Currency		+										+														+							+	
10.2	Payments for Public Services																														+				
10.3	Real-Time Gross Settlement Systems (RTGS)																																	+	
10.4	Distribution of Transfer Payments and Public Assistance																+				+													+	
11	Markets																											›				›			
11.1	Private Securities Markets (Registers, Exchanges)																																		
11.2	Energy Markets (Green Certificates)																																+		
11.3	Digital Asset Markets (Exchanges)																											+							
11.4	Food Markets																																		
11.5	Fraud Prevention in the Market																																		+

Types of public/economic processes (services)		Poland	European Union	Albania	Austria	Belgium	Bulgaria	Croatia	Cyprus	Denmark	Estonia	Finland	France	Gibraltar	Georgia	Spain	Netherlands	Ireland	Lithuania	Liechtenstein	Luxembourg	Latvia	Malta	Germany	Norway	Portugal	Russia	Romania	Slovakia	Slovenia	Switzerland	Sweden	Ukraine	Hungary	United Kingdom	Italy
12	Justice System										›						›																		
12.1	Registration of Sentences Served																+																		
12.2	Data Exchange Between Institutions During Proceedings																+																		
12.3	Court Document Registry										+																								
13	Security and Defense Systems										›																								
13.1	Protection of Smart Devices										+																								
14	Public Process Management					›											›																		
14.1	Coordination of Project Processes																																		
14.2	Support for Legal Aid Processes																+																		
14.3	Coordination of Credit Information																+																		
14.4	Public Information Management					+																													
14.5	Crisis Management																																		
15	Other																											›							
15.1	Public Metaverse or Public Use																																		
15.2	NFT Platform																																	+	
15.3	Learning Support Systems																											+							
15.4	Smart Contracts																																		

cont. Table 1

Types of Public/Economic Processes (Services)		Strategies (*)	Regulatory Sandboxes (**)	Cross-Sector Solutions	National Blockchain Network (Cloud)	Smart City Platform	Inter-Institutional (Digitization of Administration)	Document and Information Circulation Systems	Timestamping Documents	Integrity of Public Data and Services	Digital Identity / SSI	Digital Identity Documents	Digital Citizenship	Voting Systems	Central and Local Elections	Public Voting, Referendums	Voting Systems in Public Institutions/Agencies
	A	Strategies (*)	**B**	Regulatory Sandboxes (**)	1	Cross-Sector Solutions	1.1	National Blockchain Network (Cloud)	1.2	Smart City Platform	2	Inter-Institutional (Digitization of Administration)	2.1	Document and Information Circulation Systems	2.2	Timestamping Documents	2.3	Integrity of Public Data and Services	3	Digital Identity / SSI	3.1	Digital Identity Documents	3.2	Digital Citizenship	4	Voting Systems	4.1	Central and Local Elections	4.2	Public Voting, Referendums	4.3	Voting Systems in Public Institutions/Agencies
Abu Dhabi			✓																										
Saudi Arabia																													
Argentina			✓				✓		+																				
Australia		✓	✓								✓	+		✓	+														+
Bahrain			✓																										
Barbados																													
Bhutan											✓	+																	
Brunei			✓																										
Bangladesh		✓																											
Brazil																													
Chile		✓																							✓				
China		✓	✓																										
Philippines			✓																										
Israel																													
India		✓	✓																										
Indonesia			✓																										
Jamaica																													
Japan			✓																										
Jordan																													
Ghana																													
Honduras																													
Caribbean																													
Canada			✓																										
Hong Kong			✓																										
Qatar		✓																											
Kazakhstan																													
Kenya																													
South Korea			✓																						✓	+			+
Colombia		✓																											
Malaysia			✓																										
Mexico																													
Nepal																													
Nigeria		✓																											
New Zealand																													
South Africa			✓																										
Senegal																													
Sierra Leone			✓																						✓	+			
Singapore			✓																										
United States		✓					✓	+							✓		+		+										
Thailand			✓																										
Taiwan			✓																										
Tunisia																													
Bahamas																													
United Arab Emirates		✓	✓																										

Types of Public/Economic Processes (Services)		Abu Dhabi	Saudi Arabia	Argentina	Australia	Bahrain	Barbados	Bhutan	Brunei	Bangladesh	Brazil	Chile	China	Philippines	Israel	India	Indonesia	Jamaica	Japan	Jordan	Ghana	Honduras	Hong Kong	Canada	Caribbean	Qatar	Kazakhstan	Kenya	South Korea	Colombia	Malaysia	Mexico	Nepal	Nigeria	New Zealand	South Africa	Senegal	Sierra Leone	Singapore	United States	Thailand	Tunisia	Taiwan	Bahamas	United Arab Emirates
5	Public Relations			↘								↘				↘				↘	↘	↘		↘																	↘					↘
5.1	Access to Public Services		+																																											
5.2	Sale of Public Goods (Auctions)																											+													+					
5.3	Public Procurement											+																		+																
6	Certification (certificates)				↘																							↘												↘					↘
6.1	Device Certification																																													
6.2	Support for Obtaining a Driver's License																																													
6.3	Certification of Professional Competencies, University Diplomas				+																							+													+					
7	Public Registers											↘	↘			↘				↘	↘	↘		↘																	↘					↘
7.1	Register of Digital Assets																																													
7.2	Unemployment Register																																													
7.3	Invoice Register and Tracking System												+																																	
7.4	Land and Property Register															+					+	+		+																					
7.5	Claims Register																							+																					
7.6	Register of Enterprises and Business Activities																							+																					
7.7	Vehicle Register (Vehicle Passport)																																													
7.8	Public Archives																																													

cont. Table 1

Types of Public/Economic Processes (Services)																
	8	Healthcare System														
	8.1	Health Registers / Medical Data														
	8.2	Partner Network of Healthcare Providers														
	8.3	Tracking of Medicine Deliveries														
	8.4	Tracking of Epidemics														
	8.5	Contract Management														
	9	Public Finances														
	9.1	Tax Collection														
	9.2	Acceptance of Tax Payments in Cryptocurrencies														
	9.3	Tracking the Life Cycle of Financial Instruments														
	9.4	Government Bonds or Other Public														
	10	Payment System and Digital Currency														
	10.1	Digital Currency														
	10.2	Payments for Public Services														
	10.3	Real-Time Gross Settlement Systems (RTGS)														
Abu Dhabi																
Saudi Arabia													↘	+		
Argentina																
Australia							↘					+				
Bahrain																
Barbados													↘	+		
Bhutan																
Brunei																
Bangladesh																
Brazil													↘	+		
Chile																
China							↘	+					↘	+		
Philippines													↘	+		
Israel							↘					+	↘	+		
India	↘			+									↘	+		
Indonesia													↘	+		
Jamaica													↘	+		
Japan													↘	+		
Jordan																
Ghana																
Honduras																
Hong Kong													↘	+		
Canada													↘	+		
Caribbean													↘	+		
Qatar																
Kazakhstan							↘					+				
Kenya																
South Korea													↘	+		
Colombia																
Malaysia																
Mexico																
Nepal													↘	+		
Nigeria													↘	+		
New Zealand																
South Africa													↘	+		
Senegal													↘	+		
Sierra Leone																
Singapore													↘	+		
United States	↘	+			+	+	↘		+				↘	+		
Thailand													↘	+		
Taiwan																
Tunisia																
Bahamas													↘	+		
United Arab Emirates	↘	+					↘	+					↘	+		

Types of Public/Economic Processes (Services)	10.4 Distribution of Transfer Payments and Public Assistance	11 Markets	11.1 Private Securities Markets (Registries, Exchanges)	11.2 Energy Markets (Green Certificates)	11.3 Digital Asset Markets (Exchanges)	11.4 Food Markets	11.5 Fraud Prevention in the Market	12 Justice System	12.1 Recording of Sentences Served	12.2 Data Exchange Between Institutions During the Process	12.3 Court Document Registry	13 Security and Defense Systems	13.1 Securing Smart Devices
Abu Dhabi													
Saudi Arabia													
Argentina													
Australia		›	+										
Bahrain													
Barbados													
Bhutan													
Brunei													
Bangladesh													
Brazil													
Chile													
China													
Philippines													
Israel													
India													
Indonesia													
Jamaica													
Japan													
Jordan													
Ghana													
Honduras													
Hong Kong													
Canada													
Caribbean													
Qatar		›				+							
Kazakhstan													
Kenya													
South Korea													
Colombia													
Malaysia													
Mexico													
Nepal													
Nigeria													
New Zealand													
South Africa													
Senegal													
Sierra Leone													
Singapore		›	+										
United States		›	+										
Thailand													
Taiwan													
Tunisia													
Bahamas													
United Arab Emirates													

cont. Table 1

	Types of Public/Economic Processes (Services)	Abu Dhabi	Saudi Arabia	Argentina	Australia	Bahrain	Barbados	Bhutan	Brunei	Bangladesh	Brazil	Chile	China	Philippines	Israel	India	Indonesia	Jamaica	Japan	Jordan	Ghana	Honduras	Hong Kong	Canada	Caribbean	Qatar	Kazakhstan	Kenya	South Korea	Colombia	Malaysia	Mexico	Nepal	Nigeria	New Zealand	South Africa	Senegal	Sierra Leone	Singapore	United States	Thailand	Taiwan	Tunisia	Bahamas	United Arab Emirates
14	Management of Public Processes																													✔															
14.1	Coordination of Project Processes																																												
14.2	Support for Legal Aid Process																																											
14.3	Coordination of Credit Information																																											
14.4	Management of Public Information																																												
14.5	Crisis Management																													+															
15	Other		✔		✔								✔						✔										✔																✔
15.1	Public Metaverse or Public Use		+										+						+										+																+
15.2	NFT Platform																																												
15.3	Learning Support Systems																																												
15.4	Smart Contracts				+																																								

* Strategies, policies, guidelines, roadmaps, working groups (involving public entities, administration) collaborating on *blockchain* technology in the public sector, *e-government*.
** Regulatory sandbox encompassing *blockchain*.

Source: Self-reported data based on:Antadze [2017]; Baker McKenzie [2020;] Barber [2016]; Bharosa, Lips, Draheim [2020]; Bottoni [2018]; Bundesrechenzentrum [2024]; Cocks [2017]; Coinfirm [2021]; Das [2017]; Department of Industry Science and Resources Australian Government [2024]; EBRD [2021]; European Commission [2019, 2023]; European Investment Bank [2021]; Fan, Wang, Wang [2024]; Fortis [2024]; George, Al-Ansari [2024]; Goo, Heo [2020]; Hall [2024, 2022]; Holotescu [2022]; Kevey [2022]; Kristiansen, Madsen [2023]; Kshetri [2021]; Lichtenthaler [2018]; Magyar Nemzeti Bank [2022]; McGovern [2021]; OECD [2019, 2018, 2018]; Pilkington, Kumaraku, Bushi, Haveri [2022]; PwC [2019b]; Republic of Slovenia Government [2019]; Righetti [2023]; Setiawan Wibowo, Yazid [2023]; Tinianow, Long [2017]; Tiwari [2019]; Triana Casallas, Cueva Lovelle, Rodríguez Molan [2020]; Variyar, Bansal, Dalmia [2017]; Vladucu, Dong, Medina, Rojas-Cessa [2023]; Wood [2019]; Young [2016].

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OVERCOMING INVESTMENT BARRIERS BY COMPANIES IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract

The aim of the study presented in this chapter was to identify investment barriers for businesses operating in the Central and Eastern European countries as well as to provide recommendations for overcoming these barriers. This objective was achieved through a multi-stage research procedure, which included both a quantitative analysis of the results of the European Investment Bank's 2023 Investment Survey regarding investment barriers in the surveyed countries and the confrontation of these quantitative findings with the opinions of experts participating in in-depth interviews.

Cluster analysis of businesses revealed the existence of two extreme clusters in each country – one reporting low barriers in all areas and the other reporting high barriers in all areas, as well as an intermediate cluster with varied barriers across different areas. However, the hierarchy of investment barriers was similar in all countries and business clusters. The most frequently reported obstacles to investment were uncertainty about the future, lack of skilled workers and high energy costs. Less significant barriers included business and tax regulations, and the least problematic referred to the access to digital and transport infrastructures.

The study also indicated a significant variation between the Central and Eastern European countries in the level of reported barriers by businesses in different economies. The lowest investment barriers were noted in Hungary, Lithuania, Czechia and Estonia, while Latvia, Poland, Romania and Slovakia faced the highest barriers. Bulgaria, Slovenia and Croatia occupied an intermediate position, with moderate levels of these barriers. The study also presents recommendations for overcoming the identified investment barriers, applicable at the business as well as economic policy level.

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After two decades of membership in the European Union, the countries of Central and Eastern Europe (CEE)[1] have still not reached the average level of GDP per capita in EU. Some of them significantly increased their GDP during this period, but others remained more stagnant, which raised concerns about entering the middle-income trap. One of the key sources of economic development is investments of enterprises building physical capital, which, along with other factors of production (e.g. human capital, technology), is the source of national income growth. Understanding specific investment barriers faced by the CEE companies and developing appropriate strategies to strengthen these investments is a key step towards increasing economic prosperity and competitiveness.

In the previous edition of the *Report of the Warsaw School of Economics and the Economic Forum* [Radło, Napiórkowski, Szarek-Piaskowska, 2023], as part of the review of the current state of research [Dobrowolski, 2021; EIB, Ipsos, 2023; EIB, 2023; Hagemejer, Poniatowski, Pechcińska, Turgut, Śmietanka, 2021; Kawalec, Błażuk, 2021; Łagowski, 2022; Łaszek, Trzeciakowski, Zieliński, 2021; PAIH, 2022] and the results of individual in-depth interviews, we pointed to a variety of investment barriers in the CEE countries, including those related to the consequences of external shocks, the demographic structure of enterprises, the stability of the regulatory environment, the availability of human resources and human capital, the condition of infrastructure, or the energy prices and energy mix. However, the study was limited by the lack of focus on the differences between the CEE countries in terms of barriers related to the investment activity of enterprises, including the lack of comprehensive and representative data on this subject.

Therefore, in this year's edition of the *Report*, we want to fill this gap by providing empirical data and analyses focused on specific investment barriers faced by enterprises in different CEE countries. Thus, the aim of the study, the results of which are presented in this article, was to identify investment barriers in the CEE enterprises and to present recommended policies and strategies to overcome these barriers.

This goal was achieved in a multi-stage procedure, which included analysis of the results of the European Investment Bank (EIBIS – EIB Investment Survey), including cluster analysis, statistical analysis and in-depth interviews with a group of international experts, concerning the assessment of identified investment barriers and ways to overcome them. The final step was to synthesise the results and develop them. The structure of this study is similar. In Chapter 1, we present barriers related to the financing of enterprises in the countries covered by the European Investment Bank's

[1] This is a generalisation as Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia joined EU in 2004, Bulgaria and Romania in 2007, and Croatia in 2013.

investment survey. Next, we show what the barriers identified in this area look like in each CEE country. Then, focusing on the key areas of the issue discussed, we present recommended actions which can help overcome these barriers.

Barriers to corporate finance

The latest European Investment Bank (EIB) survey[2] on business investment was carried out with 12 832 entities from the EU-27 and the US, including 4 902 companies from eleven CEE countries. The results of this survey for the entire population of companies covered by the survey are presented in Figure 1. Their analysis indicates that the most frequently mentioned investment barriers by companies included uncertainty about the future (80.8% of responses), availability of employees with appropriate skills (80%) as well as energy costs (78.6%). The barriers least frequently indicated by entrepreneurs were: access to digital infrastructure (35.5%) and availability of appropriate transport infrastructure (41.5%). Among the most frequently mentioned and least frequently mentioned barriers were those related to business and tax regulations (60.7%), labour market regulations (56.2%), restrictions on demand for products or services (49.3%) or access to financing (47.1%). It is worth noting here that energy costs in the hierarchy of investment barriers only reached such a high position in 2022, in previous editions of EIBIS they were indicated by a much smaller percentage of respondents. In 2021, it was 60.9%, and in 2020 it was 54.9% [Radło et al., 2024].

The analysis of clusters (performed using the k-means method) with the participation of enterprises based on the EIBIS data shows an interesting phenomenon consisting in the occurrence of extreme differences in the perception of investment barriers. Due to this method, we identified three clusters of enterprises with different perceptions of barriers encountered during the implementation of investments: a cluster of low barriers, a cluster of high barriers and an intermediate barrier cluster.

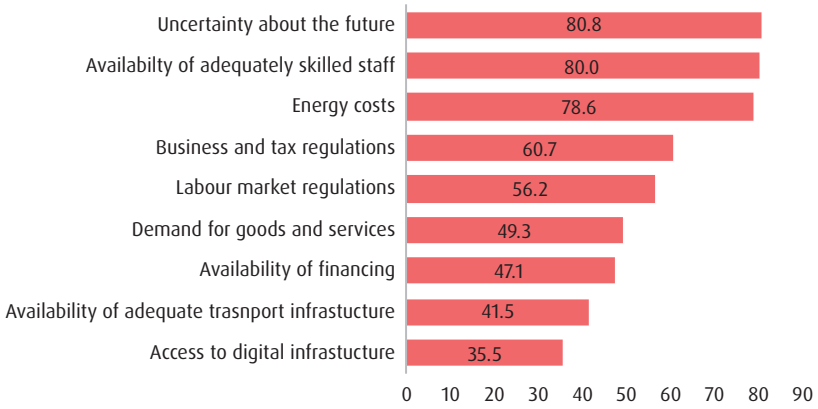
The analysis of the data presented in Table 1 indicates that clusters experiencing low and high barriers to investment are relatively homogeneous. Their similarity in the index of the values of various barriers indicates a stable perception of investment difficulties. The intermediate cluster, on the other hand, is clearly more heterogeneous, which means that some of the companies classified in it struggle with high barriers in some areas and low barriers in others.

What is common to all clusters is a similar hierarchy of barriers, with issues such as uncertain futures, the availability of workers with the right skills and energy costs

[2] The survey was conducted between April and July 2023. Since 2016, this survey has been conducted every year, and interviews are conducted at similar times (always by phone).

at the forefront. In contrast, the lowest barriers are in digital and transport infrastructure accessibility, as confirmed by the data shown in Figure 1.

Figure 1. Percentage of enterprises indicating the existence of barriers to investment in different areas (%)*



* *N* = 12 832 companies from the EU-27 countries and the US.

Source: Self-reported data based on data EIBIS 2023 [Radło et al., 2024].

Table 1. Company clusters by perception of investment barriers – cluster analysis results for all the EIBIS sample*

Cluster of companies / Type of barriers indicated by EIBIS respondents	Low barrier cluster	Intermediate cluster – diversified	High barrier cluster
Access to digital infrastructure	0.13	0.28	1.00
Availability of appropriate transport infrastructure	0.24	0.34	1.22
Availability of financing	0.30	0.46	1.35
Demand for goods or services	0.31	0.53	1.35
Labour market regulations	0.24	0.71	1.50
Business and tax regulations	0.34	0.76	1.56
Uncertainty about the future	0.66	1.34	1.70
Availability of staff with adequate skills	0.71	1.56	1.66
Energy costs	0.53	1.55	1.64
Average value	0.39	0.84	1.44
Standard deviation	0.19	0.48	0.22

* *N* = 12,832 companies from the 27 EU countries and the US. The values presented in the table show the average value of the index of investment barriers experienced by enterprises, where "0" means no barriers, and "2" means a high level of barriers.

Source: Self-reported data based on data EIBIS 2023 [Radło et al., 2024].

In summary, the extreme differences in perception of investment barriers point to the diverse needs and challenges faced by businesses. And this highlights the importance of more precise strategies to support businesses in different sectors and contexts.

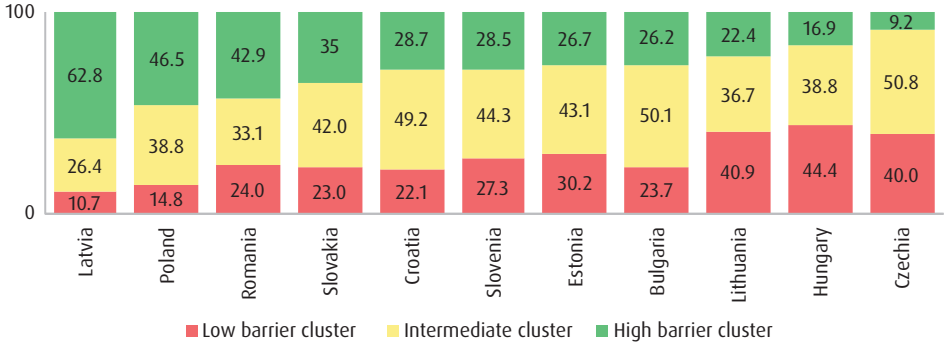
Map of challenges related to the financing of enterprises in CEE

The results for the entire population of companies show limited application in the context of the specificities of CEE countries. For this reason, it is worth looking at more detailed data for economies in this region. Information on this subject is provided by the analysis in Figure 2, which presents the structure of enterprises from the CEE countries in relation to the three previously identified clusters – high and low investment barriers and intermediate (diversified) cluster.

The country with a clearly dominant cluster of high barriers is Latvia (62.8%), which indicates the existence of significant investment challenges in this country. However, a high share of enterprises included in this cluster is also characteristic of Poland (46.5%) and Romania (42.9%). This means that companies operating in these countries experience significant barriers related to financing their investments.

The countries with a dominant share of the intermediate cluster are: Slovakia (42.0%), Croatia (49.2%), Slovenia (44.3%), Estonia (43.1%), Bulgaria (50.1%) and Czechia (50.8%). It suggests that companies operating there face greater investment obstacles in some areas and less serious ones in others.

Figure 2. CEE enterprises in investment barrier clusters (%)*



* *N* = 4902 companies from eleven CEE countries (Lithuania, Latvia, Estonia, Polish, Czechia, Hungary, Slovakia, Slovenia, Croatia, Romania and Bulgaria). The values do not always add up to 100% due to rounding.

Source: Self-reported data based on data EIBIS 2023 [Radło et al., 2024].

On the other hand, the countries with the dominant low barrier cluster are Lithuania (40.9%) and Hungary (44.4%). This suggests that the companies operating there experience the lowest investment obstacles compared to the CEE economies analysed. It may indicate a more favourable environment for investment development, easier access to financing, better infrastructure and fewer restrictive regulations. Similar results are also recorded in Estonia and Czechia, which are characterised by the highest percentage of enterprises in the intermediate cluster, but can also boast a high share of enterprises in the low barriers cluster (amounting to 30.2% and 40%, respectively).

Table 2. Percentage of indications that a certain type of investment barrier is relevant to companies in the country*

Country / Type of investment barriers in companies	Hungary	Lithuania	Czechia	Estonia	Bulgaria	Slovenia	Croatia	Slovakia	Romania	Poland	Latvia	Average	Standard deviation	Variability**
Access to digital infrastructure	19.2	21.9	20.4	21.7	25.8	32.0	35.1	31.5	34.2	48.8	48.9	30.9	10.1	0.33
Availability of appropriate transport infrastructure	21.7	26.9	20.6	22.7	53.8	43.8	38.0	44.8	60.8	44.4	53.6	39.2	13.6	0.35
Demand for goods or services	44.6	43.4	33.5	56.4	37.0	44.3	39.6	57.5	56.9	63.3	69.6	49.6	11.1	0.22
Availability of financing	37.9	45.9	39.2	45.9	39.9	45.3	49.8	57.0	61.9	65.8	65.8	50.4	10.0	0.20
Labour market regulations	33.5	44.6	49.4	52.4	53.4	59.5	63.5	64.8	68.8	62.9	67.8	56.4	10.4	0.18
Business and tax regulations	37.3	54.4	59.6	51.4	57.2	53.8	70.1	65.5	66.7	70.4	67.6	59.5	9.6	0.16
Availability of staff with adequate skills	59.4	69.8	74.8	83.8	88.1	84.0	89.2	81.0	75.6	80.4	87.0	79.4	8.5	0.11
Uncertainty about the future	71.3	73.1	90.0	70.6	73.4	80.8	83.5	83.5	81.5	87.3	85.8	80.1	6.5	0.08
Energy costs	82.5	77.1	80.4	80.3	83.4	80.5	82.9	82.3	86.9	91.7	86.8	83.2	3.8	0.05
Average value	45.3	50.8	52.0	53.9	56.9	58.2	61.3	63.1	65.9	68.3	70.3			
Standard deviation	20.4	18.5	24.3	21.0	20.1	18.1	20.1	16.7	14.6	15.2	13.2			
Variability**	0.45	0.36	0.47	0.39	0.35	0.31	0.33	0.26	0.22	0.22	0.19			

* Respondents could indicate answers such as "refused", "don't know", "a major obstacle", "a minor obstacle" and "not an obstacle at all". The table shows the percentage of responses "a major obstacle" and "a minor obstacle". ** Variability (coefficient of variation) was estimated by dividing the standard deviation value by the mean value.

Source: Self-reported data based on data EIBIS 2023.

Additional relevant information on the specificities of investment barriers faced by firms in the CEE countries is presented in Table 2, which provides data on the percentage of indications that a particular type of barriers is relevant for firms operating in a given country. This table has been optimised to facilitate analysis by sorting countries in the ascending order from those with the lowest average barriers (on the left side of the table) to those with the highest average barriers (on the right side of the table). Similarly, in the ascending order, the individual types of barriers are ordered – from the least frequently indicated (at the top of the table) to the most frequently indicated (at the bottom of the table). In addition, for all countries and barrier types, the mean value and standard deviation, as well as the coefficient of variation, were estimated.

First of all, it is worth noting that despite differences in the assessment of individual barriers in different CEE countries, their hierarchy is similar everywhere. It is also close to the hierarchy established for the entire population of companies covered by EIBIS. The most frequently indicated barriers to investment include: uncertainty about the future, energy costs and the availability of staff with adequate skills. Labour market regulations, business and tax regulations are also mentioned relatively often in this region. On the other hand, two areas are least likely to become investment barriers: access to digital infrastructure and the availability of appropriate transport infrastructure. There are only slight differences in the hierarchy of barriers between the CEE countries, indicating local problems in different areas. For example, in Romania, Bulgaria and Latvia, access to adequate transport infrastructure is still a high barrier compared to other countries in the region.

The analysis of the hierarchy of investment barriers in the CEE countries shows some analogy with the results of an earlier survey covering the entire corporate population as part of the EIBIS survey. What is particularly worth emphasising, however, is the significant difference in the general perception of the level of barriers related to the development of investments in the CEE countries. At the same time, it confirms the conclusions based on the data presented in Figure 2 and further highlights the specific types of barriers that exist in each country. It is an important aspect that indicates the need to take into account the regional context when formulating strategies to support business investment.

On the basis of the analysis of the results presented in Table 2, it is possible to identify four countries with the lowest barriers to investment experienced by the CEE companies. These include (in the ascending order) Hungary, Lithuania, Czechia and Estonia. Four countries with the highest barriers to investment (in descending order) are Latvia, Poland, Romania and Slovakia. Between these two groups, there are countries with medium-sized barriers to investment, which include (in the ascending order) Bulgaria, Slovenia and Croatia. When comparing the group of countries characterised

by low barriers with groups with medium and high barriers, it should be noted that in the latter two groups, problems with labour market regulations and business and tax regulations are much more often indicated than in the first one. Moreover, in the group with the highest investment barriers, barriers related to access to financing or demand for goods and services, as well as problems with digital and transport infrastructures, are much more common than in the other two groups.

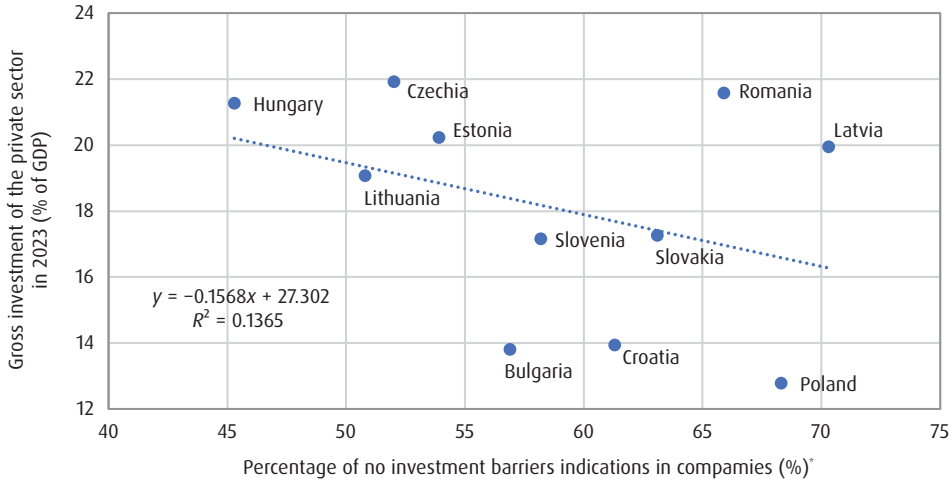
It is also worth pointing to the results of the analysis of the variability of barrier perception – both by reporting country and by barrier category. First, the rate of variation of barriers is much higher in countries with lower or medium barriers than in countries with high barriers. This means that the latter group of countries is characterised by more persistent or even structural problems related to the spread of barriers to investment among enterprises, with high barriers in most areas. High variability rates in countries with lower average barrier values suggest that the perception of these barriers is less uniform, which may be due to the fact that barriers to the growth of business investment are in many cases low in these countries, but there are a few problem areas where they remain high. This, of course, applies to the barriers already mentioned related to uncertainty about the future, energy prices and the availability of adequately skilled staff.

On the other hand, the analysis of the coefficients of variation for individual barriers occurring in the CEE countries indicates that the more often the barrier is reported, the lower the value of the coefficient of variation is. This may indicate that some of the most important barriers to investment are also most widespread, which is where uncertainty about the future, energy costs or the availability of adequately skilled staff come from again. It indicates a general consensus among companies from different countries on the onerous character of these barriers, regardless of the local conditions. In the case of barriers with the lowest average percentage of indications, such as the availability of digital or transport infrastructure, a high value of the coefficients of variation may reflect differences in local conditions, resulting in particular from the underdevelopment of this type of infrastructure in only some CEE countries. On the other hand, the value of variability indicators for other barriers – demand for goods or services, availability of financing and regulations (labour market, business and tax) – shows that they come in between the two groups mentioned above.

Finally, it is worth comparing the results of the EIBIS study on the perception of investment barriers to the level of gross private sector investment outlays in the analysed economies. The data on this subject are presented in Figure 3. On their basis, it may be noted that a higher average percentage of indications regarding the existence of investment barriers often coexists with a lower level of this type of investment. It means that in the countries where the perception of barriers is lower, private

investment accounts for a larger percentage of GDP. The examples to be quoted are Hungary and Czechia, where the percentage of indications concerning barriers is relatively low (45.3% and 52%), and gross private investment is at a high level (21.3% and 21.9% of GDP). While, Poland and Bulgaria, with a high average percentage of indications concerning barriers (68.3% and 56.9%), record lower levels of gross private investment (12.8% and 13.8% of GDP). The exceptions to this rule are Estonia and Romania, which are characterised by relatively high private gross investment outlays (20.2% and 21.6% of GDP) and at the same time a high perception of barriers (53.9% and 65.9%). Overall, the available evidence suggests a trend that higher perceptions of barriers to investment are associated with lower levels of private investment, although there are exceptions suggesting the influence of other factors such as specific national policies, economic situation and availability of capital.

Figure 3. Percentage of indications of the existence of investment barriers and the level of gross capital expenditure of the private sector in 2023



* Percentage of indications according to the data from Table 2 – line "average".

Source: Self-reported data based on EIBIS 2023 and AMECO data.

To recap this part of our study, it should be noted that the analysis of barriers related to the investment activity of the CEE enterprises indicate significant differences in the perception and occurrence of these barriers in individual countries. The results based on the EIB survey confirm the general pattern that the countries where business opinion surveys indicate high barriers to investment tend to experience structural problems that hinder investment processes. And the countries in which the survey identified the presence of low barriers to investment are characterised by

structural determinants that are more conducive to business investment. However, these results suggest that investment levels may be influenced by factors other than those included in the EIB study.

The analysis of the variation coefficient shows that in the countries with higher barriers to investment, the perception of these barriers is more uniform, which may indicate a more widespread and persistent occurrence of obstacles related to investment activity. In the countries with lower barriers, perceptions of these barriers are less uniform, which in turn may reflect the fact that many types of barriers to investment have been eliminated, but there is still a group of barriers that are difficult to address which companies have to deal with.

The most frequently indicated barriers in the region are uncertainty about the future, high energy costs and the lack of availability staff with appropriate skills. To a lesser extent, but still significantly often, companies report problems related to labour market regulations and business and tax regulations. Barriers related to access to digital and transport infrastructure turned out to be the least problematic, although high rates of variability in the perception of these barriers indicate that some CEE countries face significant problems in these areas.

Barrier-free financing: strategies for the CEE companies to overcome investment barriers

We assessed the results of the research based on the EIB survey through a series of individual in-depth interviews with a group of experts, including EIB representatives from various CEE countries, EIB credit advisors and representatives of investment and trade agencies. The selection of experts was deliberate, as we wanted to collect the opinions of people who know the situation and understand the needs and problems of enterprises operating in individual countries of the region. This diversified perspective was intended to provide a deeper understanding of the specificities of local markets and to facilitate the identification of the most effective strategies to support business investment in the region. The aim of the interviews was both to deepen the diagnosis of the identified investment barriers among enterprises, as well as to examine potential strategies for reducing these barriers and stimulating investment processes.

Problems and recommendations in three key areas

In this section, we analyse the key barriers to the investment activities of CEE companies identified during the in-depth interviews. These are made up of three main

problem areas: uncertainty about the future, energy prices and a shortage of highly skilled workers. Our analysis is intended to show various aspects of these problems, their impact on business operations as well as numerous recommendations aimed at reducing barriers and creating conditions conducive to the development of investments.

By analysing the responses of interviewees about investment barriers caused by uncertainty about the future, several key areas can be identified that are often indicated as obstacles. The participants in the in-depth interviews pointed to three different types of uncertainty about the future, including geopolitical uncertainty, economic cyclicality and instability of government policies. Geopolitical uncertainty is primarily related to international conflicts, changes in foreign policy and geopolitical tensions. These factors have a significant impact on the market situation, causing fluctuations in exchange rates and energy prices, which creates an unpredictable environment for businesses. Economic cyclicality, including recession or slowdown in growth, limits the ability of companies to plan and invest for the long term, which can discourage them from pursuing new business projects. On the other hand, frequent changes in government policies, such as tax, energy and other key areas, affect the ability of companies to predict the future, hindering their investment planning.

Key recommendations for mitigating the impact of the above factors on the investments made by the CEE companies include

- **categorisation of types of uncertainty** – it is important for companies to be able to distinguish geopolitical uncertainty from economic cyclicality and manage these factors appropriately, e.g. through a diversification strategy or risk management;
- **stability in business relationships** – maintaining stable, long-term relationships with partners and customers can increase the predictability of the future and reduce the impact of market uncertainty on companies;
- **government support** – governments can create a business-friendly environment by maintaining stable tax and regulatory policies and offering investment incentives such as tax breaks or subsidies;
- **strategic planning** – companies can gain more certainty about the future by adopting this strategy and taking into account potential changes in the market environment, such as economic cyclicality or changes in government policies;
- **supervision and adaptation** – systematic monitoring of changes in the business environment and modification of investment strategies in accordance with new circumstances can help companies manage uncertainty about the future and maintain stability.

The analysis of the responses of participants in the in-depth interviews covering another area, which is energy prices, also made it possible to specify several types of problems, for example in relation to the energy mix, high operating costs, uncertainty

of energy prices or problems with energy infrastructure. According to the respondents, the energy mix is a key factor that affects the cost of energy and the stability of its supply. In some countries, especially those based mainly on fossil fuels, due to the rising costs of energy resources, regulations related to emissions and uncertainty about the availability of raw materials, there may be problems with the stability of energy prices and the increase in energy prices for companies. Rising energy costs have a direct impact on the operating costs of enterprises, reducing their competitiveness. The structure of economy is of great importance in this context. For this reason, the negative effects of rising energy prices will be more pronounced in the countries where industry is energy-intensive, such as Poland, where high energy costs may be seen as a significant barrier to investment development. Fluctuations in energy prices, caused by both global and local factors, lead to increased uncertainty, previously described as a separate barrier to investment. Moreover, they can negatively affect companies ability to plan for the long term, which also discourages them from making business investments. The availability of adequate energy infrastructure is also a challenge in many countries, which concerns not only the limited capacity of existing networks, but also difficulties in including new investments, which prevent the development and expansion of enterprises. The problem related to energy infrastructure is also revealed in the context of the energy mix and investments in renewable energy sources, as the quality of energy infrastructure in many countries limits the possibilities of connecting new installations to the power grid.

With regard to investment barriers related to energy prices, the following recommendations can be pointed out resulting from the interviews:

- **diversification of energy mix** – its source is primarily investments in renewable energy sources and zero-emission energy sources; wind, solar, hydropower energy, development of biogas plants, geothermal energy and investments in nuclear energy can provide a stable, renewable or zero-emission source of energy; this is particularly important in the context of global climate commitments and energy policy pursued by EU;
- **energy infrastructure** – the development and modernisation of transmission networks and solving problems with connecting new investments are crucial to ensure stable access to energy for enterprises, as well as the development of renewable energy sources;
- **investment in the development of energy storage** – energy storage systems, such as batteries or other forms of storage, can help to compensate for fluctuations in the supply of energy from renewable sources, such as solar or wind, which further stabilises the energy mix;

- **energy efficiency** – investing in increasing the energy efficiency of business operations and modernising machinery can reduce operating costs by reducing energy consumption per unit of production;
- **government support** – the introduction of tax breaks, subsidies and other incentives for companies that focus on energy efficiency and renewables can encourage companies to invest in long-term energy strategies;
- **regulatory stability** – a stable institutional environment, with minimum legislative changes, can help reduce business uncertainty and enable companies to effectively plan future investments.

The third key barrier to investment activity in the CEE companies is a limited availability of adequately skilled staff. In this context, the participants in the in-depth interviews mentioned several problem areas. One of them was a mismatch between the skills of staff and the demands of the market. It was also pointed out that educational programmes do not keep up with changes in the labour market, which leads to a shortage of qualified specialists in many industries. A significant problem in most CEE countries is also the ageing population, which also causes a decrease in the number of available staff, which translates into additional challenges for companies wishing to employ highly qualified staff. In some CEE countries, the economic emigration of specialists also remains a problem, related to the search for better-paid job offers abroad, which further reduces the pool of available talents. The above factor is related to another problem, which is a low level of salaries and the reluctance of companies to raise rates for higher qualifications. It leads to a situation where highly skilled workers seek employment elsewhere or are not interested in further developing their skills.

On the basis of the conducted in-depth interviews, it is possible to indicate directional actions that will contribute to increasing the availability of qualified workforce in the CEE countries, such as

- **better adjustment of curricula to the needs of companies** – governments and educational institutions should introduce curricula that better reflect the needs of the labour market; it requires cooperation with companies to develop courses and learning pathways tailored to sectors with a high demand for specialists; universities and companies can also establish closer cooperation by setting up apprenticeship programmes, dual studies and implementation doctorates; which will allow them to combine theory with practice and allow future employees to learn the market realities;
- **training programmes for staff (including older people) and support for small and medium-sized enterprises** – companies can invest in training programmes for existing workers to improve their skills; in particular, training programmes for older workers can be an important part of their adaptation strategy to the ageing

population, enabling them to adapt to changing market demands; the CEE countries can also introduce financial programmes, such as grants or loans on favourable terms, to make it easier for small and medium-sized enterprises to develop the skills of their workforce and invest in innovation;

- **migration policy and the development of social infrastructure** – the CEE governments should introduce incentive schemes, such as special visas or promotional campaigns, to attract skilled migrants back to the country while making it easier for companies to hire workers from abroad; this also requires investment in social services such as healthcare, education and housing to make countries more attractive to skilled workers and retain them in the local labour market;
- **structural changes and increased competitiveness** – higher wages for skilled workers require structural changes in the economy, including the advancement of local firms in value chains and increased non-cost competitiveness; this will allow for the development of more complex forms of activity, which in turn will translate into higher salaries for professionals;
- **support for staff** – can be executed through the implementation of various programmes (scholarship, rotation or social programmes) that contribute to attracting and retaining talented staff; solutions in the form of easily accessible healthcare or flexible working hours can increase the retention of qualified staff;
- **regional cooperation within CEE** – the CEE governments can cooperate to exchange skilled workers and integrate the labour market, which will better match the demand and supply of specialist jobs.

Problems and recommendations in other areas

EIBIS results point to several problem areas in the CEE countries that hinder business investment. In addition to the three main challenges described above, business and tax and labour market regulations rank fourth and fifth in the hierarchy of investment barriers in CEE. In some cases, the impact of these countries varies, with in-depth interviewers highlighting that frequent regulatory changes limit the stability of businesses and their ability to plan for the long term.

Another challenge is the stability of financing. In the opinion of respondents, the availability of financing is not sufficient to ensure a long-term development of companies, and the lack of alternative sources, such as capital markets or development institutions, limits stable financing of operations. The instability of tax and legal regulations further affects the ability of companies to plan investments.

With regard to the demand for goods and services, the interviewees drew attention to two aspects: geopolitical and economic uncertainty, which may limit demand,

and the lack of innovation of companies from the region, which has a negative impact on their product and service offer.

The problems related to transport and digital infrastructure are the least important barriers to the development of investments. Despite this, infrastructure is still underdeveloped in some of the countries studied, as confirmed by the results of EIBIS. According to the participants in the in-depth interviews, the CEE countries should strive to unify their infrastructure at the level of trans-European networks (TEN-T), as well as sub-regions in individual countries, in order to join or diversify their participation in global value chains on the one hand, and to ensure more even development of countries and use the resources available in their sub-regions on the other.

A summary of the key recommendations resulting from the presented challenges presented can be shown in the following points:

- **regulatory stability** – it is necessary to ensure the stability of business, tax and labour market regulations; frequent regulatory changes in some CEE countries hinder long-term planning, limiting the stability of companies; this can be remedied, for example by implementing consultation and predictability mechanisms for legislative changes to enable companies to adapt effectively to the new legal environment;
- **increased availability of finance** – to ensure a long-term growth of companies, alternative sources of financing such as capital markets and development institutions need to be developed; improving the sustainability of financing will enable companies to manage their projects and plan investments more effectively;
- **supporting innovation, competitiveness and diversification** – the lack of innovation of companies from the region limits their goods and service offer and the ability to expand into new markets; cooperation with universities and research centres can accelerate technology transfers and strengthen the innovation ecosystem, increasing the competitiveness of companies from the region; expanding the goods and service offer and diversifying value chains will contribute to the development of the economy and strengthen the resilience to geopolitical and economic shocks;
- **infrastructure development** – strengthening transport and digital infrastructure is key to ensure the balanced development of the region and facilitate integration into global value chains; the CEE countries should strive to harmonise infrastructure at the level of trans-European networks (TEN-T) as well as sub-regions in individual countries, which will translate into more sustainable development of individual CEE economies and better use of their resources.

Issues not covered by EIBIS

The participants in the in-depth interviews highlighted several significant barriers to CEE companies investment activities which were not included in the EIB investment survey.

Firstly, they pointed to the need to transform the competitiveness model of the region as the CEE economies are getting closer to the level of Western Europe. According to the respondents, the region needs to move from a low-wage competitive model to other competitive advantages. The focus should be on specialisation and unique market offers and investment in research and development that can ensure long-term competitiveness.

The second important area of barriers includes relatively low innovation, problems with the commercialisation of research results or the backwardness of the venture capital market in CEE, which hinders the development of startups and the scaling of local innovative enterprises. In the opinion of respondents, the CEE region therefore needs to intensify development activities in this area in order not to lag behind the world leaders such as the USA, China and other EU countries.

The third barrier is the difficulties encountered by local enterprises, especially smaller ones, in creating effective investment projects. The lack of support from the public sector and appropriate tools to prepare projects further hinders obtaining financing. This limits the opportunities for the development of innovative enterprises and effectively inhibits the investment potential of the region.

These problems became the basis for several recommendations in the areas described. They are as follows:

- **change in the competition model** – the CEE countries and companies should focus on building competitive advantages through specialisation in specific sectors and developing unique market offers; governments and business organisations can promote sectoral initiatives which focus on building specialised skills allowing companies to compete on the global market;
- **support for innovation and commercialisation of research** – to increase innovation in the region, it is necessary to invest in programmes to support research and development and facilitate the transfer of technology from science to business; governments and business organisations should develop such programmes as mentoring, which integrate researchers with entrepreneurs, facilitating the commercialisation of research;
- **development of the venture capital market** – supporting the growth of start-ups and innovative companies requires the creation of appropriate tax relief schemes for

venture capital investors and the promotion of public-private partnerships in the financial sector to increase the availability of finance for early-growth companies;

- **support in preparation of investment projects** – local enterprises, especially smaller ones, should receive support, e.g. in the form of training programmes and consultations on the preparation of effective investment projects; governments and business organisations can set up business support centres offering advice on financing and management of investment projects;
- **investment in technological infrastructure and education** – in order to increase the competitiveness of the region on the international arena, investments in technological infrastructure and education are necessary; it can be achieved, for example by developing training programmes for specialists in various technological areas or creating technology parks which will become a place for development and cooperation for innovative enterprises.

Summary

The aim of the study presented in this chapter was to give a comprehensive picture of investment barriers faced by enterprises in the CEE countries and to indicate strategies to overcome them. The results of the study indicate the complexity and diversity of investment barriers in the CEE countries and differences in their perception between individual countries.

Based on the results of the EIB investment survey, it was found that the most frequently identified barrier to investment for the CEE companies as well as for other countries surveyed, is uncertainty about the future, resulting from geopolitical factors, economic cyclicality and the instability of government policies. The second major problem is energy costs, which affect the operating costs of enterprises, especially in countries with energy-intensive economies. The third barrier is the availability of well qualified staff – the mismatch between their skills and the needs of the market, the ageing of the population and the economic emigration of specialists are the main challenges here. Business, tax and labour market regulations are the fourth and fifth barriers to investment in the region, and their instability and frequent changes limit the ability of companies to plan for the long term. The problems with digital and transport infrastructure are less important, although they are still a significant obstacle in some countries.

The study also presents a number of recommended strategies to overcome each barrier in the CEE countries – at the level of enterprises as well as public policies. Their use should enable dynamic economic development of the region and increase the competitiveness of companies on the international arena.

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ECONOMIC DEVELOPMENT AND ECONOMIC AND SOCIAL INEQUALITIES

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Abstract

This paper aims to discuss trends in economic growth and selected dimensions of economic and social inequalities in 11 Central and Eastern European (CEE) countries. It is based on the analysis of available data and conclusions drawn from the research review. In the deliberations, the differentiation of the situation between the described countries is presented against the average situation in the European Union, and in several cases also against the background of other selected groups of countries. In recent decades, the CEE countries have reached a level of economic development approaching that of richer Western European countries, while income inequality has increased. In terms of wages, access to education, skills or health status, there is a greater variation between the CEE countries and between different groups in the population of these countries (younger versus older people, women versus men and people with various levels of formal education). To maintain the potential for growth in the future, it is worth addressing these inequalities.

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The aim of this chapter is to discuss the differentiation and major changes in income inequality and selected social inequalities in relation to economic growth trends in eleven Central and Eastern European (CEE) countries.[1] The relationship between economic growth and inequality is difficult to study and its results are strongly dependent on the level of economic development of the country and the institutional context. The research shows that income inequality can hinder economic growth, especially in countries with a lower level of development, although it can also promote growth in highly developed countries [Salverda, Nolan, Smeeding, 2009; Mdingi, Ho, 2021; Mo, 2000]. There are also opinions that in the course of economic development, inequalities first increase and then decrease. It may be explained by the transition from agriculture-based to industrial-based economies and from traditional to high-tech sectors. Technological innovation initially increases inequality, as more people join high-income sectors and income related inequality decreases. Regardless of the level of gross domestic product, institutional factors such as the tax system or the social security system can contribute to the distribution of income in society in different ways [Stiglitz, 2015].

When it comes to social inequalities (e.g. in education, access to the labour market or health), Piketty and Saez [2014] showed that there is a long-term relation between them and economic growth, although it is not the same in all countries. For example, a higher participation of women in the labour market can both mitigate income inequalities and make them grow when women are employed in lower-paid occupations. A faster economic growth allows for more investment in education and health, but if opportunities for better education and access to health care are unevenly distributed, it can negatively affect the growth potential in the future.

The following analyses allowed us to answer the question of what social and economic inequalities in the CEE countries look like against the background of the entire European Union, accounting for the trend of economic development in this region.

On the basis of statistical data and available literature on the subject, an analysis of the trends in economic growth in the CEE countries in the last decade and a discussion on the main factors influencing this growth were carried out. The second part of

[1] Bulgaria, Croatia, Czechia, Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia, Hungary.

the study discusses income inequalities, and the third part discusses the differences in health situation and education levels in each country.

Economic growth trends in the CEE countries

Political and social changes and the transition from a centrally controlled economy to a free-market economy more than 30 years ago initiated a period conducive to faster development of most CEE countries. Each county began implementing reforms, starting from different levels, but after the initial transformation shock, the real GDP per capita increased significantly in each of them, and the development gap with the countries of Western and Northern Europe decreased (Table 1). According to the latest available data from 2023, the most developed countries in the region were Czechia and Slovenia, reaching 91% of the average GDP per capita at the purchasing power parity (PPS) in the EU, while the country with the lowest GDP per capita according to PPS was Bulgaria (64% of the EU average).

Table 1. Real GDP per capita in PPS relative to the EU-27 average in 2012, 2022 and 2023

	2012	2022	2023*
EU-27	100	100	100
Bulgaria	47	62	64
Croatia	62	73	76
Czechia	84	90	91
Estonia	74	85	81
Lithuania	71	89	87
Latvia	61	73	71
Poland	67	79	80
Romania	57	76	78
Slovakia	77	71	73
Slovenia	83	90	91
Hungary	67	76	76

* Preliminary data.

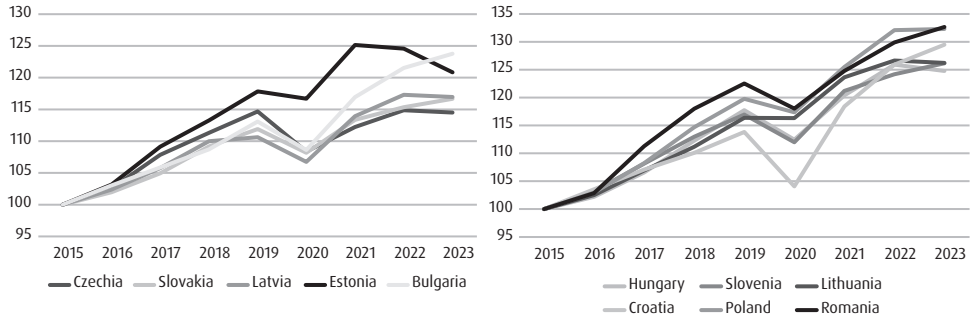
Source: Self-reported data based on Eurostat data.

The main factors for the growth and convergence of economic development between CEE and Western European countries were the accumulation of capital and the increase in productivity after the economic transformation and accession to the EU. Market reforms, privatisation of state-owned enterprises, inflow of foreign investment

as well as benefits from international exchange, mainly exports, played an important role [Hagemejer, Mućk, 2018]. The pace of real convergence in Romania and the Baltic states was also significantly affected by migration.

In the last 15 years, after recovering from the negative shock of the economic crisis of 2008–2009, the CEE countries experienced a period of stable economic growth, only disturbed by the shock of the COVID-19 pandemic in 2020, the subsequent inflation as well as the effects of the war in Ukraine felt by the economies of many countries [Maszczyk, Lissowska, Próchniak, Rapacki, Sulejewicz, 2023].

Figure 1. GDP growth at market prices in 2015–2023 (year 2015 = 100)



Source: Self-reported data based on Eurostat data.

It is worth noting that in the years 2015–2023, all the CEE countries described above recorded an average higher per capita economic growth rate than the EU average, which indicates further convergence in the level of development among the member states. According to the Eurostat data, the fastest – almost twofold – GDP per capita *growth* in PPS in the analysed period was recorded in Romania and Bulgaria, followed by Poland (an increase of 67%), and the slowest in Czechia and Estonia (almost 50%), which still meant a faster growth than the average in the countries belonging to the EU before 2004.

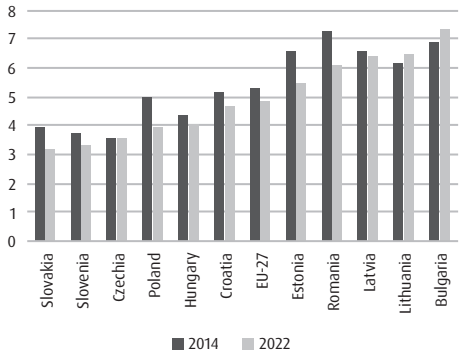
Income inequality

Income inequality increased significantly in former socialist countries during the economic transition, as did wealth inequality, although the latter on average is still lower than in Western European countries [Brzeziński, Sałach, 2022]. Wesołowska [2024] examined the factors influencing changes in the Gini coefficient in the years 1991–2019 in former socialist countries (EU and non-EU), covering mostly the CEE

area. The results of her analysis indicate that the countries which joined the EU in the 2010s (i.e. Bulgaria, Czechia, Croatia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) at the beginning of the economic transformation were characterised by a lower level of income inequality, and their growth was spread over many years. At the same time, in the group of countries that did not join the EU (Armenia, Belarus, Kazakhstan, Moldova, Russia and Ukraine), at the beginning of the transformation, the values of the Gini coefficient were higher and its growth was faster.

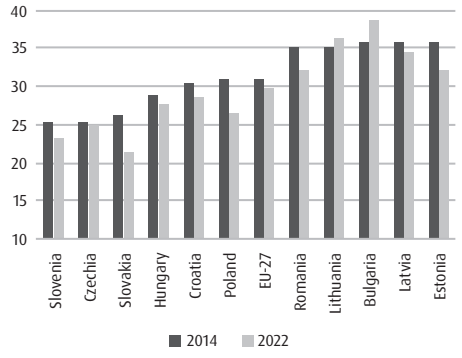
In most of the CEE countries we analysed, income inequality decreased after 2014, with the exception of Lithuania and Bulgaria (where income inequality increased) and Czechia (where it remained unchanged), as shown in Figures 2 and 3.

Figure 2. Ratio of income earned by the top 20% of population to income earned by the bottom 20% of population in 2014 and 2022



Source: Self-reported data based on Eurostat data.

Figure 3. Gini coefficients for equivalised disposable income in 2014 and 2022



Source: Self-reported data based on Eurostat data.

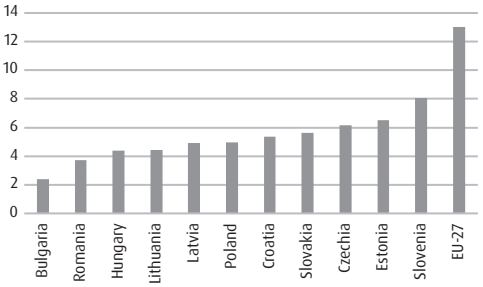
Three Baltic countries: Lithuania, Latvia and Estonia, as well as Bulgaria and Romania – have a more diverse income distribution, regardless of the chosen measure of this indicator. Croatia, which was the last to join the EU, is also a country with a relatively high income inequality. On the other hand, Slovenia and Slovakia were the countries with the lowest and decreasing income gaps in 2014–2022.

The CEE countries differ significantly in the level of wages (Figure 4). These range from about EUR 2 (median hourly wages) in Bulgaria (the latest available data come from a survey carried out in 2018) to almost EUR 8 in Slovenia. Poland is in the middle of this rate, with median hourly wages of almost EUR 5. All the CEE countries are also far from the median wage in the EU-27, which exceeds EUR 13.

The differences are also visible in the level of wage inequality (measured by the level of wages in the ninth decile in relation to the first decile – as shown in Figure 5).

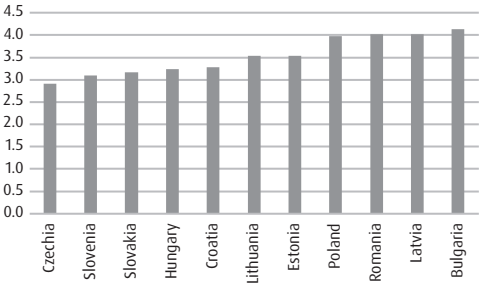
The lowest level of wage inequality is in Czechia, where people in the ninth decile earn almost three times less than people in the first decile. It is unclear to what extent these differences reflect differences in education or seniority. In Bulgaria, wages in the ninth decile are more than four times higher than in the first decile.

Figure 4. Median hourly wages in 2018 (EUR)



Source: Self-reported data based on Eurostat data.

Figure 5. Hourly wage differentiation in 2018 (EUR, decile 9 / decile 1)



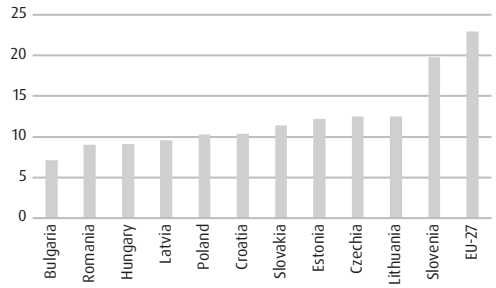
Source: Self-reported data based on Eurostat data.

The EU countries also differ significantly in the amount of labour costs, which reflects the described differences in median wages. 20 years after the enlargement of the EU by ten new countries, labour costs in CEE are still significantly lower than in Western European countries. In Bulgaria, Romania, Hungary and Latvia, they do not exceed EUR 10 (per hour), while in Denmark and Luxembourg they are more than five times higher. The EU average is EUR 22.9, while only Slovenia is close to the EU average (19.8) among the CEE countries. In Poland, labour costs remain at the level of EUR 10.3.

The years 2021–2023 were a period of significant economic changes in the EU countries, including CEE. At that time, they faced crises caused by the COVID-19 pandemic, high inflation and the consequences of Russia's attack on Ukraine. While in 2021 most CEE countries recorded an increase in real wages (the highest in Bulgaria – over 8%; a decrease in real wages took place only in Poland and Romania), in 2022 real wages declined in most CEE countries (most strongly in Estonia – over 9%). In Poland, a slight increase in real wages (0.6%) was recorded in 2022. The data for the second quarter of 2023 point to a further differentiation in the situation of the CEE countries in terms of changes in the level of real wages: in Czechia, they decreased by almost 5%; and in Romania, they increased by almost 9%.[2]

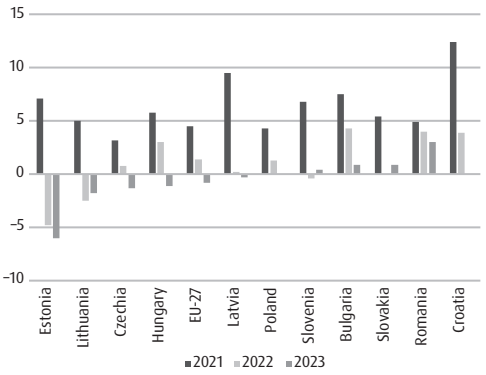
2 Eurostat data.

Figure 6. Labour costs in 2022 (EUR)



Source: Self-reported data based on Eurostat data.

Figure 7. Labour productivity by growth rate (y/y, %)



Source: Self-reported data based on Eurostat data.

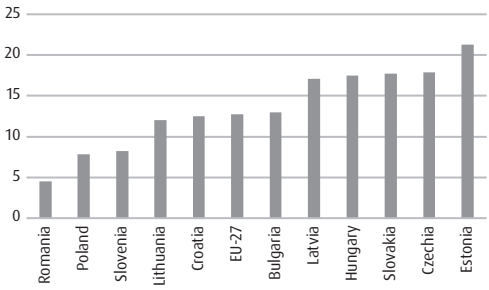
Changes in real wages were accompanied by changes in labour productivity (Figure 7). They were clearly higher in the CEE countries in 2021 than in 2022 and 2023 (when they reached the lowest values). Changes in productivity in Poland were comparable to the average level of changes in the EU. It is worth noting that labour productivity growth in 2021 was clearly weaker in Poland than in most CEE countries, which to some extent may reflect a lower decline in employment as a consequence of changes related to the outbreak of the COVID-19 pandemic.

One of the dimensions of wage inequality is the gender pay gap, i.e. the difference in the amount of their wages in relation to men's (hourly) wages. There are two indicators to determine the size of this gap:

- the so-called raw pay gap, showing the average difference in average wages of women and men, regardless of their characteristics;
- the so-called adjusted pay gap, taking into account the differences in the characteristics of men and women that are relevant in terms of wages (education, age, seniority, characteristics of the workplace, etc.).

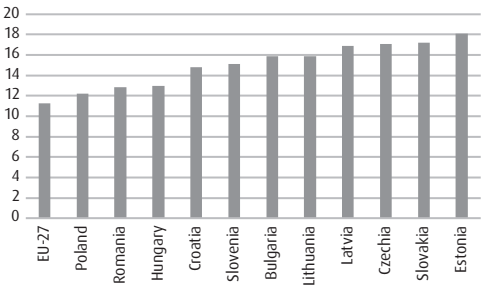
Data on raw pay gaps are widely available, adjusted gaps are calculated less frequently, and their size is strongly dependent on the available data and methodological assumptions made. Figure 8 shows that the raw pay gap varies in the CEE countries. The average difference in hourly wages between men and women exceeds 20% in Estonia and 15% in Czechia, Slovakia, Hungary and Latvia. In Poland, there is a severe difference in wages of 8% between men and women.

Figure 8. Raw pay gap in men's wages in 2022 (%)



Source: Self-reported data based on Eurostat data.

Figure 9. Adjusted pay gap in men's wages in 2018 (%)



Source: Self-reported data based on Eurostat data.

In this respect, Poland is one of the countries with a lower value of the raw pay gap.

However, this does not mean that the problem of wage inequality does not exist. A low value of the raw gender pay gap is mainly due to a better level of education of women. If the characteristics of men and women are taken into account in the adjusted pay gap, it can be seen that it is much higher and exceeds 12%, thus exceeding the EU average (Figure 9). It is also evident that the adjusted pay gap is clearly higher in the CEE countries than the EU average.

What are the sources of inequality in wages between women and men? Parenthood plays an important role, as it affects career and salary paths primarily among women [Cukrowska-Torzewska, Lovasz, 2016; Cukrowska-Torzewska, Matysiak, 2020]. The so-called wage penalty for maternity is caused by unequal distribution of childcare and household duties, resting mainly on the shoulders of women. The work-life balance directive implemented in 2023 is expected to increase men's involvement in childcare, translating into better career prospects for women.

Diversified health situation

Health inequalities are linked to lower potential for economic growth. On the one hand, they reduce the productivity of workforce, but on the other hand, they require higher healthcare costs. It is estimated that in the EU, health inequalities consume several percent of GDP each year [Mackenbach, Meerding, Kunst, 2011].

The general measures of the health of a population are life expectancy and healthy life expectancy. A tabular summary of data on life expectancy indicates a slowdown in the upward trend of this indicator, or even a slight decrease in the years 2014–2021.

It was largely related to a higher mortality rate during the COVID-19 pandemic [Aburto et al., 2022]. This decrease occurred in all countries, although with varying intensity. Slightly lower values were recorded in Estonia (in the case of men, even an increase in life expectancy was observed) and Slovenia, and much larger decreases were recorded in Bulgaria, Romania and Slovakia. Also in Poland, these decreases were significant: 2.1 years in both women and men. The coming years will show whether the decline in life expectancy was only related to the pandemic, or whether it was also affected by other factors.

Table 2. Life expectancy at birth in selected years

	EU-27	BG	CZ	EE	HR	LT	LV	HU	PL	RO	SI	SK
	Women											
2014	83.7	78.0	82.0	81.9	81.0	79.4	80.1	79.4	81.7	78.7	84.1	80.5
2017	83.6	78.4	82.0	82.6	81.0	79.7	80.5	79.3	81.8	79.0	84.0	80.7
2020	83.2	77.5	81.3	83.0	80.9	80.0	80.1	79.0	80.7	78.3	83.4	80.4
2021	82.9	75.1	80.5	81.4	79.8	78.0	78.8	77.8	79.6	76.6	83.8	78.2
	Men											
2014	77.9	71.1	75.8	72.4	74.7	69.1	69.2	72.3	73.7	71.3	78.2	73.3
2017	78.1	71.4	76.1	73.8	74.9	69.8	70.7	72.5	73.9	71.6	78.2	73.8
2020	77.5	70.0	75.3	74.4	74.7	70.6	70.1	72.3	72.5	70.4	77.8	73.5
2021	77.2	68.0	74.1	72.7	73.6	68.2	69.5	70.7	71.6	69.2	77.7	71.2

Source: Self-reported data based on Eurostat data.

Table 3. Healthy life expectancy in selected years

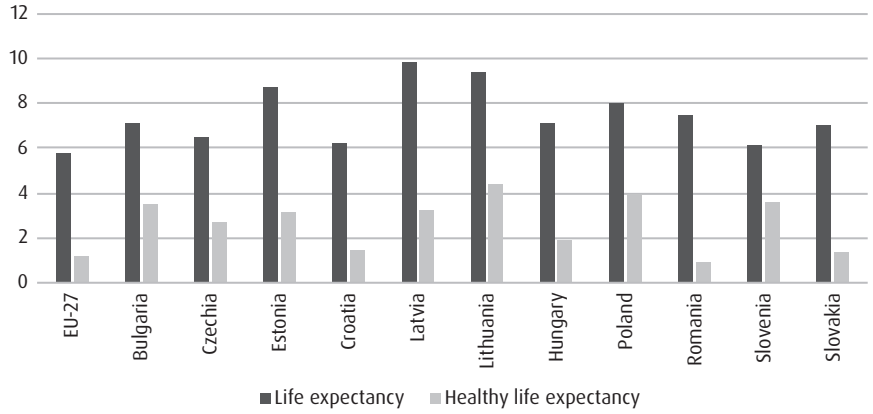
	UE-27	BG	CZ	EE	HR	LT	LV	HU	PL	RO	SI	SK
	Women											
2014	61.4	66.1	65.0	57.1	60.0	55.3	61.7	60.6	62.7	59.1	59.6	54.6
2017	64.3	66.2	62.4	57.2	58.0	52.2	59.8	60.8	63.5	58.3	54.6	55.6
2020	64.5	67.8	62.5	59.6	59.6	54.3	58.7	63.5	64.3	60.5	66.3	57.1
2021	64.2	65.1	63.4	58.0	59.3	55.4	59.8	63.5	64.6	58.2	67.3	57.5
	Men											
2014	61.1	62.0	63.4	53.2	58.6	51.5	57.6	59.1	59.8	58.9	57.8	55.5
2017	63.5	62.9	60.6	54.7	57.3	50.6	56.4	59.6	60.6	59.1	55.3	55.6
2020	63.5	63.6	60.9	55.5	57.5	52.6	55.1	61.6	60.3	59.3	63.9	56.3
2021	63.1	61.6	60.7	54.9	57.9	52.2	55.4	61.6	60.7	57.3	63.7	56.2

Source: Self-reported data based on Eurostat data.

The situation is different with regard to the measure describing healthy life expectancy. Between 2014 and 2020, it increased in EU. In the CEE region, the situation was more diverse. A longer healthy life expectancy was observed in: Estonia, Hungary, Poland, Slovenia and Slovakia, and shorter than before in: Bulgaria, Czechia, Croatia, Latvia and Romania. Changes in healthy life expectancy between 2020 and 2021 are more diverse.

Both life expectancy and healthy life expectancy are lower among men than among women, not only in the countries of the region, but also in the EU as a whole. The largest differences are found in the Baltic States as well as in Romania and Poland, while much smaller in Czechia, Croatia and Slovenia (Figure 10).

Figure 10. Difference in years between life expectancy and healthy life expectancy between women and men in 2021



Source: Self-reported data based on Eurostat data.

Health is a multidimensional concept, including various aspects and points of view. The basic division assumes a distinction between physical and mental health. Another approach is to analyse health in terms of:

a) medical condition, i.e. diagnosed illness,
b) daily life restrictions, i.e. restrictions resulting from the health condition,
c) subjective approach, i.e. self-assessment of health condition and individual symptoms by the examined people [Alperin, 2016].

The assessment of health condition of the population should therefore account for its complex nature, not to be limited to only one of the given dimensions. Itis also our approach to assessing health condition in the CEE countries.

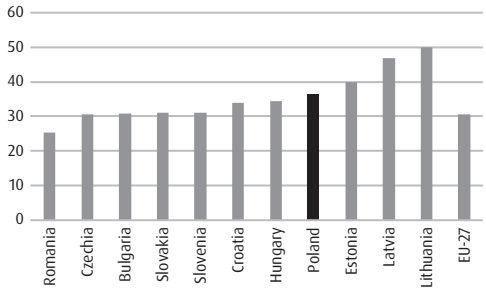
The two basic measures of health, i.e. self-assessment of health and the occurrence of depressive symptoms, show a large variation among the countries in the region. It

should be noted that these measures are built on the basis of the self-assessment of the survey respondents.

In the case of self-assessment of health, most countries in the region are in a worse health condition than (on average) all inhabitants of the EU countries (EU-27). The best assessment of their health is given by the inhabitants of Romania, where 25% of respondents perceive it as average or bad (Figure 11). It is also lower than for all EU countries (30.5%). The inhabitants of the Baltic States worst assess their health, including nearly 47% in Latvia and 50% in Lithuania of people aged 16 and over perceive their health as average or bad. Against this background, Polish residents assess their health worse than the majority of other representatives of the region: over 36% perceive their health as average or bad.

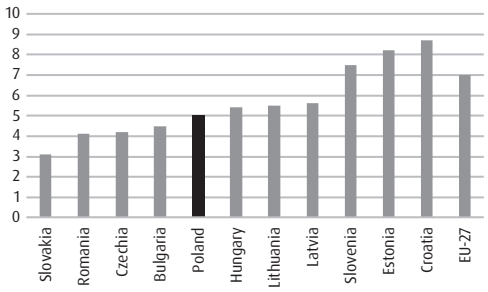
In the case of mental health, the situation in the region is slightly different, as in most CEE countries symptoms of depression are less frequent than the EU average (7%, Figure 12). The inhabitants of Slovakia (only 3% of respondents see symptoms of depression) as well as Romania and Czechia, best assess their health in this respect, while the inhabitants of Estonia (8%) and Croatia (9%) assess their health worst. In Poland, 5% of people aged 15 and over admit to experiencing symptoms of depression. It is worth pointing to the link between mental and physical health, because in countries with good (compared to other countries) self-assessment of health, we can also observe a low level of depressive symptoms – these include Romania, Czechia, Slovakia and Bulgaria.

Figure 11. Average or poor self-assessed health among people aged 16 and over in 2022



Source: Self-reported data based on Eurostat data.

Figure 12. Incidence of depressive symptoms among people aged 15 and over in 2019



Source: Self-reported data based on Eurostat data.

Health problems, of course, increase with age. Therefore, it is important to monitor the health of older people due to the use of public resources, including those allocated to the healthcare system.

In assessing the health of the elderly, data were used from the project "Study of Health, Population Ageing and Pension Processes SHARE", which has been carried out for several years also in the EU countries [SGH, 2024]. It takes into account many measures of health determined on the basis of the self-assessment of the examined person. Four indicators were selected for the purposes of the analyses presented here: self-assessment of health, occurrence of symptoms of depression, occurrence of chronic diseases and daily life restrictions due to health problems. Chronic diseases include more than 20 diagnosed diseases and ailments. This study uses a synthetic measure to illustrate the occurrence of two or more diagnosed diseases. And daily life restrictions are the assessment of the presence or absence of any restrictions by the respondents.

In most CEE countries, the health condition of people aged 50 and over is worse than the average in the EU countries. However, there are clear differences between countries as well as according to the measure of health adopted.

In the case of self-assessed health, the lowest percentage of people with average or poor health was observed in Slovakia (21%), followed by three countries: Czechia, Slovenia and Croatia – with lower rates than the EU average (Figure 13). The worst assessment of health – as in the case of the general population – is made by the inhabitants of Lithuania, Estonia and Latvia (nearly 69%). In Poland, almost 45% of people at this age perceive their health as average or poor.

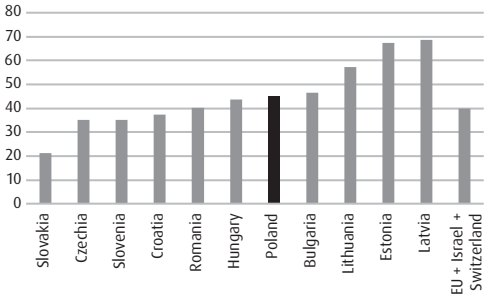
The occurence of depressive symptoms among the elderly is clearly higher than in the general population. In three CEE countries, we observe a lower percentage of people declaring symptoms of depression than the EU average (Figure 14). These are Slovenia (22%, the lowest value), Czechia and Slovakia. The highest percentage of people with symptoms of depression is in Hungary (41%). In Poland, this value is slightly lower (38%), which means that older people in Poland struggle with such symptoms more often than representatives of other countries in the region.

Daily life restrictions occur in CEE more often than the average in EU countries (45%). Only in Poland the percentage of people with restrictions is lower and amounts to 43% (Figure 15). In other countries of the region, it exceeds this value, and is the highest in Latvia and Estonia (55%). However, it is worth noting that in the case of this measure of health, the differences between countries are smallest.

The last measure analysed is the incidence of chronic diseases. On average, 42% of people aged 50 and over in the EU struggle with at least two chronic diseases (Figure 16). In most CEE countries, the proportion of people with two chronic diseases is higher, with the exception of Slovakia (32%) and Romania (40%). The highest values are observed in Latvia and Hungary (53%). In Poland, this percentage is also high (51%).

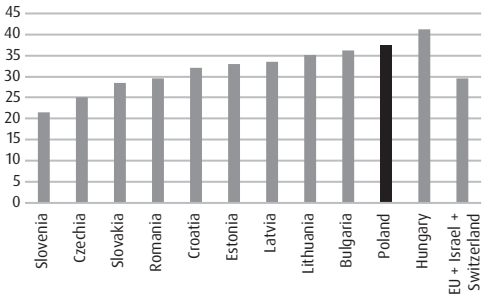
Summing up the health situation of the elderly in Poland, it should be noted that it is diverse. Chronic diseases and symptoms of depression are relatively common in Poland, and daily life restrictions are less frequent than in other CEE countries.

Figure 13. Average or poor self-assessed health among people aged 50 and over in 2021



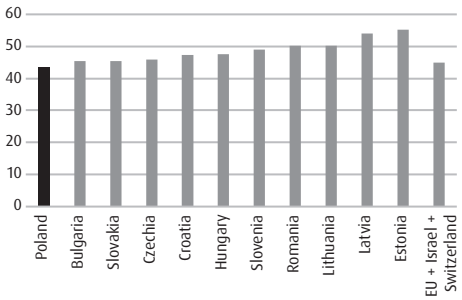
Source: Self-reported data based on the SHARE survey.

Figure 14. Incidence of depressive symptoms among people aged 50 and over in 2021



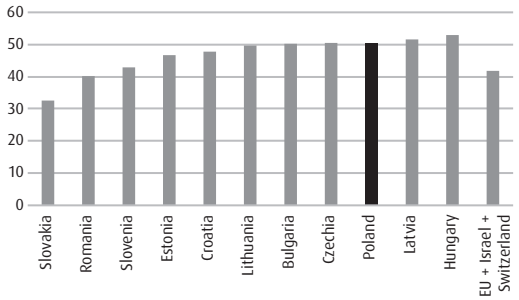
Source: Self-reported data based on the SHARE survey.

Figure 15. Daily life restrictions due to health problems among people aged 50 and over in 2021



Source: Self-reported data based on the SHARE survey.

Figure 16. Incidence of two or more chronic diseases among people aged 50 and over in 2021



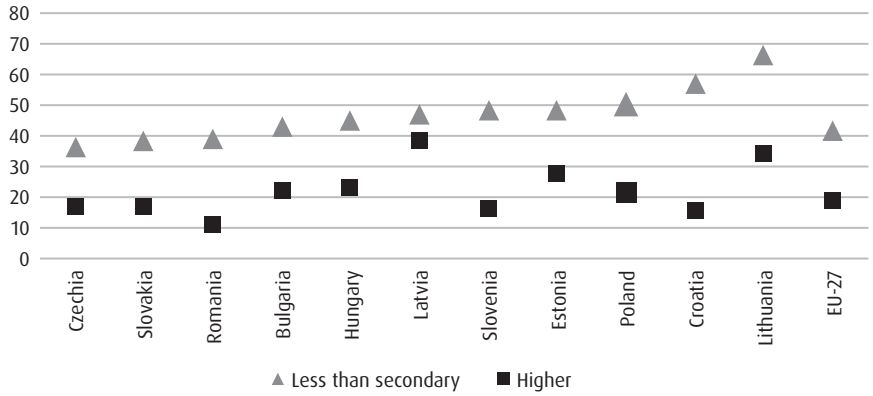
Source: Self-reported data based on the SHARE survey.

Many studies prove that health condition is linked to a person's socioeconomic situation, including their income and education [e.g. Mackenbach, Stirbu, Roskam, 2008; Mäki et al., 2014]. Therefore, it is worth taking into account this dimension of health of the CEE residents in the presented analysis.

The literature indicates that on average in the whole EU as well as in all countries of the region people with less than secondary education are characterised by worse health than people with higher education. However, there are some differences in this respect in the CEE countries (Figure 17).

In the case of Latvia, these discrepancies are smallest and amount to less than 9 p.p. In many countries, they reach a value of 20 p.p, which is close to the EU average. However, there are a few countries where these differences are really high. In Slovenia and Lithuania, they are a little over 30 p.p., and in Croatia over 40 p.p. It means that in these countries there is a clear relationship between the level of education and self-assessment of health, and thus – investments in human capital can bring a significant return also in the form of better health and reduced inequalities in the health of the population of a country.

Figure 17. Average or poor self-assessed health among people aged 16 and over by education in 2022



Source: self-reported data based on Eurostat data.

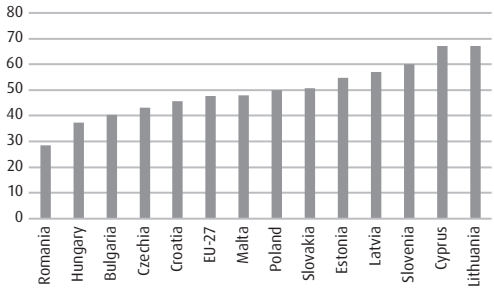
In Poland, these differences are also high. A little more than 21% of people with higher education and as many as 50% of people with less than secondary education assess their health as average or poor. These results confirm previous analyses indicating the importance of education in the context of health. Education is a factor which indirectly shapes other determinants of health and affects them throughout a person's adult life, for example, influencing behaviours related to health prevention and protection [see, e.g. Wróblewska, 2012].

Inequalities in education and competences

Another dimension of sociodemographic inequalities which we can observe in the CEE countries is the different level of education. Figure 18 shows the proportion of the population with tertiary education among people aged 15–64. On average, this

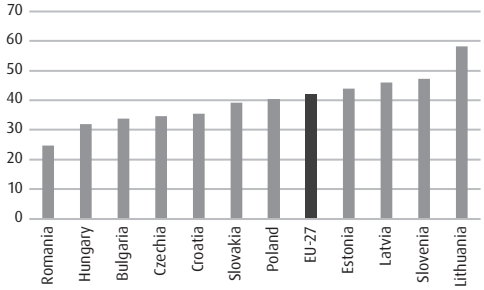
percentage in the EU countries is 30%. At the same time, in Lithuania more than 40% of the population have higher education, while in Romania less than 20%. In Poland, 30% of the population aged 15–64 have higher education, which corresponds to the EU average. Differences in educational background are important in view of the demand for a well-educated labour force in the context of the challenges of technological and demographic change and the growing demand for qualifications and cognitive skills.

Figure 18. Percentage of 15–64 year-olds with tertiary education (%)



Source: Self-reported data based on Eurostat data.

Figure 19. Percentage of 25–34 year-olds with tertiary education (%)

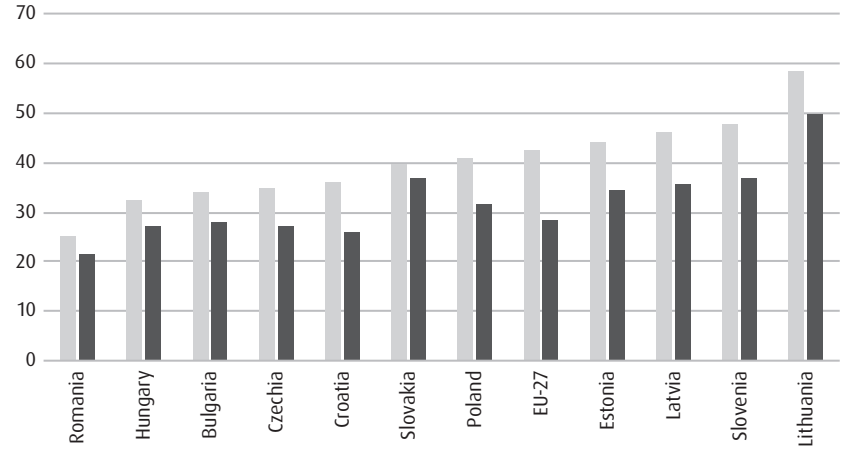


Source: Self-reported data based on Eurostat data.

The proportion of people with tertiary education is clearly higher among younger population. As shown in Figure 19, on average, 42% of the EU population aged 25–34 have a tertiary level of education. The best result in this respect is recorded in Lithuania, where this percentage reaches almost 60%. The lowest level of education is in Romania, where only one young person in four has a university degree. Poland is in the middle of the rate, close to the EU average, with 40.5% of young people with higher education. However, this is still below the target set by the EU (45%) [European Union, 2021], which most CEE countries have not yet achieved, except Lithuania, Slovenia and Latvia.

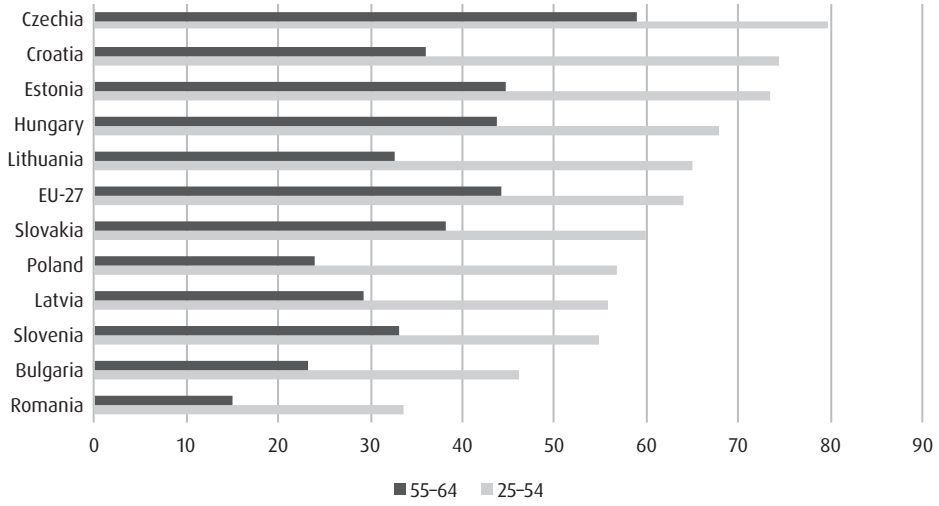
In addition to the differences in education levels between countries, we can also observe large gender disparities in education in these countries. Among young people, a higher proportion of women than men have tertiary education in each of the CEE countries. On average in the EU-27, more than 47% of women aged 25–34 have a tertiary level of education (compared to 33% of men in the same age group). In Lithuania, two-thirds of women aged 25–34 have higher education, while Romania is at the other extreme, where only 28% of women have higher education. In Poland, exactly half of young women have higher education, which places us in the middle of the EU rate (Figure 20).

Figure 20. Percentage of women and men aged 25–34 with tertiary education (%)



Source: Self-reported data based on Eurostat data.

Figure 21. Percentage of 25–54 and 55–64 year-olds with at least basic digital skills (%)



Source: Self-reported data based on Eurostat data.

In the context of technological change and rapid development of artificial intelligence, not only higher education is crucial, but first all also technological and digital skills. One of the challenges is to increase the percentage of STEM (*Science*, *Technology*, *Engineering* and *Maths*) graduates, especially with the participation of women.

Currently, men predominate among the STEM graduates, and it also applies to all the CEE countries. In this respect, there is the highest percentage of women is in Poland and Romania (over 40%), and the lowest in Hungary and Lithuania (below 30%).

The level of digital skills also varies greatly between the CEE countries. The data on the share of people with at least a basic level of digital skills aged 25–54 (Figure 21) show that while 64% of the EU-27 population aged 25–54 declare a basic level, almost 80% in Czechia and only 33% of the population in Romania. The population aged 55–64 have significantly lower levels of digital literacy. In this case, less than 15% of the Romanian population and 59% of the Czech population declare basic skills. Poland is also lagging behind most countries, with a share of people with basic digital skills lower than the EU average for both age groups (25–54 and 55–64). Less than one in four older Poles declares such skills.

Summary and recommendations

After the shock associated with the transition from centrally controlled to market-based economies, the economic growth allowed most of the CEE countries to catch up with developed countries. On the other hand, when it comes to social and economic development, treated more broadly than just changes in GDP, convergence is not unambiguous.

Firstly, in line with the projections described in the literature and examples from other regions of the world, income inequality in CEE increased in line with the economic development (from low initial levels), and has stabilised or even decreased in recent years. It seems, however, that starting point, pace and sequence of political reforms had an impact on the development of income inequality, which is also confirmed by the research of, for example Aristea and Perugini [2014].

The analyses presented in this study show that the CEE countries differ from each other in terms of the socioeconomic indicators analysed. In this respect, it is worth moving away from treating the region as a whole and start taking into account the differences in the institutional environment, which translate into different levels of income, wages, the situation on the labour market or health.

The most important conclusions from our analyses are as follows:

- the unequal situation of women and men on the labour market, including the gender pay gap, continues to be a challenge in the CEE countries; the existing gender pay gap can only be partly explained by differences in education or seniority;
- the ongoing convergence in economic growth does not have a significant impact on health convergence, with divergence between countries at the same time; the

health situation of the CEE residents remains worse than average in the EU countries, especially when it comes to health self-assessment;
- education is a feature that differentiates the health condition of each group – people with tertiary education have fewer health problems than people with less than secondary education, especially in Slovenia, Lithuania and Croatia;
- older people in most CEE countries are in a worse health situation than in countries of the whole EU, although the health situation of older people in different countries may vary; for example, chronic diseases and symptoms of depression occur more often in the older population in Poland and daily life restrictions less often than in other CEE countries;
- the share of people with tertiary education increased in most countries after 1990 and is much higher among the younger population, and in Slovenia, Lithuania, Latvia and Estonia it is even higher than the EU-27 average;
- digital skills vary among the CEE countries, with a significantly lower level of digital skills among people aged 55–64 than in Western European countries, which can be a challenge in light of the ageing workforce resulting from demographic changes in the region.

Since not only indicators such as the level or growth of GDP are important to achieve an adequate standard of living in the country, but also to counteract inequalities, on the basis of the discussed data and research results, the following recommendations can be made for actions to reduce economic and social inequalities in the analysed areas, while supporting the potential for future economic growth:

- more resources should be invested in improving human capital in countries with low levels of tertiary education, which should have a positive impact on the competences enabling people to adjust to a changing labour market as well as on health disparities reduction;
- the way in which the Pay Transparency Directive is implemented may determine at least a partial reduction in the pay gap, in particular among women and men entering the labour market; the implementation of the Minimum Wage Directive may also play an important role here;
- the CEE governments should monitor income and wealth inequalities and, where necessary, apply greater income redistribution and social transfers which do not limit labour market participation;
- large differences among the CEE countries in terms of life expectancy and health condition should lead to the search for factors specific to the national context going beyond regional conditions.

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STRATEGIES OF CENTRAL AND EASTERN EUROPEAN FIRMS' FOREIGN EXPANSION AND PLACE-OF-ORIGIN EFFECT, CROSS-BORDER E-COMMERCE DEVELOPMENT, AND PRESSURE ON INNOVATION

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Abstract

In recent decades, a growing role of companies from the Central and Eastern European (CEE) countries in the global economy and their progressive internationalisation has been observed. Many companies from this region, especially small and medium-sized enterprises, have to take into account numerous challenges in the international environment and internal corporate determinants, which influence their decisions regarding strategies on foreign markets. Key challenges identified in this study include a negative effect of the country/region of origin, a strong pressure on innovation from both foreign customers and competitors, development of cross-border e-commerce (CBEC) and its legal conditions. The aim of this report is therefore to describe these key determinants of corporate foreign expansion and to identify an internationalisation strategy recommended to companies in the CEE countries in response to the challenges arising in their international environment.

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In recent decades, the countries of Central and Eastern Europe (CEE) have been playing and increasingly significant role in the global economy [Boso, Debrah, Amankwah-Amoah, 2018]. A sign of this is higher rate of internationalisation and better competitive position of enterprises from CEE on the international markets of various categories of goods (e.g. Czech Avast Software – antivirus software, Polish Fakro –windows, Slovenian Gorenje and Polish Amica SA – household goods, Ukrainian Roshen – grocery). These businesses have been more and more successfully competing with companies from developed countries. Also, the number of mergers and acquisitions performed by them has been growing (e.g. Polish household goods brand Amica SA has taken over British CDA and Danish Gram, while Slovenian Gorenje has acquired Danish ATAG and Czech Mora), as well as their brand equity. A list of 500 most valuable European brands [Brand Finance, 2023] comprises Polish brands, including the energy concern Orlen (159th place), two brands of financial institutions, PKO BP (257th place) and mBank (495th place), as well as an insurance brand, PZU (332nd place), an energy sector brand, PGE (336th place), an IT brand, Asseco Group (484th place), as well as Czech Škoda (288th place), an automotive brand.

However, many companies from CEE, especially small and medium-sized ones (SME) are still facing issues such as building their international competitiveness, choice and use of adequate internationalisation strategies, including active expansion to foreign markets. These cover not only internal conditions at the organisational and individual level (decision-makers' and employees' profile), including their resources and dynamic

capabilities (branding capabilities, innovation capabilities, digital orientation), which are often limited compared to competitors, but also conditions of the international environment, such as sometimes negative country/region-of-origin effect [Witek-Hajduk, 2020], and related additional costs of origin (so-called liability of origin), pressure to innovate (in various dimensions), exerted by foreign clients and competitors, especially in the context of competing on international markets with businesses from developed countries. Other international environment conditions that have emerged recently are the development of cross-border e-commerce (CBEC), its legal determinants and foreign buyers' pressure on online shopping [Witek-Hajduk, Grudecka, 2022].

The aim of this study is to identify strategies of international expansion recommended to enterprises from Poland and other CEE countries, which before the social and economic transformation in late 1980 s and early 1990 s were part of the so-called Eastern bloc, along with Ukraine as a candidate country for accession to the European Union. The strategies are to provide answers to key challenges occurring in the international business environment: (1) an often negative country/region-of-origin effect, and related additional costs of international expansion incurred by enterprises, besides the costs of being foreign (*liability of foreignness*), (2) development of cross-border e-commerce on B2B and B2C markets, and related pressure from both institutional purchasers and consumers to have the possibility of purchasing goods online, as well as legal barriers for cross-border e-commerce, (3) pressure to innovate exerted by competitors and buyers on foreign markets in the context of building competitive advantage of enterprises operating on these markets, especially in developed countries.

In particular, this study is supposed to provide answers to the following questions:

1) What strategies of international expansion are recommended to enterprises from emerging markets in CEE in response to the country/region-of-origin effect and related costs?
2) What are the key legal issues of cross-border e-commerce in respect of international expansion of enterprises from emerging markets in CEE?
3) What strategies of international expansion are recommended to enterprises from emerging markets in CEE in the conditions of cross-border e-commerce development and pressure from institutional and individual e-buyers?
4) What strategies of international expansion are recommended to enterprises from emerging markets in CEE considering the pressure to innovate on foreign markets?

In order to answer these questions, the authors have not only reviewed literature, including empirical research studies, but have also referred to the results of their own research, both quantitative and qualitative, including in-depth interviews with company managers from CEE countries. They have also analysed selected legal matters, crucial from the perspective of international e-commerce expansion.

Strategies of foreign expansion of enterprises from emerging markets in CEE in response to the country/region-of-origin effect

Factors that play a significant role in international business, and in internationalisation of enterprises from CEE markets, include, among other things, country/region-of-origin effect, perceived in multiple dimensions: not only as made-in-country, but also country of corporate origin, country of parts/components origin, country of brand origin, country of assembly, or country of operation [De Nisco, Oduro, 2020]. Recently this factor has turned out to be important in the context of Russian invasion in Ukraine and changes in the strategy of international expansion in response to this situation [CELI, 2024], including withdrawal of many businesses from Russia, also those from CEE (e.g. Polish Amica with its household appliances, Bulgarian air carrier Bulgaria Air, Lithuanian Kurokesu, producing electronic items, Czech manufacturer of alcoholic beverages Pivovar Velhe Popovice, Croatian food producer Podravka, or Romanian IT company Softwin). In many cases these actions were accompanied by decisions to enter new foreign markets (Polish fashion brand CCC decided to divert its investments to other CEE countries) or taking respective actions (e.g. Polish Amica prepared a plan of expansion on the American market, which should partly compensate for its withdrawal from Russia), and intensified penetration of foreign markets that the companies have already entered (a strategy applied by Polish fashion company LPP on the European markets).

The strategic role of country of origin in international business expansion is connected with the influence of the country/region-of-origin image on the evaluation of enterprises, products and brands from a given country or region. The country/region-of-origin effect is also connected with costs of origin, which result from the problems faced by enterprises in host countries because of their national origin.

Perception of the country of origin is a challenge for enterprises from CEE, especially those associated with relatively lower level of development [Witek-Hajduk, Grudecka, 2024]. Companies, brands, and products from emerging markets are still perceived worse than those from developed countries, both on B2B and B2C markets. What is also significant is the fact that these countries, despite having gone through system transformation, still have to confront negative stereotyping [Petroye, Lyulyov, Lytvynchuk, Paida, Pakhomov, 2020]. According to Anholt Ipsos Nation Brands Index [2023], where respondents (consumers) from 20 countries evaluate 60 countries from the entire world, among CEE states those best perceived are: Poland on the 28th place, followed by Czechia on the 30th place, Slovakia on the 35th place, Romania on the 43rd place and Ukraine, which, however, took only 57th place in the ranking. Better developed non-CEE European countries were clearly better rated: Germany on

the 2nd place, UK on the 4th place, Italy on the 5th place, Switzerland on the 7th place, Sweden on the 10th place. This means that nation brands of CEE countries are definitely perceived worse than those from developed European countries. According to Bloom Consulting country brand raking [2023] recommended by the World Bank, developed for trade (investments), where brands of individual countries are evaluated based on their economic performance, digital appeal, country brand strategy (in reference to its positioning), and effectiveness of internet activities, the first three positions among the European countries are taken by developed countries, namely: UK, France, and Germany, respectively. The highest position among CEE countries is occupied by Poland (12th place), followed by Romania (16th place), Ukraine (17th place), Czechia (19th place), Hungary (24th place), Bulgaria (25th place), Estonia (26th place) and Lithuania (28th place).

The decision to take into account the country-of-origin effect in international business expansion should depend on factors such country image being fit vs not fit, and the way features of products from a given country are perceived by foreign investors. If both the country of origin and features of a given product category from the market are perceived in a positive way, it is recommended to refer to the country or region of origin. If the country image is negative, but the category of products offered by the company is viewed in a positive way, it is not advisable to refer to the country of origin in foreign expansion, although it is worth to support measures aimed at the image improvement. However, if the country image is positive, but products from a given category from this country are not perceived well, it is recommended to refer not to the place of origin, but to the improvement of image of the product category from this market. If both the country image and perception of products from a given category from this country are negative, the company should ignore the country of origin in its foreign expansion strategy or neutralise the negative country-of-origin effect.

CEE enterprises may take into account the country/region-of-origin effect in various aspects of their internationalisation strategy, such as: (1) choice of markets for international expansion and the order of entering them, based on the criterion of positive or at least neutral image (perception) of the enterprise's country of origin or its brands, as well as perception of a specific product category by stakeholder, including buyers from a foreign market; in the case of negative perception of the country of origin, the effect should be adequately neutralised. Moreover, the country-of-origin effect may be considered while choosing (2) modes of expansion on foreign markets, often in connection with the decision to (3) apply brand or brands owned by the enterprise or exports of goods labelled with brands of foreign partners. If a negative perception of the country of origin in the context of certain product category poses a barrier for foreign expansion, the enterprise may opt for exporting products labelled with

the brand of a partner pursuant to a contract with the original equipment manufacturer (OEM), holder of a strong brand, or for selling products labelled with the brand of a foreign trade intermediary, for instance a retailer.

The enterprise may also take over a foreign business along with its brand or brands, and in consequence offer products with the acquired local brand on foreign markets (an example is a Czech brand Relax, acquired by Polish Maspex) or international brand (in Scandinavia, the owner of Danish Gram company is Amica SA). Alternatively, it may obtain an international trademark (brand) licence from a foreign partner (an example is Amica SA, which in 2019 signed with a Spanish company a licence agreement to use for 30 years the Fagor brand for large household items).

Many enterprises from CEE countries export also products labelled with their own brands. If needed, they can also apply measures that neutralise the negative country-of-origin effect, by not revealing information about the real country of origin, and sometimes suggesting the products originate from a different country or region. Moreover, to enter and penetrate foreign markets, companies may sell their products at relatively lower prices compared to the competitors, especially those from developed countries, which, however, may negatively impact mainly the perceived quality of brands/products and, in the long term, may create a stronger brand on foreign markets. To improve the image, it is recommended to ensure relatively high quality of products in a longer time frame. Firms can also think about addressing products/brands only to specific target niches, i.e. segments of foreign market clients that would appreciate features of offered goods.

Depending on the image of country of origin on a foreign market, enterprises from CEE may (4): (a) refer in their marketing communication to the country of origin of their brands or products, if the country image on a given foreign market is positive, or apply strategy of (b) country-of-origin decomposition, or (c) neutralise the negative country-of-origin effect or one of its dimensions.

In the case of negative perception of a CEE market by foreign stakeholders, the strategy of country-of-origin decomposition, especially as a made-in country, can consist in enterprise communication referring to another country with a positive image, where parts, components, or technologies used are produced or designed.

To neutralise a negative image of a CEE country as a country of origin, the following measures may be used:

- foreign brand name suggesting a different country of origin, such as, for example, a foreign local or international brand taken over by the enterprise or obtained through a licence from trademark holder, or an independently created brand, which suggests that the product originates from a country with the desirable image (e.g. the brand Hansa of the Polish Amica SA company, suggesting German origin, or

the Czech fashion brand Pietro Filipi, suggesting Italian origin), or a brand/company name containing a name of a country/region/city with a positive image (e.g. Polish underwear brand Italian Fashion);
- names of products or product lines in the language of a suggested country of origin or names that refer to that country (e.g. products of a Polish lingerie brand Le Petit Trou named in French);
- slogans in the language of the suggested country of origin (e.g. a slogan of the Polish CCC firm in English: "Go for more," a slogan of the Hungarian petrochemical MOL Group in English: "Shaping the future of energy");
- elements of visual identification of an enterprise/brand referring to a suggested country/region/city, like flag colours, typical landscapes, buildings, animals, fonts, patterns (e.g. natural Greek yoghurt of the Polish brand Pilos with the Greek key pattern);
- positioning of an enterprise, brand, or product with a reference to values represented by a suggested country of origin or universal (global) values;
- endorsement by celebrities or people stereotypically associated with a suggested country (e.g. Hungarian brand Hall Energy Drink endorsed by the American actor Bruce Willis, Polish brand of energy drinks Black endorsed by Mike Tyson);
- design and components of products referring to a suggested country of origin (e.g. towels of the Polish firm King of Cotton made of positively perceived Egyptian cotton – Egyptian cotton 800 thread count");
- brand alliances of an enterprise with organisations of a suggested country of origin (e.g. alliances of the Polish 4F brand with eight Olympic Committees, among others Greek or Lithuanian, in connection with Olympic Games in Tokyo in 2021);
- using "made in EU" instead of "made in Poland" labels (e.g. the Polish brand of office and school stationery Office Product) or, if legally permitted, avoiding this information.

Strategies of foreign expansion of enterprises from emerging markets in CEE in the conditions of development of cross-border e-commerce and pressure from institutional and individual e-buyers

The development of the internet and modern technologies provides substantial opportunities for international expansion, without the need for physical presence of the manufacturer on foreign markets, which seems particularly important for CEE businesses, which often have fewer resources, especially compared with competitors from developed markets, in particular SMEs. An important challenge for entrepreneurs

is an increase in cross-border e-commerce, additionally enhanced by the COVID-19 pandemic [OECD, 2020].

It is estimated that in 2023, among all the internet users 75% of consumers from Central Europe and 62% of those from Eastern Europe made some purchase online, while in Czechia the share was 85%, in Ukraine 73%, in Latvia 69%, in Poland 68%, in Bulgaria 53%, in Romania 52% [Ecommerce Europe, 2023].

In 2022 cross-border e-commerce accounted for as much as 22% of global e-commerce, while in 2016 it was only 15% [Statista, 2022]. It is predicted that by 2030 it will reach USD 6.12 trillion (compared to only USD 0.948 trillion in 2022), developing at 26.23% compound annual growth rate (CAGR) in 2023–2030 [SNS, 2023].

According to a report prepared by Eurostat [2023] for the entire EU, during three months preceding the survey 53% of e-buyers purchased goods and services from a domestic seller, 21% from a foreign-country seller, while 13% from a seller from the rest of the world, and 10% purchased something from a seller from an unknown country. According to Statista [2023] data about Poland, 75% of internet users made a purchase from a national seller, and 30% from a foreign one. What is more, the most numerous group among EU citizens shopping online are people aged 25–34 and 35–44, and the least numerous group are people aged 65–74 [Eurostat, 2023]. Additionally, OECD data from 2020 show that 34.5% of Polish non-financial enterprises hiring 10 and more people conducted cross-border e-commerce, 17.5% of them only in the EU, 16% in the EU and beyond, 0.8% only beyond EU [OECD, 2020].

Cross-border e-commerce, as one of the modes of expansion to international markets, has enormous growth perspectives [Eduardsen, 2019] and plays an increasingly important role in internationalisation of both large companies and SMEs from EEC, by reducing barriers resulting from their limited resources and risk connected with traditional modes of expansion (like having own brick-and-mortar shops abroad), and lowering costs of entry to foreign markets [Witek-Hajduk, Targański, 2018], as well as expansion to new, often distant ones. This is a response to growing interest of both consumers and institutional buyers in cross-border e-commerce [Gemius, 2021]. Foreign expansion through an internet retailer or wholesaler and multi-sided digital platforms of international reach gives not only access to a large client base and new markets, which translates into sales growth, but also contributes to better awareness of the enterprise and its brands among its foreign buyers, as well as image or reputation of the brand quality [Witek-Hajduk, Grudecka, Napiórkowska, 2020]. Some of the barriers for sales through international intermediaries and multi-sided digital platforms are sometimes limited control over marketing measures, such as product range, prices, and promotion of products sold only through them, and often high mark-ups of e-distributors.

Cross-border e-commerce is an important aspect of both internet-based internationalisation, consisting in using only online distribution channels in the process of entering foreign markets, and internet-enabled internationalisation, where an enterprise operating on foreign markets applies not only traditional entry methods and offline distribution channels, but also some forms of e-commerce.

Considering factors such as pressure from foreign institutional buyers and consumers to shop online, and legal determinants, CEE enterprises operating both on B2B and B2C markets may apply different paths and forms of cross-border e-commerce, including:

- their own online shops or platforms enabling supply of goods to foreign markets, which can be global e-shops/e-platforms for global clients not adjusted to the specific conditions of foreign markets, or e-shops/e-platforms adjusted to the conditions of a foreign market/region (in terms of language, currency, or communication strategy);
- social commerce over platforms such as Facebook or Instagram;
- selling through an internet retailer (e.g. the Polish brand Chylak sold by Net-A-Porter) or wholesaler;
- selling through multi-sided digital platforms, also global e-platforms outside the region (e.g. American Amazon) or European e-platforms from country/region of origin of an enterprise (e.g. Polish Allegro, Romanian eMAG, Lithuanian Pigu).

These forms of e-commerce are used at various stages of international business expansion, although companies from CEE countries, especially SMEs, more and more commonly opt for selling through an online retailer or wholesaler, or through international multi-sided online platforms. They also run their own online shops or platforms as initial modes of their international expansion, sometimes simultaneously with traditional market entry modes.

For example CD Projekt Red, a Polish computer games producer, was initially providing its products online abroad, and then started to cooperate with foreign distributors of so-called box game editions, to finally open its own foreign branches, like the one in Vancouver (Canada). Kiwi.com (formerly Skypicker.com), a Czech virtual travel agency, which initially relied on its own website, after some time started to open its divisions abroad, e.g. in Spain or Great Britain. The owner of the Latvian ceramic tableware brand Vaidava was almost from the beginning selling its goods internationally over its website, and through foreign distributors, such as German Jürgen J. Burk. Also the owner of a Hungarian cosmetics brand Omorovicza offers its products on its own website and sells them on international multi-sided intermediary platforms (e.g. Notino). A Bulgarian brand of fashion accessories, Wooden Lifestyle, specialising particularly in wooden bow ties, sells its products only through

their own e-platform. Croatian Jewelry Craft provides its products both on an official website, and over social media (Instagram).

Key legal issues of cross-border e-commerce in respect of foreign expansion of enterprises from emerging markets in CEE

International business expansion using e-commerce requires adjusting business activities to legal conditions specific for cross-border sale. Not knowing them may lead to pricey disputes with foreign clients, and in extreme cases it can even make international expansion impossible. Below we present three legal issues which, as trade practice shows, may be a source of serious risk if they are not made specific enough before starting international expansion.

The first issue is the applicable law for contracts made with e-shop customers from other countries. In the EU, this issue is regulated by Regulation on the law applicable to contractual obligations [OJEU L 177; further referred to as Rome I]. According to a general rule, parties may agree on which law will be applicable for transactions made over an online shop (Article 3(1) RomeI]. However, the specific character of the internet makes it impossible for an entrepreneur running an e-shop to agree detailed transaction terms, including the applicable law, with each customer.

In practice, an entrepreneur running an e-shop defines the applicable law in its terms and conditions, and an e-buyer accepts it while using such a shop, e.g. by placing an order. Still, the freedom to agree on the governing law is limited, if the e-buyers are foreign consumers, and an e-shop by any means directs its activities to their countries. In practice it means that e-shop activities comprise elements suggesting readiness to process orders from foreign customers, such as multiple language versions, service in foreign languages (e.g. call-centre), payments in multiple currencies, offering deliveries to a different country, online advertisements, also based on key words from a different language. It is true that online shops conducting international sales may state that the applicable law is the law of the seller's country, but this decision may not deprive the customer of protection guaranteed them by the law of the country where the consumer has their habitual residence. In practice this means that before launching active online sales on the territory of a given country, an owner of an online shop should learn about legal consumer protection in force there, and adapt to it its internal procedures of order fulfilment. The law sets for issues such as the entrepreneur's information obligation towards consumers in a given country, consumer's right of withdrawal, consumer's right to terminate the contract, unilateral limitations and exemptions from the trader's liability for non-performance or improper perfor-

mance. While there should be no significant discrepancies in the EU, in the case of expansion beyond the EU it is recommended to analyse thoroughly local consumer protection regulations. For instance in the USA the rights granted to consumers may vary between different states.

The applicable law is connected with the issue of disputes with foreign consumers. Lack of knowledge about legal protection of consumers in a given country raises the risk of claims and complaints, often leading to legal disputes. These in turn may be very costly, especially for SMEs from emerging markets in CEE. The reason is that regulations in force in the EU grant legal protection to consumers. Pursuant to Article 18 of the Regulation on jurisdiction and the recognition and enforcement of judgements in civil and commercial matters [OJEU L 351], a consumer may bring proceedings against an entrepreneur either in the courts of the Member State in which the consumer is domiciled or in the courts for the place where the entrepreneur is domiciled (para 1). Proceedings may be brought against a consumer by an entrepreneur only in the courts of the Member State in which the consumer is domiciled (para 2). This solution is aimed at securing the legal situation of consumers, so that they can effectively shop online both on the internal EU market and beyond. To reduce the risk of costly disputes abroad, an e-shop owner should proactively respond to negative comments and complaints of foreign clients, so that they do not turn into legal proceedings, and offer consumers alternative, especially internet-based forms of solving disputes [European Commission, 2023].

A key legal issue from the perspective of brand owners is also their protection through previous registration of trade marks in countries where the goods are to be sold. An entrepreneur may register trade marks in the entire EU by the procedure of the European Union Intellectual Property Office (EUIPO) or in selected countries in the so-called Madrid System managed by the World Intellectual Property Organisation (WIPO), which brings together 113 member states representing over 80% of global trade [WIPO, 2024]. Choice of one of the two procedures depends on directions of foreign expansion and registrability of a trademark in a given country. Registration does not cover marks describing the type and properties of a product and marks similar to already registered ones, for which effective legal proceedings have already been brought. It cannot be therefore excluded that in its international expansion an enterprise will have to use another trademark than the one it uses on its domestic market. The best solution is when registration covering the territory of future expansion is done at the same time with obtaining protection on the domestic market.

Strategies of foreign expansion of enterprises from emerging markets in CEE under the pressure to innovate

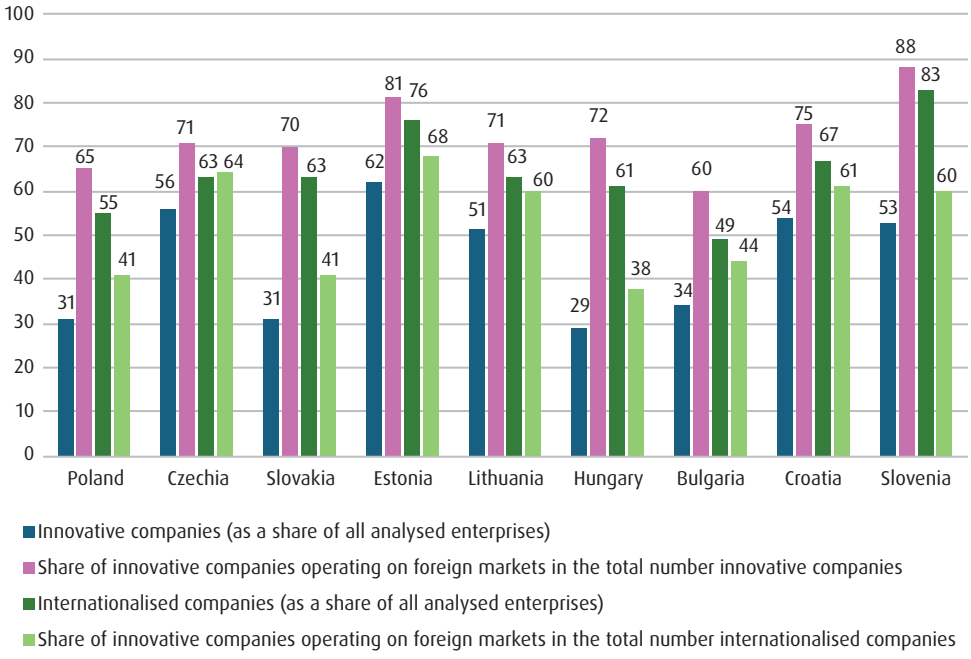
One of the driving forces of international competitiveness, and an important factor of international expansion of CEE enterprises is innovation [Ipsmiller, Dikova, 2021]. Determinants of internationalisation, especially for small and medium-sized business entities, refer mostly to internal determinants taken into consideration at the level of management or enterprise, and much less to environmental-level determinants [Górska-Grginović, 2022]. The pressure to innovate, exerted on enterprises, stems from the dynamic technology advancement, with rising digitisation (along with increasingly common use of Big Data and Artificial Intelligence), turbulent business environment (caused by, among other things, the phenomenon of long COVID, war in Ukraine and the conflict in the Middle East), as well as progressing climate change, forcing businesses to implement the principles of sustainable development.

Reference literature on international business has oftentimes proven the relation between innovation and internationalisation, and their positive effect on business performance, especially for SMEs [Ipsmiller, Dikova, 2021]. The interdependence between innovation and internationalisation of enterprises was also confirmed by innovation indicators devised by OECD based on aggregate Eurostat data from 2018–2020 and other organisations for some CEE countries [OECD, 2023]. Among nine countries presented on Figure 1, the biggest shares of innovative enterprise are found in Estonia (62%), Czechia (56%), Croatia (54%), Slovenia (53%) and Lithuania (51%), while the lowest shares are in Bulgaria (34%), Poland (31%), Slovakia (31%) and Hungary (29%). What is more, Estonia is on the highest (16^{th}) position in the Global Innovation Index 2023 and the highest (9^{th}) position among European countries. The other analysed countries of the region score between 20^{th} and 30^{th} place in the ranking of European countries, in accordance with their economic development rate, except Bulgaria and Ukraine, whose innovation indices are higher than their economic development rates would suggest [WIPO, 2023]. In all the analysed countries the share of innovative firms operating on foreign markets in the total number of innovative enterprises was above 60% (in Poland it was 65%), and in two countries it exceeded 80% (81% in Estonia and 88% in Slovenia). It can be stated that innovative enterprises from CEE conduct mostly pro-active international expansion. In most countries, such as Czechia, Slovakia, Lithuania, Hungary, and Croatia, internationalised firms accounted for 60–70% of all businesses. Higher percentage of international enterprise was found only in Slovenia (86%) and Estonia (76%). It was the lowest in Poland (55%) and Bulgaria (49%). The share of innovative enterprises operating on foreign markets in the total number of internationalised enterprises was the highest in Estonia (68%),

in some countries of the region it was between 60 and 65%; in Bulgaria, Poland, and Slovakia it was 40–45%, with the lowest share in Hungary at 38%.

These rates show that CEE enterprises operating on foreign markets are at the same time innovative, although in the countries where the share of innovative companies is generally lower (e.g. Hungary or Poland), there are fewer internationalised firms [OECD, 2023].

Figure 1. Relationship between innovation and internationalisation of enterprises in some CEE countries in the years 2018–2020 (%)

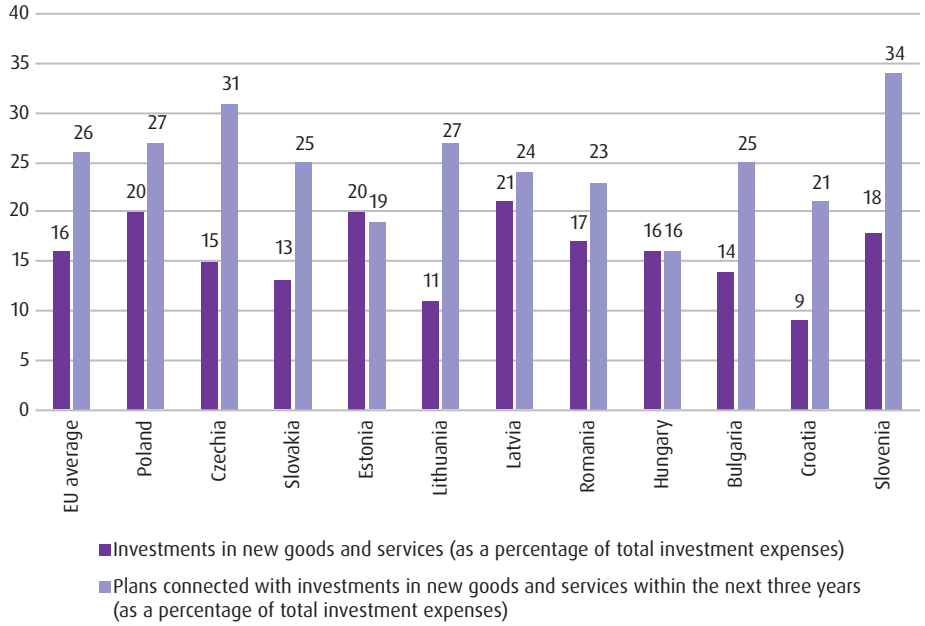


Source: Self-reported data based on OECD [2023].

Enterprises from CEE countries, especially in the sectors where the pressure to innovate is particularly high, should consider, while planning their international expansion strategies, measures aimed at development of both process and product innovations, or innovations that bring an organisation closer to the principles of sustainable development and the European Green Deal. According to data collected by the European Investment Bank [EIB, 2023], while enterprises from the CEE region introduce new innovations at a rate comparable to the EU average (26%), most of them, except businesses from Latvia, Lithuania, Slovenia, and Poland, introduce less radical innovation, i.e. innovations new for the country or the world, than EU average (13%). Yet it is this

kind of innovation that contributes to conquering new foreign markets. That is why internationalised companies that want to grow internationally should focus on introducing radical innovations. An example may be Vigo System, a company from Ożarów Mazowiecki in Poland, producing infrared photodetectors, which implements new, radically innovative products in cooperation with science centres in Poland, thereby substantially broadening its foreign expansion scope.

Figure 2. Investments in new products and services in 2022 and related investment plans for the next three years in enterprises from CEE countries that are members of the EU (%).



Source: Self-reported data based on EIB [2023].

Moreover, in order to gain sustainable competitive advantage on the international markets, CEE enterprises should allocate an adequately high share of its total investment expenses for new products and services. Figure 2 shows that the share was higher than EU average (16%) for business entities from Latvia (21%), Poland (20%), and Estonia (20%) In other countries of the region the share of financial resources allocated for investments in new products and services was closer to the EU average. Only in Croatia and Lithuania did companies allocate fewer funds (9% and 11% respectively), expressed as percentage [EIB, 2023]. In the next three years most enterprises from CEE intend to allocate approximately 26% of their expenses for investments in new goods and services, which is equal to the share declared by other companies

operating in the EU. The exceptions are Slovenia and Czechia, where businesses plan to spend more (34% and 31% respectively), and firms from Hungary and Estonia, which plan to lower their innovation investments to only 16% and 19% of total investments respectively [EIB, 2023].

Development of product and process innovations, especially ones that would bring measurable benefits from the CEE companies' expansion on international markets, gives the best effects when it is done in cooperation with other entities. Strategies that are conducive to innovation development are coopetition within a group of businesses from the same country or neighbouring countries, and cooperation with foreign providers or institutional buyers (both manufacturers and trade intermediaries), which may lead to gaining better insight in the requirements of a foreign market, and may be an incentive to implement innovations in an enterprise. A measure that should work for divisions/branches of transnational corporations is close collaboration with other companies within a business group (with the head office or other divisions/branches), especially with companies from highly developed countries, having access to cutting-edge technologies, world-class specialists and bigger resources allocated for research and development. Moreover, research carried out by OECD [2023] suggests that firms from CEE may develop and implement innovations in cooperation with national universities or science centres conducting R&D, and with non-profit organisation, using the expertise of scientists and other specialists in a given field. Unfortunately, enterprises in the region rarely apply these forms of cooperation. According to the OECD research, on average only 28% of innovative firms from CEE have so far undertaken any form of cooperation to develop innovations. In Estonia and Hungary the share was higher – 41% and 35% respectively, while in Latvia it was 21%, and 22% in Slovenia and Poland [OECD, 2023]. For instance a Polish chemical group, Ciech SA, has been intensively working on numerous projects and searching for inspiration using a policy of so-called open innovation, or cooperation with academic centres, scientists, or a crowdsourcing platform.

Summary

Considering the international business determinants discussed in the study, enterprises from the CEE region should take into account the following recommendations for their international expansion strategies:

1) in the case of negative perception of a CEE country or region on the target foreign market, it is advisable to apply strategies neutralising the negative country-of-origin effect, consisting in suggesting that goods come from positively perceived

countries/regions, and disguising the real country of origin, and also to support measures taken by state/municipal governments to improve the image of a certain country; moreover, it is recommended to choose an adequate strategy of entry on foreign market, connected with the decision to use or not use the brand of an enterprise, which may entail acquiring or licensing foreign brands positively perceived in a given country/region, or exporting products under brands of foreign producers or trade intermediaries;

2) using, also by SMEs, online tools and technologies in their expansion to foreign markets, both close and distant in geographical and cultural respects, including the use a website in foreign language or languages, as well as forms cross-border e-commerce, such as online intermediaries, multi-sided online platforms or own e-shops or e-platforms;
3) taking into account specific features of foreign markets, including cultural differences and profiles of target groups, companies should consider adaptation (localisation) of their enterprise/brand marketing communication on their websites, e-shops or social media accounts to the specific features of foreign markets (language versions, communication strategies, currency, etc.);
4) international expansion through cross-border e-commerce entails the need to adjust an e-shop to legal protection rules applicable to foreign consumers;
5) to reduce the risk of costly disputes abroad, an e-shop owner should proactively respond to negative comments and complaints of foreign customers, and offer consumers alternative, especially internet-based forms of solving disputes, so that they do not turn into legal proceedings;
6) a key legal issue from the perspective of brand owners is also their protection through previous registration of trade marks in countries where the goods are to be sold; the best solution is when registration covering the territory of future expansion is done before trademarks are used on the domestic market;
7) in the conditions of pressure to innovate, it is worth to consider cooperation with multiple partners (other enterprises, including suppliers, clients, but also science centres, R&D institutions and non-profit organisations), aimed at developing and implementing product innovations, especially radical ones, and thus strengthening competitive position on an international market, as well as coopetition with enterprises within a group of businesses from the same country or neighbouring CEE countries, or, in the case of enterprises belonging to foreign investors or being a part of transnational corporations, close cooperation with entities from a business group from a developed country;
8) in order to ensure adequate protection of developed innovations against their copying, enterprises should file patent applications not only in the Polish, but

also European Patent Office, before they introduce their innovative products on the community market; if they consider exports to markets beyond the EU, they should acquire knowledge about the possibility of innovative products protection on the target markets.

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INFLUENCE OF DEMOGRAPHIC AND SOCIOECONOMIC FACTORS ON HEALTH IN THE CONTEXT OF LABOUR MARKET OPERATION

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Abstract

The chapter examines the impact of demographic and socioeconomic factors on the health of workers in the Central and Eastern European countries, focusing on sickness absence and its implications for the labour market. Despite moderate sickness absence rates in Poland compared to other EU countries, the proportion of individuals reporting work-related health issues is the highest in the EU. The analysis reveals variation in sickness absence levels in the region, stemming from demographic, socioeconomic and psychosocial factors. Drawing on statistical data and scientific literature, the study identifies determinants of workers' health and their influence on the labour market. The conducted analysis leads to the formulation of research questions and recommendations for businesses to improve employee health and labour market efficiency. The integration of data from various domains of professional and social life allows for a comprehensive understanding of the situation and the identification of areas requiring further research and intervention.

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The study aims to assess the impact of demographic and socioeconomic factors on employee health in the countries of Central and Eastern Europe (CEE), as contrasted against other European Union (EU) economies in the context of labour market operations.

Poland stands out among other EU countries with its moderate rate of work absences caused by health issues. Simultaneously, the proportion of individuals reporting work-related health issues in the total number of employees is the highest in the EU. In the upcoming years the situation may lead to increased health absence rates, which can hamper the Polish labour market and employee productivity in particular. Analysis of high employee health risk factors is urgently needed to develop effective tools for protecting the wellbeing of professionally active individuals.

In a wider perspective, the presented study is expected to outline the impact of key health determinants among professionally active residents of CEE countries, as compared against other EU countries on the labour market, using an interdisciplinary approach and analysis of demographic and socioeconomic factors, as well as those related to lifestyle and access to the healthcare infrastructure. A vital part of the study focuses on assessment of the sickness absence levels among professionally active CEE residents and their implications for effective functioning of the labour markets in these countries.

In the paper, we strive to obtain answers to the following research questions:

1) What are the determinants of employee sickness absences in CEE countries?
2) Can we indicate any significant differences in the level of absences caused by an employee health condition in CEE countries compared to other EU countries and what might be the economic consequences of this fact?
3) What actions should employers take to mitigate the risk of work absence among their employees?

A thorough analysis of various factors combined with a survey of institutional environments of the selected countries will allow to recommend the best course of action helping companies reduce their health-related employee absences. Conclusions and recommendations postulated by this study should be also employed to plan actions for tackling problems of ageing populations and accompanying challenges on European labour markets.

Literature review

Some reasons for employee absence may be previously scheduled, e.g. a holiday leave or convalescence leave, others will be incidental like a sickness absence or time-off to take care of a family member. Sickness absences and their dynamics provide an indication of the healthcare system condition, overall social health levels and the labour market situation [Karczewicz, Sikora, 2022, p. 5].

European Foundation for the Improvement of Living and Working Conditions defines work absence as not being present at work during the scheduled working hours, except for the time of a planned holiday or other scheduled leaves [Eurofound, 2010]. The source of information on work absences are the surveys published by Eurostat, conducted among employees and employers. In Poland, statistics of work absence are based on the data from doctor's notes which are statements of a temporary unfitness for work.

To establish the scope of sickness absence, four basic indicators are being used: the absence rate, absence frequency, average time of duration and the Bradford Index combining the absence frequency and duration data [Stiker, 2013, p. 103]. Thanks to Bradford Index, short, unplanned absences can be identified (i.e. absenteeism) which are more harmful to business activity than the longer, scheduled time off [Mach, Madera, Kochańczyk, 2021, p. 59]. Work absences translate into costs of lost productivity and affect staff morale. It is paramount that companies monitor the level of absences and manage them accordingly. It should be also added that next to lost productivity resulting from absenteeism, a phenomenon of the so called presenteeism is observed when employees are ineffectively present at work [Rynekpracy.pl, 2024] despite sickness or

poor health. Both of these issues should be addressed by employers and make them care more about proper work culture and employees' wellbeing in the company.

Surveys conducted by the Social Security Institution (ZUS) on employee absences in Poland have found out that work absences are significantly correlated with terms of employment, nature of the job itself, psycho-social aspects and job satisfaction [Karczewicz, Sikora, 2022, p. 5]. In a regional perspective, particular absence indicators may reflect differences in the structure of the working population, including, among others, the proportion of women or elderly people in the workforce [Eurofound, 2010]. Literature on sickness absences documents an inverse relationship between the level of unemployment and work absences [Striker, Kusideł, 2018]. It is also the nature of the social security system that plays a role and the availability of such institutions as medical certificates (doctor's notes) and how they are applied in relation to gender, age and social class. Women, elderly individuals and manual workers tend to exhibit higher levels of absence in all countries of Europe [Begall, van Doorne-Huiskes, 2019, p. 14]. Interestingly, post-communist countries and countries of Southern Europe present the lowest scores in the index of exposure to mental health risks, which may stem from lower productivity levels in these countries, as well as from insufficient awareness of the work stress problems [Begall, van Doorne-Huiskes, 2019, p. 15].

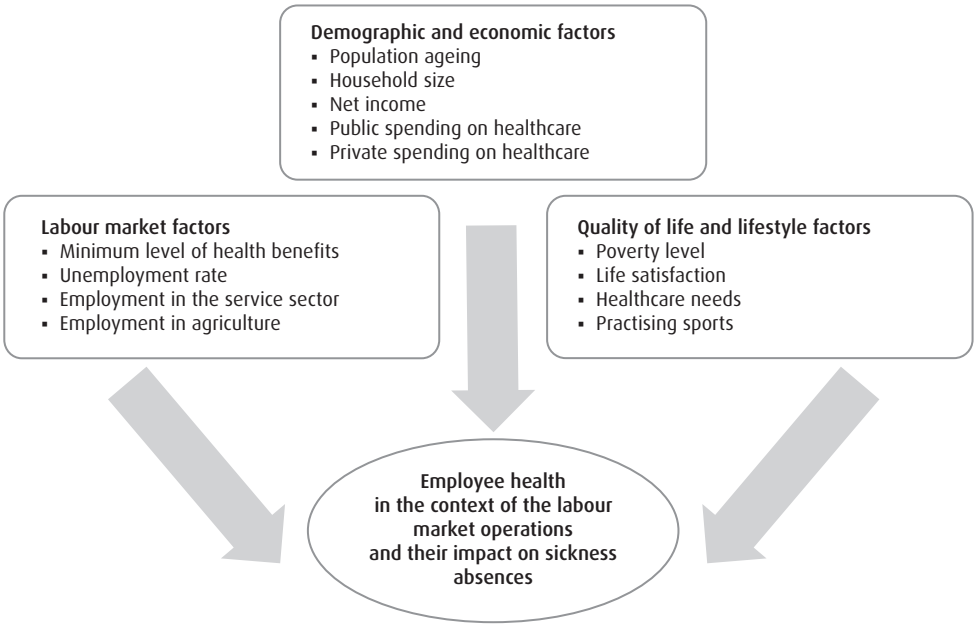
Factors affecting work absence are considerably diversified not only in terms of region, but also gender. For men, the most important is the body mass index (BMI), sense of job satisfaction or doing some physical activity, whereas for women more vital are aspects of the poverty risk, social exclusion, access to social security benefits or a long-term disease and health problems [Antczak, Miszczyńska, 2021].

To recap, the above mentioned factors affecting levels of the sickness absence index account for such health aspects as: self-assessment of health, subjective evaluation of life quality and living conditions, and death toll for some diseases, as well as socioeconomic factors including: demographic diversification of age and gender, household incomes, poverty index, unemployment rate, structure of employment according to PKD code classification and social structure according to the education level [Striker, 2013; Striker, Kusideł, 2018; Majcherek, Kowalski, Lewandowska, 2022].

Research methodology and data sets

According to the literature of the subject, there are 13 factors determining health of professionally active individuals on the labour market. These factors have been broken down into three groups: demographic-economic factors, labour market factors, lifestyle and life quality factors. Figure 1 presents a detailed list of factors.

Figure 1. Selected factors determining health of professionally active individuals in the context of their activity on the labour market



Source: Self-reported data.

In accordance with the proposed model, statistical data corresponding to the discussed variables were collected and aggregated at the level of particular countries and their groups.

Analysis of factors affecting the health of professionally active individuals in the context of their functioning on the labour market was performed in the following regions: EU-27 (all 27 countries), EU-13 (Bulgaria – BG, Croatia – HR, Cyprus – CY, Czechia – CZ, Estonia – EE, Hungary – HU, Latvia – LV, Lithuania – LT, Malta – MT, Poland – PL, Romania – RO, Slovakia – SK, Slovenia – SI), PIGS countries (Portugal, Italy, Greece and Spain) and EU-10 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden). When calculating averages for particular groups, weights based on the population number of each country in selected regions were adopted. Data sets, along with references to their sources, have been set out in the description for Table 2 included in the Appendix. A separate section in References has been also devoted to them.

In our study, the dependent variable is the level of work absences due to a health condition. Data on work absences due to a health condition from the European Health Interview Survey (EHIS) conducted in 2019 were used to illustrate this variable.

Demographic and economic factors are described using the following variables:

- population ageing – a proportion of population aged 50–64 based on Eurostat data of 2022,
- size of households – an average household size according to the European Union Statistics of Income and Living Conditions (EU-SILC) of 2022,
- net income – net income balanced by the purchasing power standard (PPS) according to the data from the European Union Statistics of Income and Living Conditions (EU-SILC) of 2022,
- public spending on healthcare – domestic expenditure of the public sector institutions and local governments on healthcare (% GDP) according to the data from the World Health Organisation (WHO) of 2022,
- private spending on healthcare – private expenditure (% of current expenditure on healthcare) according to the data from the World Health Organisation (WHO) of 2022.

Factors of the labour market are described by the following variables:

- minimum level of sickness benefits – a minimum level of the sickness benefit during the first 10 days of absence (% of compensation) based on the data from the Mutual Information System on Social Protection (MISSOC) of 2023,
- unemployment rate – unemployment rate according to Eurostat data of 2022,
- employment in the service sector – proportion of workforce employed in the service sector (%) according to Eurostat data of 2022,
- employment in agriculture – proportion of workforce employed in agriculture (%) according to Eurostat data of 2022.

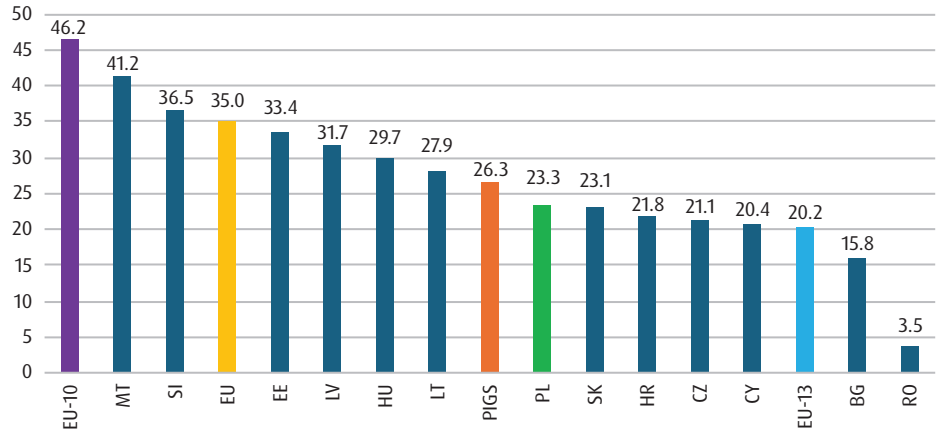
The last group of factors determining the quality of life and lifestyle is described by the following variables:

- poverty level – persons at risk of poverty or social exclusion according to the data from the European Union Statistics of Income and Living Conditions (EU-SILC) of 2022,
- life satisfaction – general life satisfaction (scale 0–10) according to the data from the European Union Statistics of Income and Living Conditions (EU-SILC) of 2022,
- healthcare needs – declared unsatisfied medical care needs due to long waiting lists according to the data from the European Health Interview Survey (EHIS) of 2019,
- practising sports – practising sports, staying fit, participating in recreational physical workout at least once a week (% of society) according to the data from the European Health Interview Survey (EHIS) of 2019.

Sickness absences in Poland as compared to EU countries

Sickness absence is a temporary unfitness for work due to own illness or taking care of a child or another family member [Karczewska, Sikora, 2024]. Statistics show that in Poland declarations of work absence due to a health condition account for 23.3%, significantly below the EU average of 35% (Figure 2). Similar levels are observed in Slovakia (23.1%), Croatia (21.8%) and Czechia (21.1%). The highest level of work absences due to a health condition is found in EU-10 countries (42.6%), as well as in Malta (41.2%) and Slovenia (36.5%), the lowest was recorded in Romania (3.5%). It is means that a group of countries of the "new" EU (EU-13), with an average of 20.2%, demonstrates a considerable diversification of the declared absence levels.

Figure 2. Work absences due to a health condition in 2022 – proportion of population aged 15–64 (%)



Source: Self-reported data based on Eurostat data [2022a].

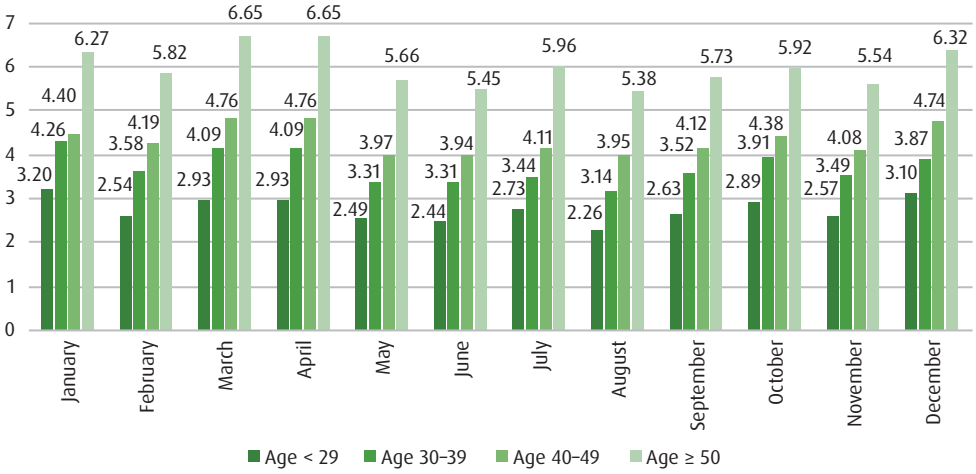
The average value of absences in Southern Europe's PIGS countries including Portugal, Italy, Greece and Spain amounts to 26.3%, well below the EU-10 average of 46.2%.

Drawing on the source data and Conperio analyses, the absence index in the studied companies in Poland, between January and December 2023 reached 6.6% in August and 9.2% in December, showing a considerable seasonality of the level of absences. Work absences in Poland visibly increase in winter months, which, on one hand, may be caused by the holiday season, on the other, by a higher level of seasonal infections. Conperio also points out to the problem of one-day sick notes falling particularly on Mondays and Fridays. It is a way in which employees seek to extend their

weekends or build a "bridge" to the nearest preceding or following day-off (so called holiday bridging).

Conperio analyses have also identified an upward absence trend in the age group of 50+ related to increasing health problems and long-term health conditions among employees (Figure 3). The lowest absence propensity was found among employees in the age group up to 29. There occur some significant regional discrepancies in the absence index in Poland, where the highest index is observed in Southern parts and the lowest in the Eastern territory of the country. It stems from unemployment levels, various employment sectors or a rural versus urban nature of the regions.

Figure 3. Sickness absence index in 2023 in the studied companies according to age groups (%)



Notes: Conperio's work absence index is calculated based on doctor's notes documenting sickness absences due to a personal health condition of the employee or the need to provide care to a family member; it does not include absences due to a holiday leave, quarantine, isolation or rehabilitation benefit.

Source: Self-reported data based on Conperio [2023]

Analysis of factors affecting employee sickness absence in CEE countries

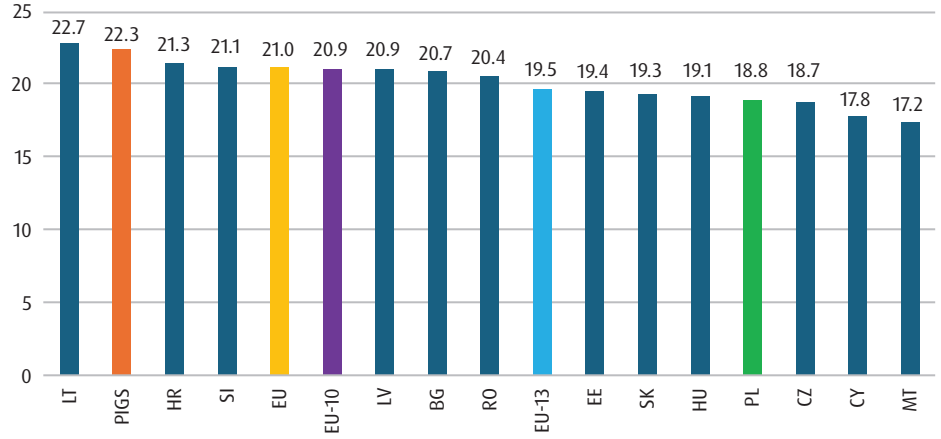
Demographic and economic factors

As underlined by numerous researchers, demographic and economic factors are significant determinants of employee sickness absence. The following elements among them can be singled out: population age, the average size of a household or average level of net income [Perez-Campdesuner, De Miguel-Guzman, Garcia-Vidal, Sanchez-Rodriguez, Martinez-Vivar, 2020, pp. 3–12; Striker, Kusideł, 2018]. Perfor-

mance of the most important demographic and economic factors in Poland and CEE countries as compared to other EU countries is outlined below.

Figure 4 presents a proportion of people aged 50–64 in the entire studied population in a given country in 2022. As can be seen, in Poland this share accounts for 18.8% and is lower than the average proportion in the EU which stands at 21.0%. Similarly, other country groups such as PIGS, EU-10, EU-13 are characterised by a higher percentage of the population aged 50–64–22.3%, 20.9% and 19.5% accordingly. It can be also observed that in particular countries of EU-13 the proportion of population aged 50–64 varies. Only three countries have a lower proportion of this population group than Poland: Czechia (18.7%), Cyprus (17.8%) and Malta (17.2%). In the remaining countries of EU-13 this share is higher and fluctuates between 22.7% and 19.1%.

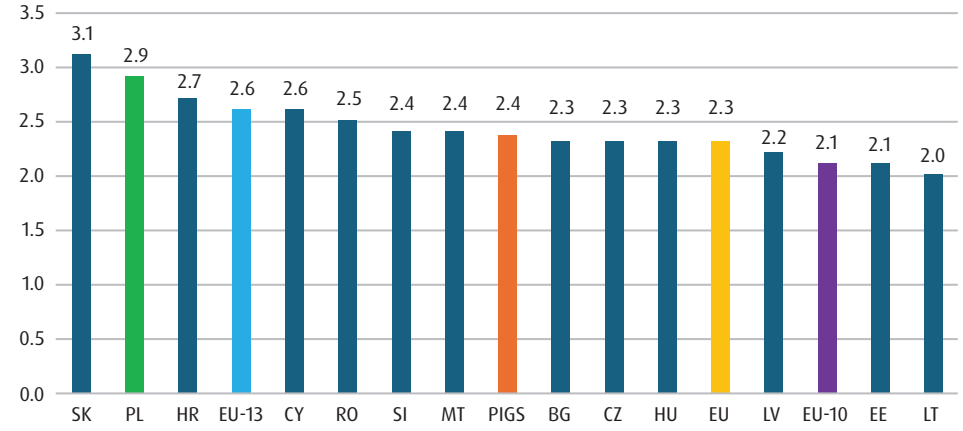
Figure 4. Proportion of population aged 50–64 in the entire studied population in 2022 (%)



Source: Self-reported data based on Eurostat [2024a].

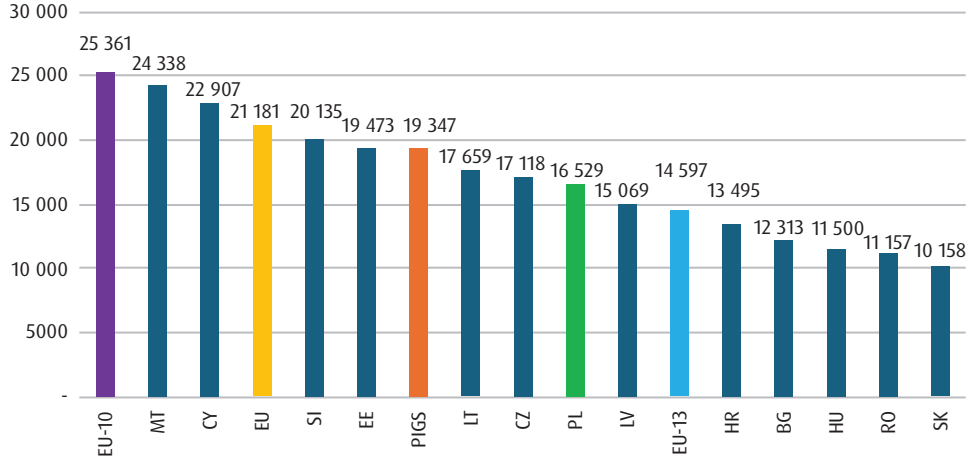
One of the factors determining the level of sickness absences is the average household size. Data presented in Figure 5 indicate that in Poland this value is relatively high and amounts to 2.9. Only Slovakia has recorded a higher average (3.1). In the group of EU-13 countries the average household size is 2.61. However, it is visibly diversified among countries and ranges from 3.1 (Slovakia) to 2.1 (Latvia). Also other groups of countries involved in the study possess a considerably lower average household size than Poland. An average household size in EU-27 countries reaches 2.30, in PIGS countries – 2.37, and in EU-10 countries – 2.11.

Figure 5. Average household size in European countries in 2022



Source: Self-reported data based on Eurostat [2024b].

Figure 6. Average equivalised net income (PPS) in 2022 (EUR)



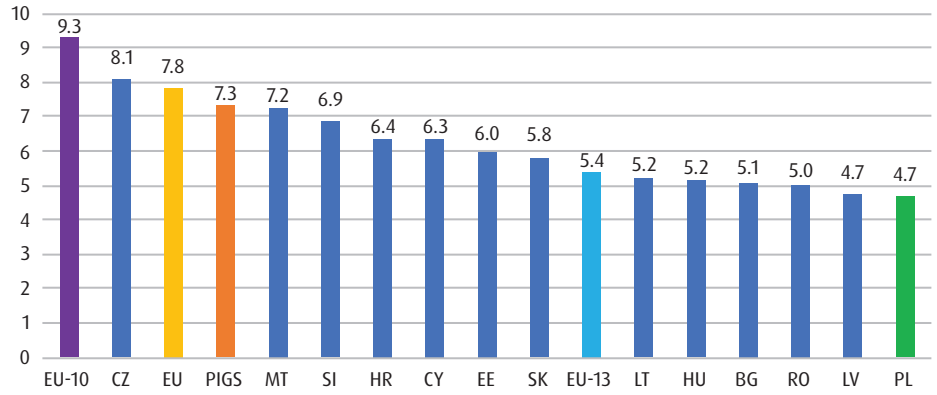
Source: Self-reported data based on Eurostat [2024c].

Data exhibited in Figure 6 prove that CEE countries enjoy a considerably lower average net income equivalised by the purchasing power standard as compared to other countries. It pertains to the average income recorded both in EU-27 and in Western European countries (EU-10), as well as in PIGS countries. In Poland, the average net income stands at 16,529 EUR and is higher than the average net income in EU-13 countries (14,597 EUR). The index also varies among individual countries.

Countries such as Slovenia, Estonia, Lithuania, Czechia, Latvia and Poland stand out among EU-13, due to their higher than average income rate. It should, however, be borne in mind that the value of average net income depends on many factors, e.g. the level of economic development or the structure of employment in various countries.

Another strong determinant affecting the labour market is the level of spending on healthcare in the government institutions and local government sector (expressed in % GDP). As can be observed, the situation in Poland in this respect is particularly unfavourable. In Poland, expenditure on healthcare amounts to 4.7% of GDP and is the lowest as compared against other countries in the study. In Western European countries this expenditure is twice higher than in Poland. The spending of domestic government and local government institutions on healthcare in Poland is significantly lower than the average in CEE countries (5.4%). Poland in this respect lags far behind such CEE countries as Czechia, Slovenia or Estonia. In these countries healthcare expenditure accounts for respectively: 8.1% (for the entire group), 6.9%, 6.0%, 5.8%. It indicates not only significant disproportions observed in CEE countries, but also a serious neglect in this area in Poland.

Figure 7. Domestic general health expenditure of the government and local government sector in 2020 (% GDP)

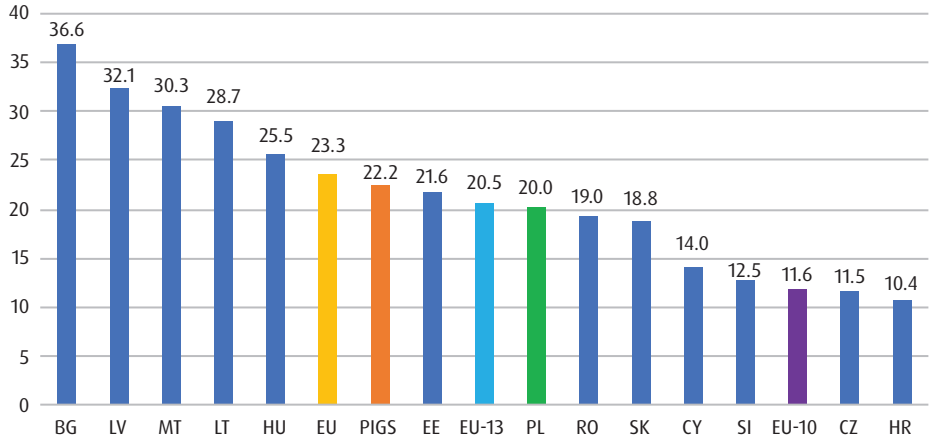


Source: Self-reported data based on WHO [2014].

Data set out in Figure 8 illustrate a large diversification in private (out-of-pocket) expenditure on healthcare in particular CEE countries. In Poland it accounts for 20.0% of the current spending on healthcare and does not divert significantly from average spending in CEE countries (20.5%). Yet, in Bulgaria, Latvia, Lithuania, Hungary and Estonia this expenditure is far higher than in Poland and amounts to accordingly: 36.6%, 23.1%, 28.8%, 25.5%, 21.6%. It can be seen also that the average level of

out-of-pocket spending on healthcare in CEE countries is lower than the same value in EU-27 countries and the PIGS group. However, as compared to Western European countries (EU-10), CEE countries' private spending on healthcare is higher. Such heterogeneity in private spending on healthcare stems from the adopted model of healthcare financing in particular countries and its role in the overall level of financing.

Figure 8. Out-of-pocket health expenditure as a proportion of the current health expenditure in 2020 (%)



Source: Self-reported data based on WHO [2014].

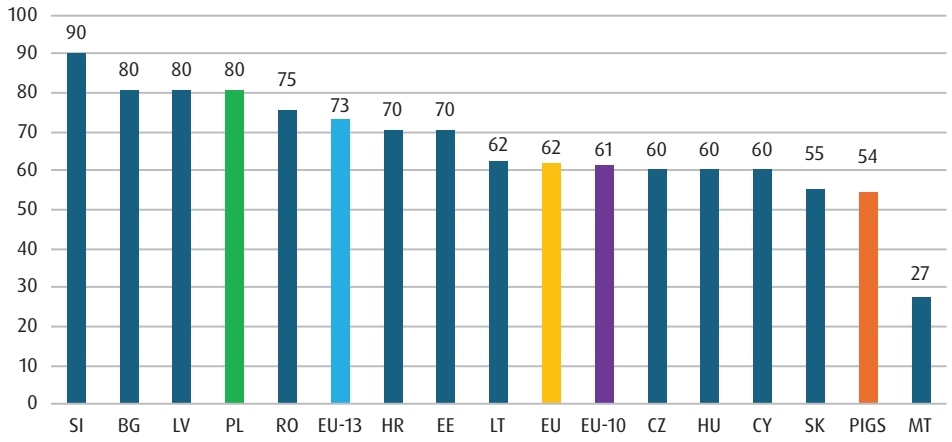
Factors of the labour market

In different countries there are versatile systems of sickness benefits designed to provide financial support to employees during their short-term sickness absences, relieving the financial pressure and allowing individuals to focus on recovery. It is key to strike the right balance between protecting employee and employer rights, and protecting the health and wellbeing of workers. All EU countries ensure access to sick leave and sickness benefits. The systems of compensation and sickness benefits vary in terms of qualification conditions and duration, and the rights granted under them may depend on whether a given person is employed, self-employed or unemployed [Spasova, Bouget, Vanhercke, 2016]. The value of minimum sickness benefit replacement levels during the first 10 days of absence (% of salary) have been presented in Figure 9.

Analysis of the data outlined in Figure 9 indicates a higher level of sickness benefit replacements granted during the first 10 days of absence in CEE countries (73% on average) as compared to Western European countries (61% on average), and Med-

iterranean countries in particular (54% on average). Countries with the highest value of this indicator are: Slovenia, Bulgaria, Latvia and Poland.

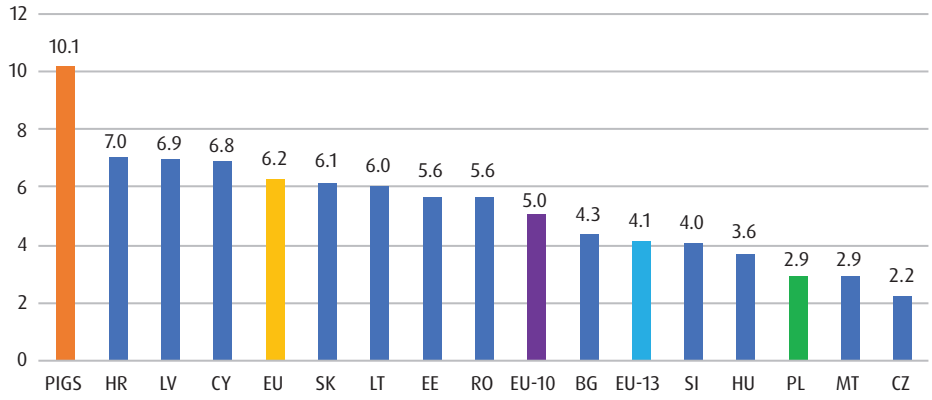
Figure 9. Minimum sickness benefit replacement levels during the first 10 days of work absence in 2022 (% of salary)



Source: Self-reported data based on MISSOC data [2023].

One of the key indicators applied in the analyses of economic and social differences between countries and regions in the context of the labour market situation is the unemployment rate [Floerkemeier, Spatafora, Venables, 2021]. It is a direct reflection of the level of economic activity and health in the region, and a low unemployment rate results usually from sound economic growth and stability. Impact of the unemployment rate and labour market situation on the health of populations has been the subject of numerous studies. Jin, Shah, Svoboda [1995] proved a tight relationship between unemployment and adverse health consequences, including higher general death toll, higher death toll due to cardiovascular diseases and suicide, more frequent reporting of symptoms and health conditions and a higher probability of using healthcare services. Also Janlert, Winefield and Hammarström [2015] found out a particularly unfavourable impact of long-term unemployment, even when cumulated in a short term, on deteriorating health and health behaviours. Meta-analysis conducted by Picchio and Ubaldi [2023] includes the findings of 327 surveys discussed in 65 articles published in reviewed scientific journals in the years 1990–2021 confirms that long-term unemployment can have harmful effects on employee health. Thus, a negative impact of unemployment on health, particularly on mental health aspects, was proved. The values of unemployment rate in EU countries are presented in Figure 10.

Figure 10. Unemployment rate in EU countries in 2022 (%)

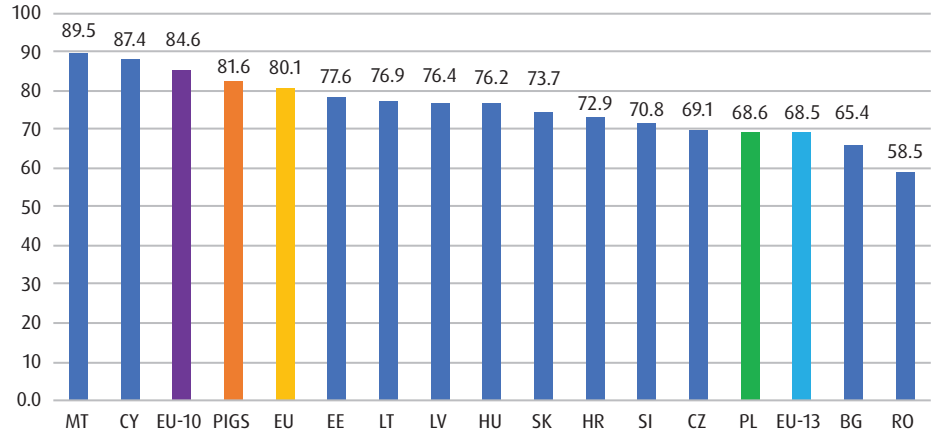


Source: Self-reported data based on Eurostat data [2024d].

Analysis of the data presented in Figure 10 indicates a lower level of unemployment in CEE countries as compared to Western European countries (EU-10), in particular to Mediterranean countries characterised by a low labour market elasticity. The lowest unemployment rate is found in: Czechia (2.2%), Malta (2.9%), Poland (2.9%) and Hungary (3.6%), the countries which joined the EU in 2004.

One of the key dimensions of economic growth is related to the structure of the economy, i.e. employment in services (tertiary sector), industrial production (secondary sector) and agriculture (primary sector). Economic structure evolves along with economic growth and development, the shift is usually from the dominant role of agriculture, through industrial production to services. This movement reflects changes in productivity, technological progress and changes in domestic as well as international demand [Herrendorf, Rogerson, Valentinyi, 2014]. Currently, a widely observed phenomenon is servitisation which stands for an expansion of the service sector in the economy, as well as stimulating the service functions in industrial production and agriculture. The observable changes in management practice lead to combining services and production. The traditional distinction between services and manufacturing gets increasingly more blurred. Industrialisation of services is on the rise, at the same time the service aspect in manufacturing is continuously boosted, often resulting from the adoption of new technologies. Services are more industrialised, which also leads to changes in traditional craft processes that start to resemble industrial processes [Kowalski, Weresa, 2020]. These changes signify a growing meaning of the service sector in terms of socioeconomic development. Figure 11 sets out data for the share of labour force employed in the service (tertiary) sector.

Figure 11. Share of workforce employed in service (tertiary) sector in 2022 (%)



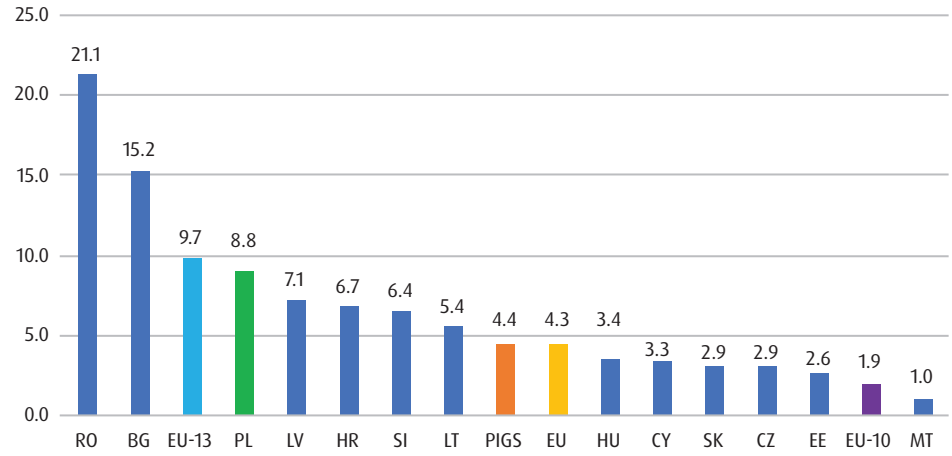
Source: Self-reported data based on Eurostat data [2024e].

Analysis of the data presented in Figure 11 indicates a lower proportion of the workforce employed in the service sector in CEE countries as compared to Western European countries, which is partly justified by the differences in the economic development stages and structure of the economy. Western European countries which have been through a full post-industrial transformation are characterised by a larger share of the service sector in their economies and employment. CEE countries, on the other hand, which began their economic transformation at the start of the '90 s of the 20th century, are still in the process of shifting from economies dominated by industrial production to more service-oriented systems. In their case, it is also agriculture that plays a vital part, both in terms of its share in the Gross Domestic Product (GDP) and in employment, which has been shown in Figure 12.

According to the data exhibited in Figure 12 in CEE countries the share of agriculture in employment is higher than in Western European countries. This pattern demonstrates differences in the economic structure, history of development and agricultural policies among these regions. In many CEE countries agriculture remains a crucial part of the economy because the process of industrialisation and servitisation is not as advanced there as in Western Europe. It is also caused by climate and soil conditions which are conducive to farming. In CEE countries there is a large number of medium and small farms which have survived the economic transformation. Contrary to numerous western countries dominated by commercial farms, lower scale of agricultural production in CEE countries frequently entails higher employment in the agriculture sector. Consequently, larger farms and more

automated agricultural production in Western Europe results in lower employment levels in the agriculture sector.

Figure 12. Share of workforce employed in agriculture in EU countries in 2022 (%)



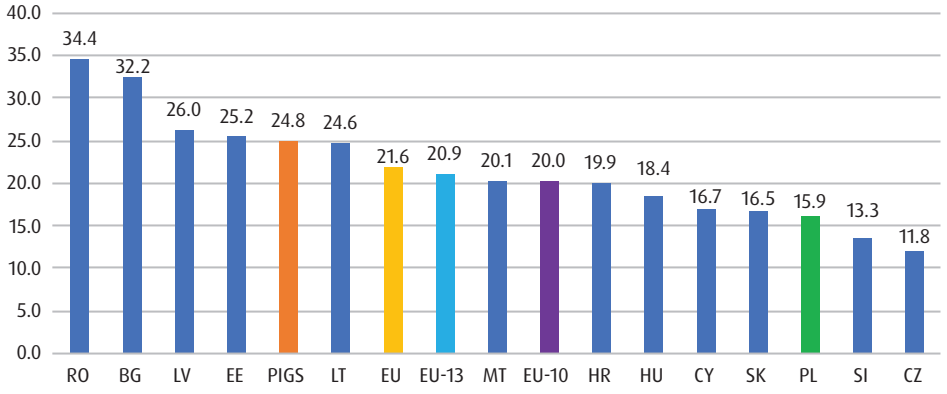
Source: Self-reported data based on Eurostat data [2024e].

Factors of life quality and lifestyle

Poverty may be defined as such material conditions in which a given individual is unable to satisfy their minimum needs [Panek, Podgórski, Szulc, 1999]. One of the factors exacerbating poverty is the previously mentioned unemployment which also results in a limited access to healthcare and education and increases social tension [Austin, Glaeser, Summers, 2018]. Poverty has a massive effect on the quality of life as it affects individuals, their families and the environment, leading to other social problems such as increased delinquency, physical and mental health issues and decreased social cohesion. In terms of citizens' wellbeing, the state and its institutions should be striving to ensure the conditions which allow residents to earn a sufficient income to meet their basic living needs and to encourage development which supports social integration, e.g. by promoting education and raising employment [Gasz, 2019].

Analysis of the data presented in Figure 13, showing the proportion of people at risk of poverty in a given society, reveals significant discrepancies between EU countries in this respect. An EU-10 average amounts to 20.0%, whereas the proportion in Romania reaches over 34.0%, and 32.2% in Bulgaria. In EU-13 the average stands at 20.9%, only slightly above the EU-10 average. The scores for Poland, Slovenia and Czechia look extraordinarily positive, with corresponding proportions of: 15.9%, 13.3% and 11.8%.

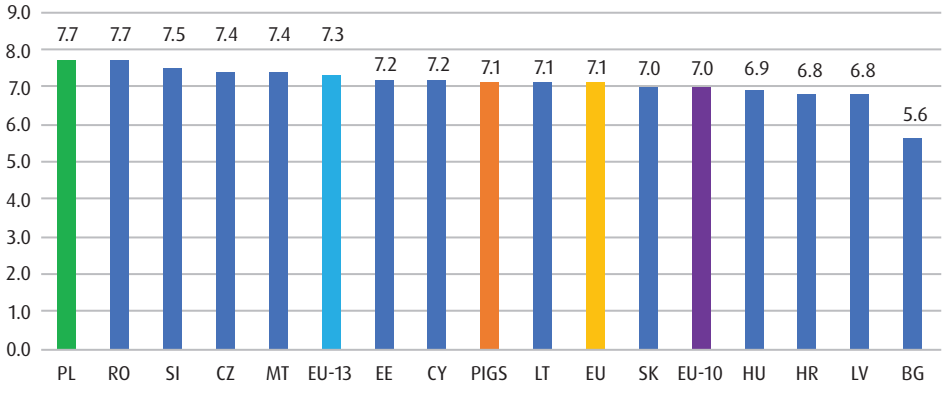
Figure 13. Persons at risk of poverty or social exclusion in EU countries in 2022 (% of the society)



Source: Self-reported data based on Eurostat data [2024f].

An interesting indicator presented in Figure 14 is the subjective assessment of individual general life satisfaction, studied on a scale of 0–10, where 0 stands for a complete lack of life satisfaction and 10 expresses full satisfaction. This indicator is one of the many elements in assessing individual wellbeing, other factors including: material conditions of living, leisure time, social interactions, economic and physical security, legal framework, the natural and life environment [Eurostat, 2023].

Figure 14. Overall life satisfaction in 2022 (on a scale of 0–10)*



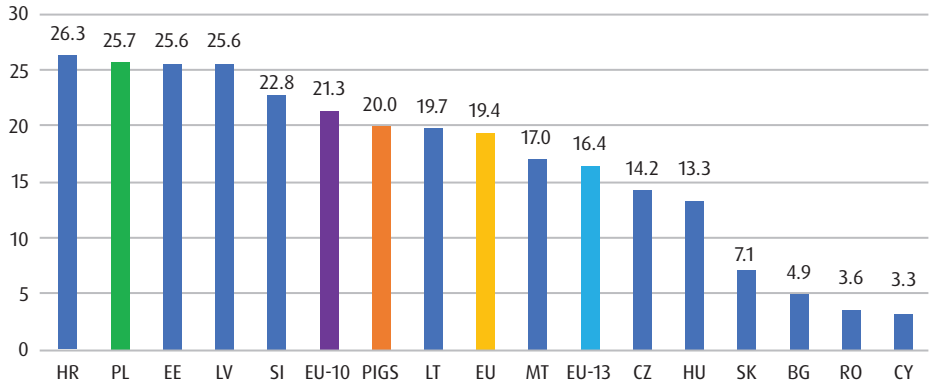
* "0" stands for a complete lack of life satisfaction, and "10" for a full life satisfaction.

Source: Self-reported data based on Eurostat data [2024g].

The subjective life satisfaction index remains at a relatively similar level in most EU countries, amounting to 7 for EU-10 and to 7.3 for EU-13. Poland's score of 7.7 out of 10 puts it at the top of the list.

Another factor affecting employee sickness absences is the level of self-reported unmet healthcare needs due to long waiting lists. A characteristic feature of the healthcare service sector is the fact that frequently the location of medical facilities does not correspond to the real demand for healthcare in a given region. The problem of imbalance between the distribution of suppliers and the local demand for healthcare services has been already identified by the Supreme Audit Office [NIK, 2019], yet analogical challenges tend to persist also in many other countries.

Figure 15. Self-reported unmet healthcare needs due to long waiting lists in 2019 (% of population)



Source: Self-reported data based on Eurostat data [2021].

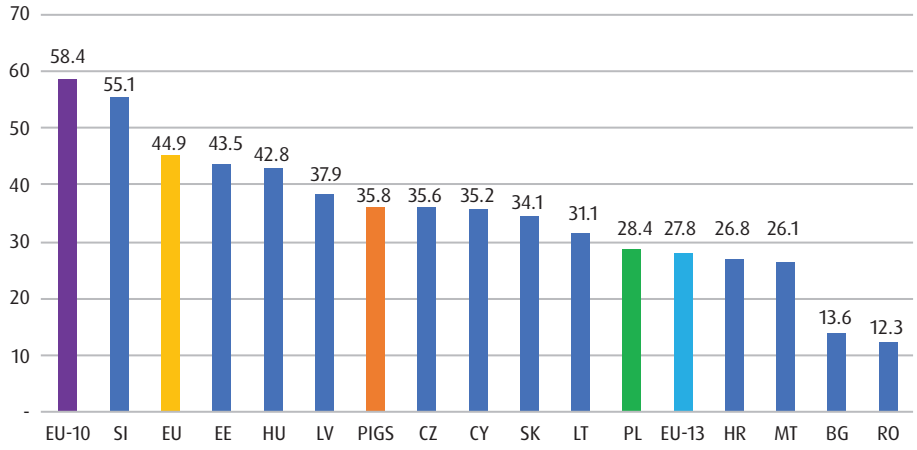
For this parameter, one more time large differences between the studied countries were revealed. The EU-10 average accounts for 21.3%, which indicates this figure to be a proportion of respondents who claimed long waiting lists to be the main reason for their inability to access healthcare services. The score for EU-13 looks a bit brighter and reaches 16.4%, the result for the PIGS group approximates EU-10 and stands at 20%. Poland ranks second on this list with its score of 25.7%, which proves that according to the opinion of every fourth patient in Poland, waiting time constitutes the greatest barrier to accessing healthcare services.

The last determinant of life quality and lifestyle is a regular (at least once a week) practice of doing sports and taking care of one's physical fitness.

In terms of this variable it should be highlighted that EU-10 countries achieve much higher scores than EU-13 countries – well over a half of respondents from

EU-10 (58.4%) declare to engage in regular physical activity, as compared to only 27.8% in EU-13. Results for the latter group are also highly diversified. The proportion of Slovenian residents who declare regular sports activity reaches 55%, whereas only 12.3% of Romanians state the same. Poland, with its score of 28.4%, ranks ninth among countries of the region.

Figure 16. Practising sports, keeping fit or participating in recreational physical activities at least once a week in 2019 (% of population)



Source: Self-reported data based on Eurostat data [2022b].

Summary and recommendations

The study aimed to establish determinants affecting sickness absences of employees from CEE countries, identify vital differences in the level of absences caused by a health condition in these countries as compared to other EU countries and their potential economic consequences, as well as strived to recommend the best course of action employers should take to reduce the risk of work absence among their staff.

Based on the conducted analysis, it can be stated that there exist major discrepancies in terms of the level of absences and their determinants not only among CEE countries, but also between particular groups of countries like EU-13, PIGS, EU-10 (specific sets of data can be found in Table 1 included in the Annex).

In the context of findings concerning employee absences it can be concluded that:

- according to EHIS survey data, the highest level of declared work absences is observed in EU-10 countries and the lowest in EU-13 countries; in general terms the level of absences is higher among women and urban residents;

- based on Conperio data and analyses of 2023, the absence index in companies in Poland was characterised by seasonality, a relatively high proportion of single days off, increased absence among employees 55+ as well as regional diversification; these factors suggest that although some actions supporting preventive practices should be implemented in a systemic manner, there exists no single universal approach to the problem of work absences and the right solutions should depend on the context of a given organisation's operations.

Having studied demographic and economic factors affecting employee health in the context of their functioning on the labour market, we may conclude that:

- population ageing measured by the proportion of people aged 50–64 in the entire population is one of the reasons for increased levels of absences; Eurostat's data indicate that Poland stands out in this respect among other EU countries, only three countries – Malta, Czechia and Cyprus have a lower share of the population aged 50–64 as compared with Poland;
- one of the factors determining the level of absences due to health reasons is the average size of households; this variable has different character in particular countries and ranges from 3.1 (Slovakia) to 2.1 (Lithuania); apart from Slovakia, both CEE countries and the entire EU demonstrate a lower average size of households; the index amounts to 2.9 in Poland;
- large diversity of average net income balanced by the purchasing power standard is observed; in CEE countries it is much lower than the average income recorded in EU-10 countries and PIGS;
- public expenditure on healthcare is one of the factors which may reduce absences due to a health condition; WHO data show a very unfavourable situation in this area in the Polish economy; expenditure on healthcare account here for a mere 4.7% of GDP, whereas in the entire EU and CEE countries the same spending amounts to 7.8% and 5.4% accordingly;
- the level of out-of-pocket spending on healthcare displays a very high differentiation level depending on the adopted model of financing healthcare; in CEE countries it is much lower than in Western European and PIGS countries; in Poland private expenditure on healthcare reaches 20% of the current spending on healthcare and does not diverge fundamentally from average outlays on this purpose in other CEE countries (20.5%).

On the other hand, the analysis of other factors and data related to the labour market leads to the following conclusions:

- CEE countries offer a higher level of sickness benefit replacements in the first days of work absence as compared with Western European countries; this approach allows for a greater financial stability of employees during short-term illnesses

and encourages a faster recovery, yet it may also give rise to some concerns about potential malpractices such as embezzlement of social security funds; this, in turn, may generate additional costs for employers and the social security system;

- in CEE countries the unemployment rate is lower than in Western Europe, which implies a more stable labour market and better use of the existing workforce potential;
- the shift from agriculture to industrial production and services in CEE countries is a slower process than in Western Europe; it reveals differences in the economic development and an unfavourable economic structure in the CEE region, which may adversely affect employment diversification and professional growth opportunities in those countries; a larger share of the agriculture sector with a simultaneous lower share of the service sector may hinder innovativeness and stifle these countries' attractiveness as modern investment targets, particularly in high-tech industries.

Analysis of the factors related to quality of life and lifestyle and their implications on employee health and functioning on the labour market allows to formulate the following conclusions:

- according to Eurostat data, the level of a poverty or social exclusion risk varies significantly among particular CEE countries and also among all EU economies; the problem is observable in Poland too, however it affects a much lower proportion of individuals than in Romania or Bulgaria;
- one of the social wellbeing indicators is the self-reported subjective index of life satisfaction, on a scale of 0–10; in most EU countries it remains on a similar level of 7 on average for EU-10 and 7.3 for EU-13; Poland looks favourable in this ranking with its 7.7 index;
- one of the important determinants affecting the quality of life is access to medical services; as proved by the data, in EU-13 countries the problem of long waiting time for a medical service is less frequently reported (16.4%) than in EU-10 countries (21.3%); in Poland the problem is experienced by one in four people, which is one of the highest scores among the studied countries;
- the level of physical activity declared by EU citizens is highly diverse; a strong positive correlation between frequently taken up physical activity and social wellbeing is visible; in Poland physical activity is practised at the level approximating the results of the entire EU-13 group.

As far as the data on declared work absences due to a health condition are concerned, it should be noted that the highest indices appear in highly developed countries of Western and Northern Europe. It implies a correlation exists between the level of absences in a given economy and its labour productivity, as well as institutional conditions of the labour market (such as the scope of and access to social and health insurance). For instance, findings of the panel study carried out in 18 European countries

by Bonato and Lusinyan [2004] indicate that generous social security programmes, where employers are not liable for costs, lead to an increased employee absence levels. Authors of the report prepared at the request of the European Commission [2016] point out that tightening the terms of social and health insurance availability, as well as slashing sickness benefit amounts brings down beneficiary numbers, which translates into fewer absences at work. It must be emphasised, however, that these changes encourage presenteeism, which not only hampers work productivity, but also exacerbates mental health issues, undermining the concept of "decent work" in European countries [Spasova et al., 2016].

According to Bonato and Lusinyan [2004] practices which lower the level of absences include: shorter working hours and flexible working, including a four-day working week, remote working, flexi-time or a longer holiday leave.

In Poland, for example, the concept of a four-day week is being deliberated. There are concerns, though, that implementing this solution may increase expectations about employee productivity [Kowalski, 2024] and put excessive pressure on work efficiency. Moreover, a lot of emphasis is put on quick return to work policies and follow-up benefits that can be used to change employee qualifications or organise rehabilitation. Principles used for sickness benefits should also involve a comprehensive prevention agenda, in particular when mental conditions are concerned [Spasova et al., 2016].

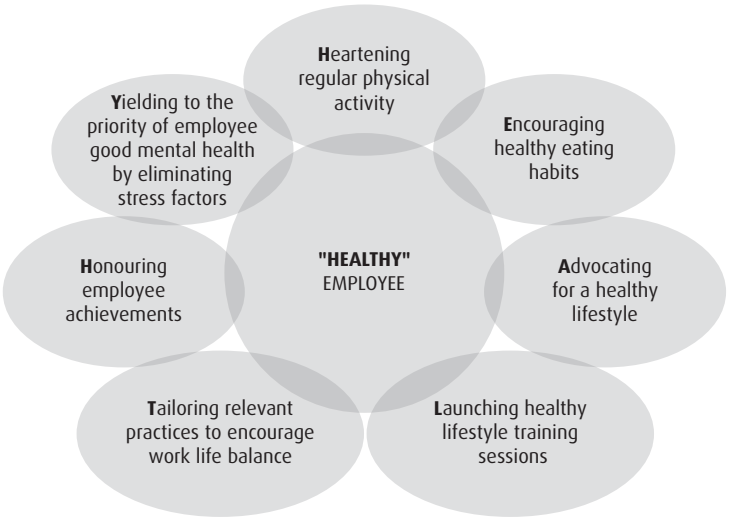
When the state increases healthcare expenditure and facilitates access to medical services, it becomes a key entity creating the environment that is conducive to protecting health, which directly affects the professional activity of employees. Expenditure allows not only to satisfy current health needs, but also to tackle long term problems, including the so called grand challenges of critical health and development issues, such as population ageing and civilisation diseases [Kowalski, 2022; Lewandowska, 2022]. Doubtlessly, a great opportunity for boosting the efficiency of healthcare systems lies in the application of digital technologies. Telemedicine solutions allow for a fast communication between patients and providers of medical services as well as data transfers (e.g. test results) between various players on the healthcare market, direct contact between patients and healthcare employees is also made possible. These solutions involve e-consultations, medical information networks, portable health-monitoring devices, integrated electronic cue-monitoring systems, helping patients quickly book a specialist doctor's appointment or medical examination date [Kowalski, Lewandowska, Majcherek, Poznańska, 2023]. Digitalisation increases the quality, availability and effectiveness of healthcare services, as well as helps reduce their costs [Majcherek, Hegerty, Kowalski, Lewandowska, Dikova, 2023].

Employers should promote higher public spending on healthcare and its digitalisation [Kowalski, Lewandowska, Majcherek, 2024]. Healthy employees are more

productive, which translates into better financial performance of companies. Moreover, investment in employees' health yields multiple returns, limiting the frequency of absences due to poor health. It should be observed that high quality and availability of healthcare services helps attract and retain talented workforce, which is of paramount significance on the dynamic labour market. Employers may conduct a social dialogue with decision makers in order to increase public spending on healthcare, support non-government organisations dealing in public health or take part in debates on reforming the healthcare system. Joint effort of employers and governments in particular countries may lead to an efficient implementation of strategies enhancing the health of CEE residents.

The conducted analysis reveals that the problems of employee absences and their reasons are a complex matter and finding relevant solutions which can quickly contain the issue and alleviate consequences is a gruelling task.

Figure 17. Agenda of the "HEALTHY Employee" programme



Source: Self-reported data.

At this point some constraints on the presented study should be stressed. The analysis does not involve such factors as housing conditions, aspects (and metrics) of the work-life balance or environment quality indicators (environmental pollution, noise levels, urbanisation indices) which may certainly expand the cognitive perspective. It could be interesting to include the data from the European Working Conditions Survey which measured the impacts of working conditions on employee wellbeing, or the influence of the COVID-19 pandemic on employee sickness absences which was

widely discussed in the literature of the subject [see e.g. Armenti, Sweeney, Lingwall, Yang, 2023; Goda, Soltas, 2023].

To conclude, it should be stated that alongside all the factors discussed in this study which bear macro-scale implications, it is the professionally active persons' closest environment as well as, or maybe first of all, employers that should initiate activities promoting healthy life style in order to reduce, in the longer term, the scale of work absences and their consequences. The authors put forward a programme called "HEALTHY Employee" which is aimed at promoting pro-health behaviours and has been shown in Figure 17.

The programme "HEALTHY Employee" is in principle universal and can be implemented in any organisation, irrespective of its size or financial resources. It strives to deliver on seven activities aimed at improving the physical and mental condition of employees, which in a longer term may translate into employee wellbeing, and in the economic perspective may allow to reduce absences due to poor physical or mental health.

The programme "HEALTHY Employee" involves the following activities:

1) **H**eartening regular physical activity by organising sports or fitness activities for employees. Offering encouragement in allocating time to physical activity can boost employee energy and productivity as well as improve their overall wellness.
2) **E**ncouraging healthy eating options in the workplace by providing fresh fruit and vegetables and healthy snacks. Ensuring easy access to healthy foods forms good nutrition habits and, in a longer term, contributes to employee wellbeing.
3) **A**dvocating for a healthy lifestyle by organising health-promoting campaigns, health challenges, fitness contests or good health days. These actions may boost employee awareness of the benefits of healthy living and motivate them to adopt healthy habits.
4) **L**aunching training sessions and workshops on healthy living, proper dieting and physical activity. Health education may help build employee consciousness of a healthy lifestyle and motivate them take up effective actions to improve personal wellness.
5) **T**ailoring relevant practices to encourage employees to maintain work-life balance. Offering flexible working hours or remote work options may help employees effectively manage their time and reduce work-related stress.
6) **H**onouring employee achievement of previously set health goals to inspire healthy habits. Applying a reward system that motivates employees to take up healthy habits may be an effective way of promoting healthy lifestyle in the workplace.
7) **Y**ielding to the priority of employee good mental health by eliminating stress factors in the workplace and popularising stress-relief techniques. Providing psycho-

logical support and organising training sessions on stress management may help employees better deal with professional and personal challenges.

* * *

We would like to express our heartfelt gratitude to the Polish consulting company Conperio which explores comprehensive problems of sickness absences and is the author of *Sickness Absence Barometer for 2023.* Conclusions formulated in the report allow to shed more light on some aspect of using formal doctor's notes (L4 notes) to document sickness absence; they also indicate tools that can be employed to manage sickness absences and eliminate malpractice, leading to the creation of a healthy work culture in companies.

Table 1. Summary of the study findings on demographic and socioeconomic factors affecting health in the context of labour market operation

Factors	Measure	Study Period	Database	Potential Impact on Employee Health	Poland vs. EU-13	Poland vs. PIGS	Poland vs. EU-10	EU-13 vs. EU-10	Highest Score in the Sample	Lowest Score in the Sample
Absence from work due to health reasons	% of population aged 15–64 years	2019	EHIS	not applicable: absenteeism measure	above	below	below	below	Malta	Romania
Demographic and Economic Factors										
Ageing of society	% of population aged 50–64 years	2022	Eurostat	with deepening phenomenon: potentially increased risk of long-term absence	below	below	below	below	Lithuania	Malta
Household size	country average	2022	EU-SILC	difficult to clearly indicate the direction of the relationship (largely depends on the number of children and household members e.g.. living with parents/grandparents)	above	above	above	above	Slovakia	Lithuania
Net income	average net income adjusted by purchasing power standard	2022	EU-SILC	difficult to clearly indicate the direction of the relationship (often related to the minimum level of benefits)	above	below	below	below	Malta	Slovakia
Public health expenditure	% of GDP	2020	WHO	with an increase: potentially reduced risk of absence	significantly below	significantly below	significantly below	significantly below	Czechia	Poland
Private health expenditure	% of respondent's health expenditure	2020	WHO	with an increase: potentially reduced risk of absence	below	below	above	above	Bulgaria	Croatia

Factors	Measure	Study Period	Database	Potential Impact on Employee Health	Poland vs. EU-13	Poland vs. PIGS	Poland vs. EU-10	EU-13 vs. EU-10	Highest Score in the Sample	Lowest Score in the Sample
Labor Market Factors										
Minimum level of sickness benefits	% of salary	2023	MISSOC	difficult to clearly indicate the direction of the relationship (often related to net income)	above	significantly above	above	above	Slovenia	Malta
Unemployment rate	% of population	2022	Eurostat	difficult to clearly indicate the direction of the relationship	below	significantly below	below	below	Croatia	Czechia
Employment in the service sector	% of population	2022	Eurostat	with an increase: potentially increased risk of absence	slightly above	significantly below	significantly below	significantly below	Malta	Romania
Employment in agriculture	% of population	2022	Eurostat	with high levels: potentially reduced risk of absence	below	above	significantly above	significantly above	Romania	Malta
Quality and Lifestyle Factors										
Poverty level	% of population	2022	EU-SILC	difficult to clearly indicate the direction of the relationship (often related to net income)	below	below	below	above	Romania	Czechia
Life satisfaction	scale 0–10	2022	EU-SILC	with high levels: potentially reduced risk of absence	above	above	above	above	Poland	Bulgaria
Unmet healthcare needs	% of population	2019	EHIS	with unmet needs: potentially increased risk of absence	above	above	above	below	Croatia	Cyprus
Physical activity	% of population	2019	EHIS	with regularity: potentially reduced risk of absence	above	below	significantly below	significantly below	Slovenia	Romania

Source: Self-reported data based on the conducted studies.

Table 2. Source of data used in the study

Specification	Absence	Demographic and Economic Factors					Labor Market Factors				Quality and Lifestyle Factors			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bulgaria	15.8%	20.7%	2.3	12 313	5.1%	36.6%	80.0%	4.3%	65.4%	15.2%	32.2%	5.6	4.9%	13.6
Croatia	21.8%	21.3%	2.7	13 495	6.4%	10.4%	70.0%	7.0%	72.9%	6.7%	19.9%	6.8	26.3%	26.8
Czechia	21.1%	18.7%	2.3	17 118	8.1%	11.5%	60.0%	2.2%	69.1%	2.9%	11.8%	7.4	14.2%	35.6
Estonia	33.4%	19.4%	2.1	19 473	6.0%	21.6%	70.0%	5.6%	77.6%	2.6%	25.2%	7.2	25.6%	43.5
Hungary	29.7%	19.1%	2.3	11 500	5.2%	25.5%	60.0%	3.6%	76.2%	3.4%	18.4%	6.9	13.3%	42.8
Lithuania	27.9%	22.7%	2.0	17 659	5.2%	28.7%	62.0%	6.0%	76.9%	5.4%	24.6%	7.1	19.7%	31.1
Latvia	31.7%	20.9%	2.2	15 069	4.7%	32.1%	80.0%	6.9%	76.4%	7.1%	26.0%	6.8	25.6%	37.9
Poland	23.3%	18.8%	2.9	16 529	4.7%	20.0%	80.0%	2.9%	68.6%	8.8%	15.9%	7.7	25.7%	28.4
Romania	3.5%	20.4%	2.5	11 157	5.0%	19.0%	75.0%	5.6%	58.5%	21.1%	34.4%	7.7	3.6%	12.3
Slovenia	36.5%	21.1%	2.4	20 135	6.9%	12.5%	90.0%	4.0%	70.8%	6.4%	13.3%	7.5	22.8%	55.1
Slovakia	23.1%	19.3%	3.1	10 158	5.8%	18.8%	55.0%	6.1%	73.7%	2.9%	16.5%	7.0	7.1%	34.1
Malta	41.2%	17.2%	2.4	24 338	7.2%	30.3%	27.0%	2.9%	89.5%	1.0%	20.1%	7.4	17.0%	26.1
Cyprus	20.4%	17.8%	2.6	22 907	6.3%	14.0%	60.0%	6.8%	87.4%	3.3%	16.7%	7.2	3.3%	35.2
EU-13	20.2%	19.5%	2.6	14 597	5.4%	20.5%	72.6%	4.1%	68.5%	9.7%	20.9%	7.3	16.4%	27.8
PIGS	26.3%	22.3%	2.4	19 347	7.3%	22.2%	54.1%	10.1%	81.6%	4.4%	24.8%	7.1	20.0%	35.8
EU-10	46.2%	20.9%	2.1	25 361	9.3%	11.6%	61.0%	5.0%	84.6%	1.9%	20.0%	7.0	21.3%	58.4
EU-27 (since 2020)	35.0%	21.0%	2.3	21 181	7.8%	23.3%	61.7%	6.2%	80.1%	4.3%	21.6%	7.1	19.4%	44.9

Sources and explanations:

1. Absence from work due to health reasons in 2019 (%) [Eurostat 2022a].
2. Percentage of the population aged 50–64 in 2022 (%) [Eurostat 2024a].
3. Average household size in 2022 [Eurostat 2024b].
4. Average net income adjusted by purchasing power standard (PPS) in 2022 (EUR) [Eurostat 2024c].
5. National government and local government health expenditure in 2020 (% of GDP) [WHO 2014].
6. Private expenditure in 2020 (% of current health expenditure) [WHO 2014].
7. Minimum level of sickness benefits in 2023 (% of net salary) [MISSOC 2023].
8. Unemployment rate in 2022 (%) [Eurostat 2024d].
9. Percentage of employees in the service sector in 2022 (%) [Eurostat 2024e].
10. Percentage of employees in agriculture in 2022 (%) [Eurostat 2024f].
11. Poverty rate in 2022 (%) [EU-SILC 2024].
12. Life satisfaction (scale 0–10) in 2022 [EU-SILC 2024].
13. Unmet healthcare needs in 2019 (%) [EHIS 2021].
14. Percentage of population regularly engaging in physical activity in 2019 (%) [EHIS 2021].

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INVESTMENT AND INNOVATION IN CENTRAL AND EASTERN EUROPEAN FIRMS – RECENT TRENDS AND THE PATH AHEAD[1]

Study of the European Investment Bank – Patron of the *Report of the SGH Warsaw School of Economics and the Economic Forum 2024*

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Introduction

The European Union has a competitiveness problem. It has not been able to keep the pace of growth of its peers, particularly the USA and China, in the last fifteen years. At the same time the EU member countries from Central and Eastern Europe (CEE)[2] have been successfully converging towards higher income levels; they were able to attract Foreign Direct Investments (FDI) and increasingly participate in the international supply chains. However, such a convergence process is losing steam and their competitive position needs to be upgraded.

Looking forward, the CEE member states face a number of mounting challenges: the proximity to the war in Ukraine, the exposure to carbon-intensive sectors (especially in the energy mix) and the ongoing transformation to a new technology-driven growth model. To avoid the risk of remaining in the so called middle income trap –

1 This study is based on the *EIB Investment Survey Country Overview 2023* for the CEE region [EIB, 2023]. For the full version of the report and for further information on the EIB's activities, please visit our website (www.eib.org). The authors would like to thank Federico Bonfio for the research support.

2 The classification of CEE countries covers: Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

when the labour cost advantages are eroded and the level of technological innovation cannot yet compete with the countries in the technological lead – the CEE countries need to move their specialisation patterns towards more knowledge- and technology-intensive functions. While notable progress has been made in such areas as digitalisation, energy efficiency, decarbonisation and supply chain reinforcement, the pace of change must accelerate in the region.

This study is largely based on the EIB Survey on Investment (EIBIS), administered every year since 2016, being a unique, annual survey of about 12.5 thousand firms across all EU member states and a sample of firms in the USA. The survey collects data on the firm characteristics and performance, past investment activities and future plans, sources of finance, financing issues and other challenges which the firms face, such as climate change or digital transformation. For the purpose of this publication, we present carefully selected results, which we believe are essential to guide the discussion on future competitiveness and growth of firms in CEE.

Generally, the investment gaps in the CEE region remain wider than in the European Union (EU): 78% of firms in CEE declare broadly adequate investment levels over the recent years (82% in the EU). On balance, firms in the CEE region remain pessimistic about short-term drivers and constraints to investment, although expectations have improved since EIBIS 2022 (the results of the survey in the previous year).

Our survey suggests that innovation activity in CEE is in line with the average of EU: more than 40% of firms in CEE developed or introduced new goods, processes or services as part of their investment activities, higher than EIBIS 2022 (35%) and in line with EU (39%). Over one in ten firms in CEE (12%) say the goods, processes or services were new to either the country or global markets, consistent with EIBIS 2022 and the EU average (13%). However, surveys typically paint a rosier picture of innovation than hard indicators, such as investments in R&D or patents. Several barriers to investment would have to be removed to foster innovation in the region, in particular the shortage of skills but also access to finance.

With digital technologies significantly transforming how innovation is created and diffused, the CEE region has been catching up: around two-thirds (65%) of the CEE firms declare to have used one or more advanced digital technologies, slightly below the EU average (70%). The most commonly used digital technologies in CEE are the Internet of Things (45%), robotics (45%) and digital platforms (37%). Improving the digital infrastructure could encourage the firms' investments in digitalisation [see EIB, 2024, pp. 143–186].

Uncertainty about the future (86%) and availability of skilled staff (79%) remain among the most frequently mentioned long-term impediments to CEE firms' investments.[3] These are also the main barriers for firms across the EU.

Climate change is increasingly perceived as a reality by firms in CEE. Nearly 60% say that the weather events have impacted their businesses, up from EIBIS 2022 (51%), although still below the EU average (64%). Four in ten firms in CEE (39%) have taken measures to build resilience against such risks, in line with the EU average. The most common measure taken by firms in CEE was to buy insurance products to offset climate-related losses (21%, higher than the EU average). Among firms in CEE, the share that had taken at least one measure was highest in Czechia (52%) and lowest in Hungary (20%).

The share of firms in CEE perceiving the transition to stricter climate standards and regulations as a risk is twice as high as the proportion seeing it as opportunity (38% and 18%, respectively), similar to EIBIS 2022. It differs from the EU overall, where 33% of firms see it as a risk and 29% as an opportunity. Within CEE, firms in Lithuania and Slovakia are the most likely to see the transition as a risk (47% and 46%, respectively), while those in Croatia and Estonia are most likely to see it as an opportunity (26% and 23%, respectively). Around nine in ten (91%) of the CEE firms declare to take actions to reduce their greenhouse gas emissions, although only a minority (35%) set and monitor relevant targets, which is lower than the EU average. The main actions taken by firms in CEE are waste minimisation and recycling (74%), followed by investments in energy efficiency (60%).

Internal financing still accounts for the largest share of finance of the CEE firms in EIBIS 2023 (70%), followed by external finance (26%). Following monetary policy tightening and deteriorating external finance conditions, firms in CEE are increasingly dissatisfied with the cost of finance. Since EIBIS 2022, the share of firms dissatisfied with the cost of external finance has increased from 7% to 15%, a pattern also seen in the EU as a whole. The proportion of CEE firms that are finance constrained (9.1%) has remained similar to EIBIS 2022 but also higher than the EU average (6.1%). Small and Medium-sized Enterprises are particularly affected, with the share of finance constrained SMEs at 12.8%. Within CEE, Romania (17.6%) and Latvia (15.0%) report the largest shares of financially constrained firms, while Czechia reports the lowest (3.4%). The loosening of monetary policy since the survey was conducted should gradually help reduce financing constraints for some borrowers. However, they are likely to remain a structural problem for younger, smaller, and innovative companies that have less collateral to offer.

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3 During the 2022 energy crisis, high energy costs were also a key investment obstacle (86% of firms).

The following parts of this study discuss in more detail the main issues laid out above. The following were characterised first: the investment landscape in CEE, the main investment trends, including existing investment gaps and investment obstacles reported by firms in EIBIS 2023, and the innovation potential of firms in the region with a special analysis diving deeper into the drivers and impediments of innovation, including availability of skills and innovation finance. The climate side of the investment was then discussed. Finally, we conclude with an overview of investment finance and its constraints.

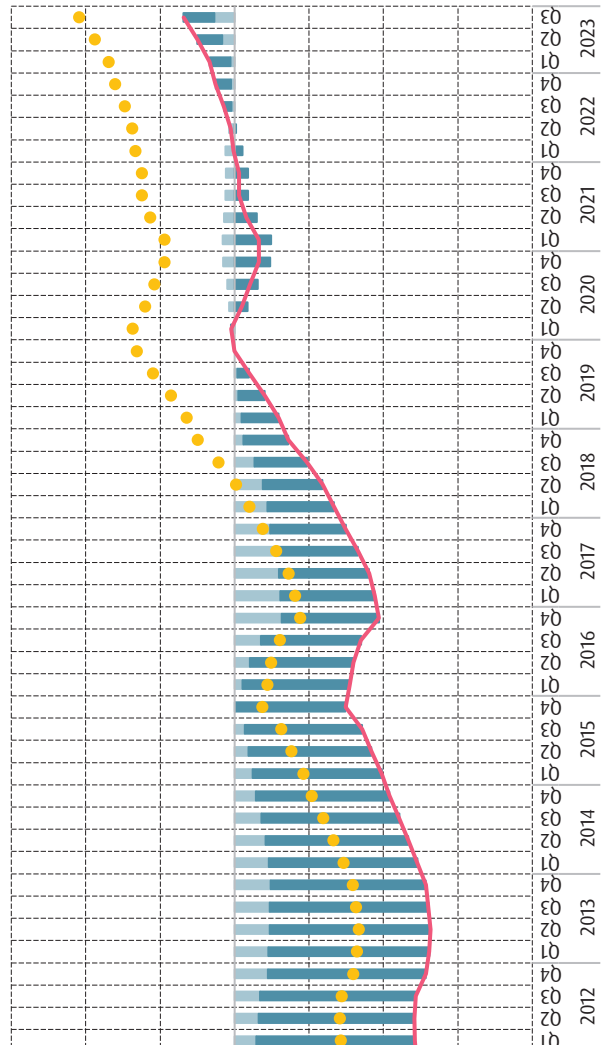
Investment trends in the CEE region

The Central and Eastern European (CEE) region has been successfully implementing and contributing to the European digital and green agenda due to its remarkable economic progress spanning the past three decades. Since the early 1990s, CEE has experienced rapid convergence across various indicators, including per capita output, productivity growth, technological advancements, and quality of life. This convergence has been primarily attributed to the capital accumulation channel, where tangible Foreign Direct Investments (FDIs) infused essential resources and technology, thereby enhancing output and facilitating the transition to a market-based economy.

However, the global financial crisis disrupted this channel in 2008, and resulted in a decade-long subdued investment effort in the region (see Figure 1). While investment reached the pre-2008 levels in 2018, the subsequent COVID-19 shock put yet another obstacle to capital accumulation. However, the investment continued the upward trajectory already in 2021 and has grown continuously ever since. As of Q3 2023, the real level of total investment in the region was 20% higher than at the end of 2008 and nearly 7% higher than at the end of 2019.

While private investment became a driving force behind the recovery in region's investment in 2021, the dynamics shifted in 2023. During that year, even though private sector continued to invest, it was the public sector that played a pivotal role in sustaining the investment momentum. The rollout of the Recovery and Resilience Facility (RRF) was an important component of this dynamics, supporting public infrastructure projects, strategic investments and targeted policy measures, aiming at enhancing productivity, fostering innovation, and supporting sustainable development (Figure 2).

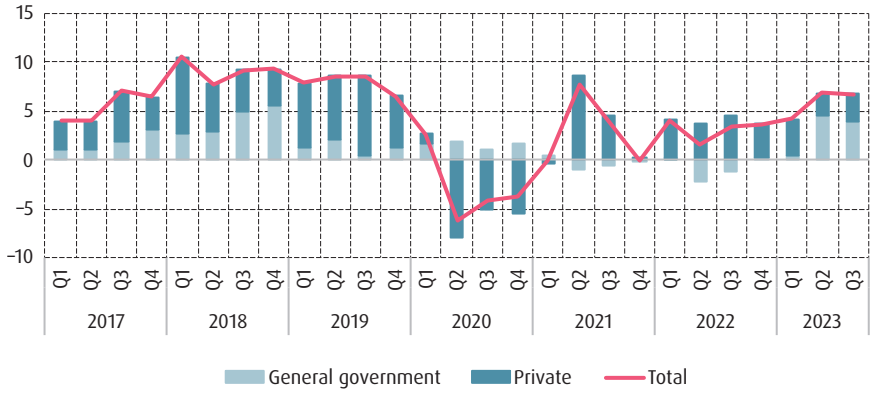
Figure 1. Cumulative growth rate in investment by sector (%)



Notes: The nominal GFCF source data for all CEE countries is non-seasonally and non-calendar adjusted. It was transformed into four-quarter sums and deflated using the implicit deflator for total GFCF (2015 = 100 EUR). The four-quarter sums of total real GFCF in 2019 Q4 and 2008 Q4 are normalised to 0 and plotted accordingly.

Source: Self-reported data based on Eurostat.

Figure 2. Annual growth rate in investment by sector (%)



Notes: The year-on-year growth figures based on the nominal GFCF source data for all the CEE countries, non-seasonally and non-calendar adjusted but deflated using the implicit deflator for total GFCF (2015 =100 EUR).

Source: Self-reported data based on Eurostat.

To gain deeper insights and to contribute to the ongoing policy discussions on future investment strategies, we delve into investment dynamics and firm-level obstacles using data from the 2023 EIBIS.

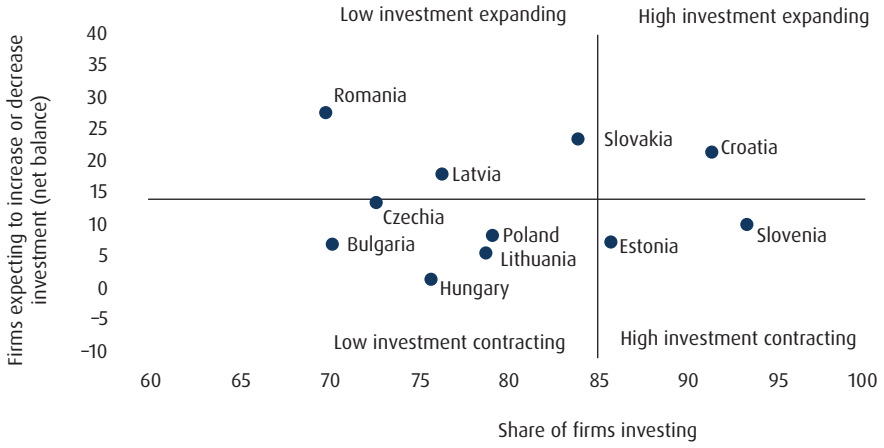
A shift towards technology-driven growth

Overall, firms operating in the CEE countries displayed a positive outlook on investment. A larger proportion of firms anticipate increasing investment (net balance of 11%), aligning with the EU average (net balance of 14%) and resembling the EIBIS 2022 results. While 78% of the CEE firms invested in 2022 (lower than the EU's 85%), large firms outpace small and medium-sized enterprises both in past investment (84% vs. 72%) and optimism for 2023 (net positive balance of 17% vs. 5%). Infrastructure companies lead the way, with a net positive balance of 23%. The CEE countries appear to be scattered around the investment cycle cross with investment rates ranging from 70% in Bulgaria and Romania to 93% in Slovenia (Figure 3).

The CEE firms allocated 45% of their investment to replacement in 2022, closely mirroring the 2021 figure from EIBIS 2022 (46%) and aligning with the current EU average (47%). Capacity expansion constituted approximately a quarter of total investment (26%), consistent with EIBIS 2022 (25%) and the EU average (24%). Investment in new goods and services accounted for 17% of the total expenditure, although the manufacturing sector reported a higher share (21%). Notably, Czechia (51%) and

Poland (49%) led in replacement investment, while Hungary (43%) saw the highest capacity expansion, and Latvia (21%), Estonia (20%) and Poland (20%) emphasised new goods and services (Figure 4).

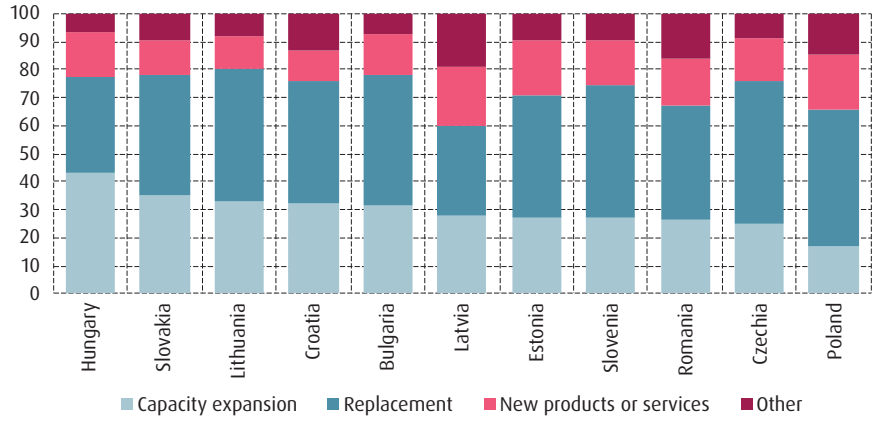
Figure 3. Investment cycle and evolution of investment expectations by country in 2023 (%)



Notes: Share of firms investing shows the percentage of firms with investment per employee greater than EUR 500. The y-axis line crosses the x-axis on the EU average for EIBIS 2023. Base for share of firms investing: All firms (excluding "don't know" / "refused" responses). Base for expected change: All firms.

Source: EIBIS.

Figure 4. Purpose of investment in the last financial year by country (%)



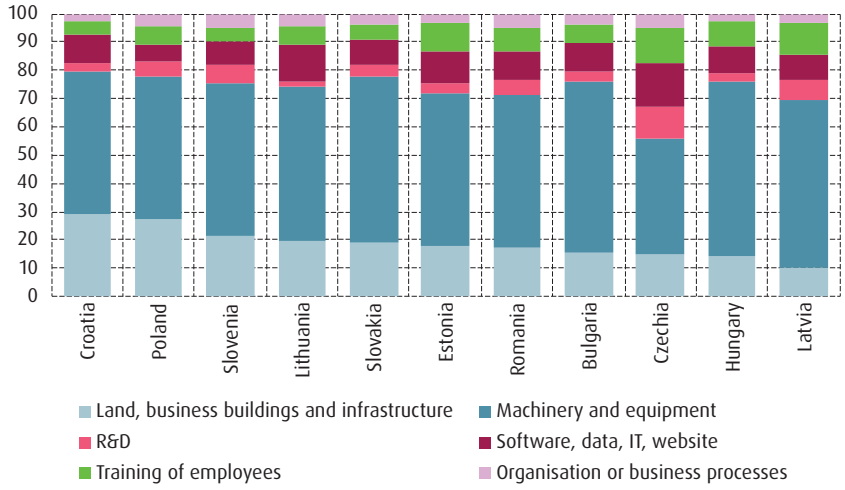
Question: What proportion of total investment was for: a) replacing capacity (including existing buildings, machinery, equipment, IT), b) expanding capacity for existing products/services, c) developing or introducing new products, processes, services? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

The CEE firms are actively investing in intangible assets, which accounted for 27% of total investment. While this aligns with EIBIS 2022, it is important to note that CEE commitment to innovation and development is driving progress. Although slightly below the current EU average (38%), this investment trend reflects the ongoing catching-up process in technology and innovation.

Investment patterns vary based on sector and business size. SMEs and service-oriented firms prioritize intangible assets, emphasizing research, software, and training. Meanwhile, tangible assets (such as land, buildings, and machinery) play a complementary role. Among CEE firms, Croatia (20%), Poland (22%), and Slovakia (22%) demonstrate the lowest shares of intangible investment. On the other end, Czechia (44%) and Latvia (31%) lead the way in embracing intangible assets, fostering a dynamic business landscape (Figure 5).

Figure 5. Specific investment areas by country (%)



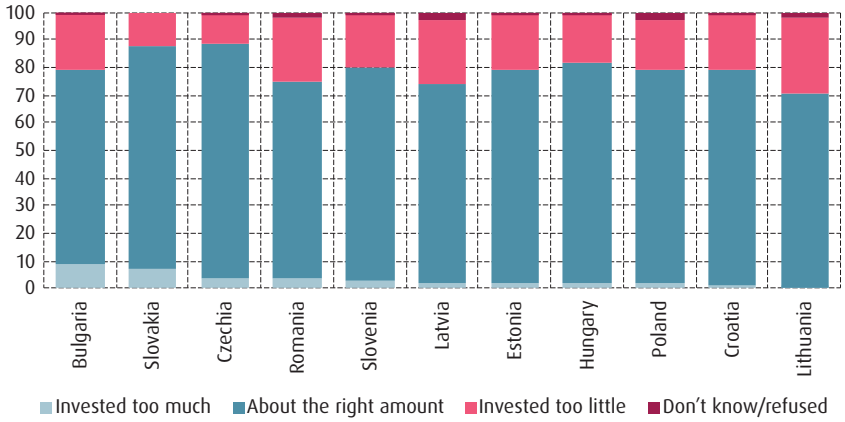
Question: In the last financial year, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

Overall, investment gaps in the region remain wider than in the EU with some 78% of firms in CEE declaring broadly adequate investment levels over the recent years (82% in the EU). The share of firms who declare they invested too little also surpasses the EU average (18% against 13%, respectively). Remarkably, only 3% report excessive investment, consistent with EIBIS 2022 and the current EU average. Infrastructure companies (24%) and SMEs (21%) express the most concern about insufficient invest-

ment. Notably, Lithuania, Romania and Latvia report the largest investment gaps (with 27%, 24% and 23% of firms having reported too little investment, respectively), while Bulgaria and Slovakia emphasise overinvestment the most frequently (9% and 7% of firms, respectively. Czechia (84%) stands out as the most adequate in the capital spending decisions (Figure 6).

Figure 6. Share of firms with an identified investment gap by country (%)



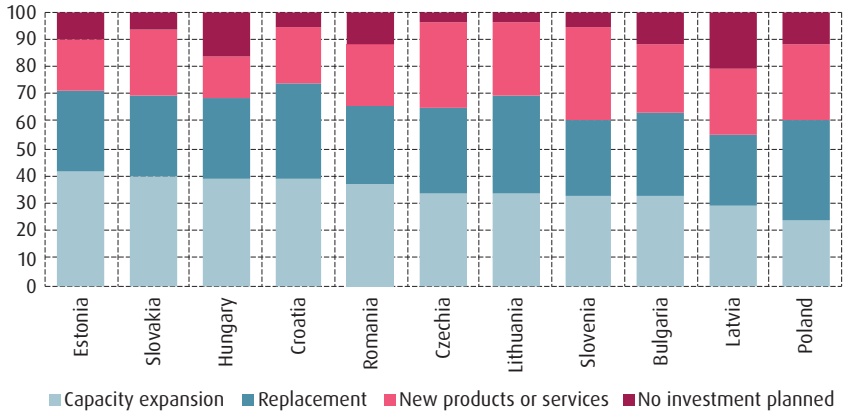
Question: Looking back at your investment over the last three years, was it too much, too little, or about the right amount? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

Firms in CEE prioritise investment in replacement (33%) for the next three years, surpassing EIBIS 2022 (28%). Meanwhile, the focus on capacity expansion (32%) and investment in new goods or services (26%) remains stable. Notably, only 10% of firms have no investment plans, lower than EIBIS 2022 (13%). Overall, CEE investment priorities closely resemble the EU average.

Within CEE, the manufacturing and services sectors lead in prioritising new product, process, and service development (30% and 28%, respectively). Construction firms are most likely to have no investment plans (16%). Across countries, Slovenia (34%) and Czechia (31%) emphasise innovation, while Latvia (21%) and Hungary (16%) have the highest share of firms without investment plans for the next three years (Figure 7).

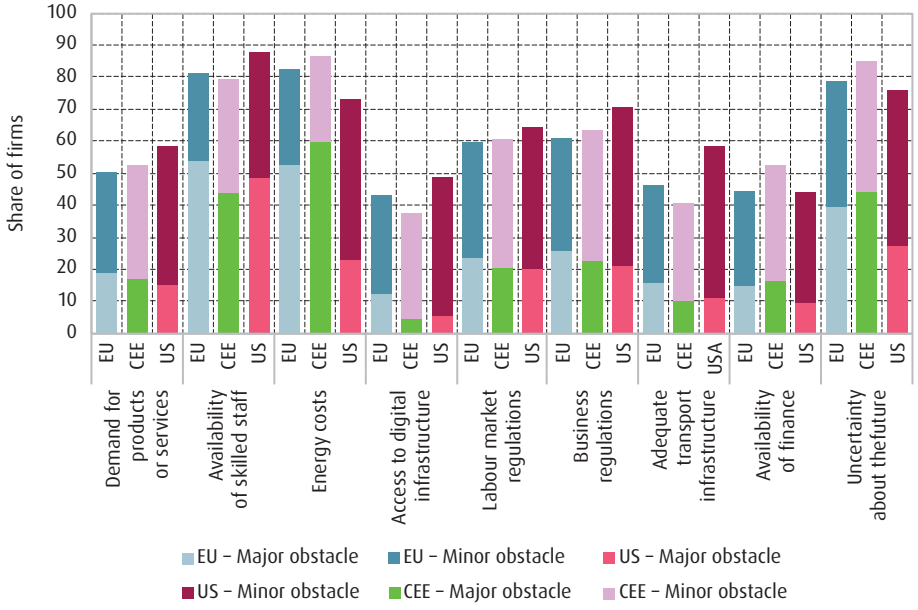
Figure 7. Share of firms declaring specific investment priorities for the future by country (%)



Question: Looking ahead to the next three years, which is your investment priority: a) replacing capacity (including existing buildings, machinery, equipment, IT), b) expanding capacity for existing products/services, c) developing or introducing new products, processes, services? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

Figure 8. Share of firms facing long-term barriers to investment (%)



Question: Thinking about your investment activities, to what extent is each of the following an obstacle? Is it a major obstacle, a minor obstacle or not an obstacle at all? Base: all firms (data not shown for those who said "not an obstacle at all" / "don't know" / "refused").

Source: EIBIS.

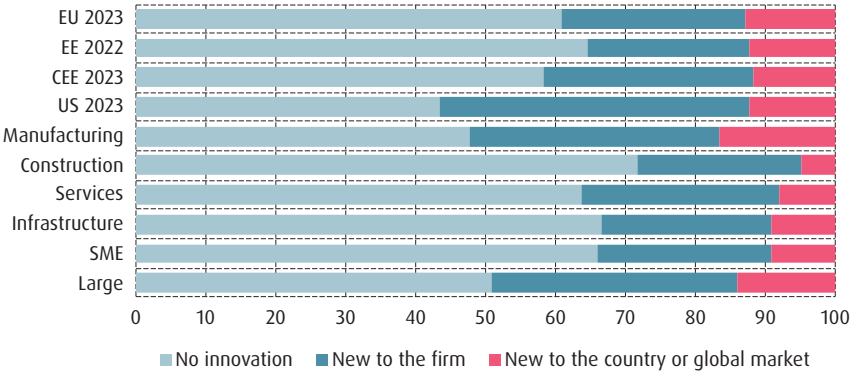
Overcoming the existing obstacles will be essential to bridge the existing investment gaps. The most frequently mentioned long-term barriers to investment in CEE are uncertainty about the future (86%) and availability of skilled staff (79%). Energy costs are also among the most frequently cited barriers to invest (86%), given the 2022 energy crisis and the associated effects on firms' financials. These results are similar to the EU averages (Figure 8). Firms in CEE are particularly likely to perceive energy costs as a major barrier (60%), to an even greater extent than firms in the EU as a whole (53%). Within CEE, manufacturing and services firms are more likely to regard energy costs as a barrier (both 90%), compared with construction and infrastructure firms (75% and 81%, respectively). The opposite applies to the availability of finance (60% and 58%, respectively, in the construction and infrastructure sectors, compared with 48% of services and 49% of manufacturing firms). In CEE, large firms are more likely than SMEs to report facing several obstacles, including energy costs, the availability of skilled staff, access to digital infrastructure and labour market regulations.

An untapped innovation potential

The CEE firms are, on average, just as innovative as their peers in the rest of the EU, according to the answers to EIBIS (Figure 9). Relative to the US, the CEE region as well as the EU as a whole, report in EIBIS less innovation. About two in five firms in CEE (42%) report that they developed or introduced new products, processes or services as part of their investment activities, higher than the share reported in EIBIS 2022 (35%) and in line with the EU average of 39%. Over one in ten firms in CEE (12%) report the development or introduction of products, processes or services that were new to either the country or global market. This proportion was the same as in EIBIS 2022 and matches the EU average (13%). The manufacturing sector has the highest share of firms that were investing in innovation (52%). Large firms were more likely to innovate than SMEs (49% vs. 34%).

Differences across countries are large, but should be treated with care, as results are volatile over years at the country level. In 2022, innovation levels were highest among firms in Czechia (55%), Slovenia (46%) and Poland (43%) and were the lowest in the relatively poorer countries Romania (35%) and Bulgaria (27%; see Figure 10). This is in line with what other surveys of innovation activities suggest as well. For example, in the EU's Community Innovation Survey, 23% of firms in Czechia replied that they had ongoing innovation activities, similar to the EU average of 22%, while only 1.3% of Romanian firms provided the same answer.

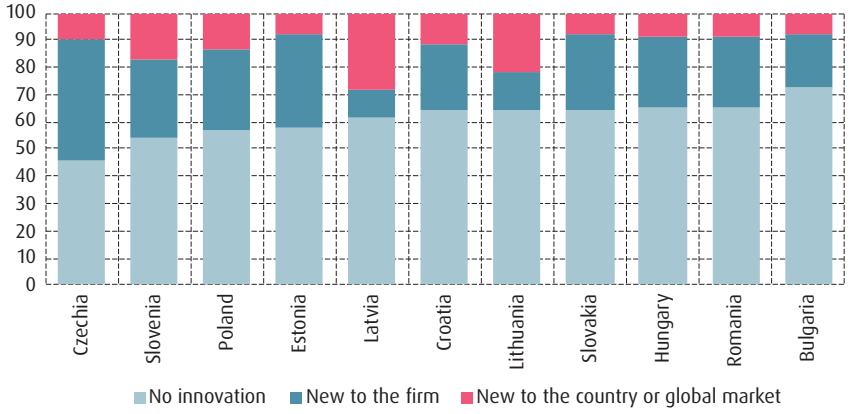
Figure 9. Innovation activity of firms by region, sector, and size (%)



Question: What proportion of total investment was for developing or introducing new products, processes, services? Were the products, processes or services new to the company, new to the country, new to the global market? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

Figure 10. Share of firms of specific innovation profile by country (%)



Question: What proportion of total investment was for developing or introducing new products, processes, services? Were the products, processes or services new to the company, new to the country, new to the global market? In the last financial year, how much did your business invest in R&D (including the acquisition of intellectual property) with the intention of maintaining or increasing your company's future earnings? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

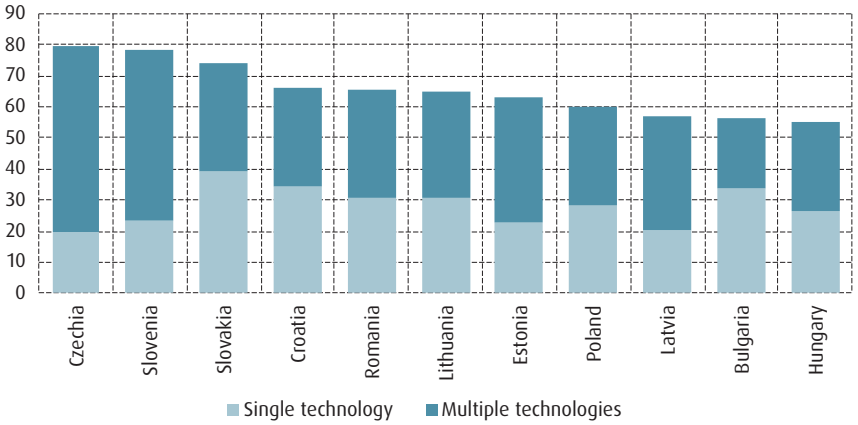
Source: EIBIS.

The survey results also suggest that the CEE firms use advanced technologies as much as their peers in the rest of the EU.

Overall, 65% of firms in CEE report using at least one advanced digital technology, similar to EIBIS 2022 but below the current EU average (70%). Firms in the manufac-

turing sector (73%) are the most likely to have adopted at least one digital technology. Only in construction (44%) were firms that used digital technologies in the minority. Large firms are more likely than SMEs to have adopted multiple technologies at the same time (47% vs. 28%). The digital technologies that firms in CEE are most likely to be using are the Internet of Things (45%), robotics (45%) and digital platform technologies (37%; see Figure 11).

Figure 11. Share of firms using advanced digital technologies by country (%)



Question: To what extent, if at all, are each of the following digital technologies used within your business? Please say if you do not use the technology within your business? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

Surveys generally paint a more optimistic picture of innovation in the region than measures of inputs to innovation, such as R&D expenditures, and of outcomes of innovation, such as firms' productivity and the number of patents filed in the region. Corporate R&D expenditures in the region have increased over the past three decades relative to GDP but they still constitute only a half of what firms spend in the North and West of the EU [Eurostat, 2024b]. In 2023, the entire region only filed 1585 patents with the European Patent Office (by residence of the first applicant). Firms in Germany alone filed almost 25 thousand patents during the same year. Furthermore, the labour productivity of firms in the private sector is at about half the EU average, which is also reflected in considerably lower wages [Eurostat, 2024a]. One reason for the discrepancy between survey results and macroeconomic statistics may be that the type of innovation conducted by the CEE countries is different, for example more related to changes in business practices. The development of these new practices might not

be booked as R&D expenditures and presumably would not result in patents. These patterns might take time to be reflected in productivity.

On balance, there appears to be significant room to raise innovation activities in the region. The key input to innovation is skills. When asked about their major obstacles to investment, innovative firms most frequently quoted a lack of skilled staff in almost all the CEE countries ahead of the pandemic and the energy price shocks in 2020 and 2021 [EIBIS, 2021, 2022]. While high uncertainty and high energy costs have taken the top position since then, highly educated staff are an increasingly scarce resource. The average unemployment rate of 25–64-year-olds with tertiary education declined from 4.9% in 2013 to 1.6% in 2023 [Eurostat, 2024c].[4]

Low investments in R&D in the public and higher education sectors, an apparent neglect of life-long learning and emigration are key reasons for the shortages of skills. Spending on R&D in the public sector and higher education is – at 0.46% of GDP in 2022 – just over half of the average in the West and North Europe, without much change over the past decade. Companies also appear to invest less in skills formation than their peers in the West and North of the EU.

There is some indication that the environment for learning and development appears to be worse on average in firms in the region. In manufacturing and business services (not in ICT though), firms employ relatively fewer staff in positions that allow a large share of time spent on cognitive tasks than in the West and North of the EU [Eurostat, 2022]. The difference is largest for employees with at most secondary education and disappears for those with tertiary education. It reflects the role that the CEE firms are currently playing in global value chains: a greater focus on production and less value added in development and post-production services.

Increasing the cooperation between firms and higher education institutions might stimulate corporate innovation. Universities excel at fundamental research and pioneering technologies while businesses excel at adapting new ideas to market needs. Combining the two strengths to guide research agendas and processes has long been recognised as a key driver of innovation. Surveys suggest that universities in the CEE region tend to cooperate less with businesses than their peers in the West and North of the EU (Figure 12a), leaving some room for improvement.

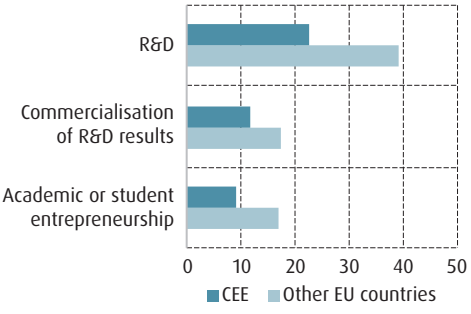
The factors holding back collaboration are cumbersome bureaucratic processes and a lack of funding from universities, businesses and the government (Figure 12b). Academics in the West and North agree on the bureaucratic processes but, instead of

4 A more direct measure of shortages might be vacancy rates of professionals and skilled technicians or service sector employees. However, except for Hungary, these data are largely missing.

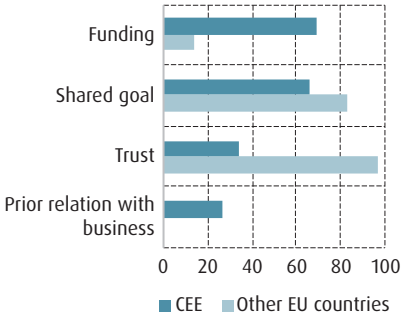
funding, they are more concerned about the different motivations of businesses and academics and their different time horizons.

Figure 12. Collaboration between universities and businesses

a) Extent of collaboration between business and universities in each group of countries (%)



b) Factors which make collaboration successful, most frequently quoted by academics', in each group of countries (%)



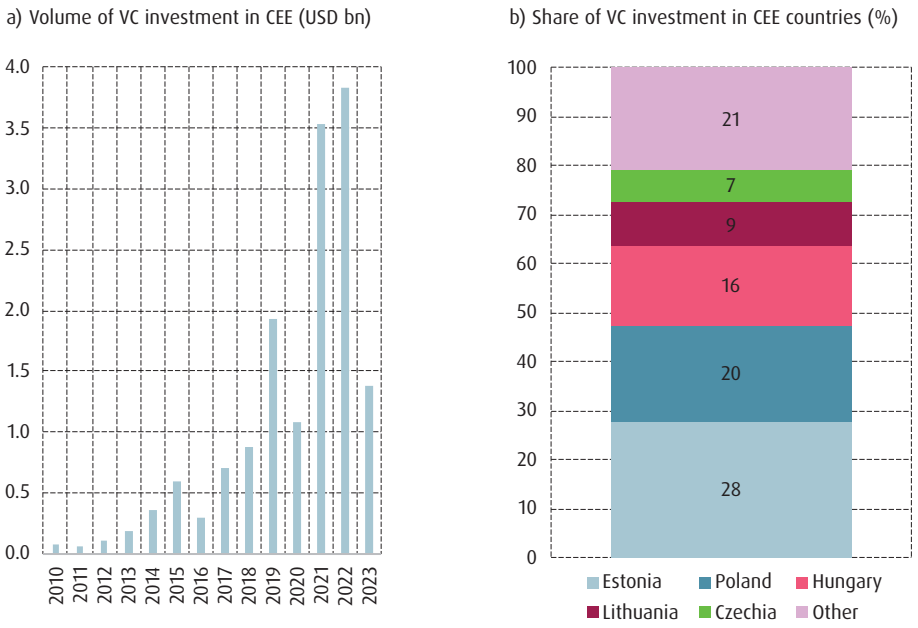
Notes: The bars show the share of academics that cooperated with businesses to a medium or high extent in the stated activity. The data are from 2017 and aggregated using GDP weights.

Source: European Union [2018].

Innovation, in particular of young firms, would benefit from a larger supply of risk capital, too. Payoffs from R&D tend to take time to materialise, if they do materialise at all. This type of activity is therefore frequently financed out of internal resources. The firms which tap external finance to fund R&D are typically large (with a portfolio of product at different stages in their lifecycle) or have physical assets in place that can be used as collateral. Young and small innovative firms need to rely on patient, risk-friendly investors that provide, for example, venture capital or venture debt.

Venture capital (VC) investments can be seen not only as a way to finance innovation but also as a proxy for the vitality of the startup environment, which is in turn very much related to the availability of risk capital. Apart from the decelerations of 2016, 2020 and 2023, VC investments have been significantly growing in the last decade in the CEE countries and have reached on average almost USD 3 bn a year in the last three years, compared to less than USD 1bn a year received in the previous decade (Figure 13a). The average size of each VC deal in CEE has been constantly increasing (around USD 2.3m in the last 3 years, while it was below USD 1 m on average in the decade 2011–2020). Still, an average size of VC deals is significantly smaller in CEE compared to North-West Europe and South Europe (close to USD 6.5m and USD 4m, respectively during 2021–2023).

Figure 13. Venture capital (VC) in CEE



Notes: Based on the total volumes between 2013–2023. Other countries include Croatia (6%), Bulgaria (4%), Romania, Slovakia and Latvia (3% each) and Slovenia (2%).

Source: Self-reported data based on Pitchbook data.

Among the CEE countries, Estonia takes the lion's share (28% of total VC funds in CEE countries in the decade 2013–2023), followed by Poland (20%) and Hungary (16%; see Figure 13b). The performance of Estonia is partially influenced by the later stage VC rounds of financing received by Bolt[5] (representing 45% of the total amounts received by Estonia in 2021 and 2022).

In per capita terms (ie. VC investments per capita on average during the last decade), Estonia is among the top EU countries. Among CEE countries, it is followed by Lithuania, Croatia, Hungary and Latvia, but most of CEE countries have a low level of per capita VC investment, signalling the need for additional risk capital to support the start-up environment in the region.

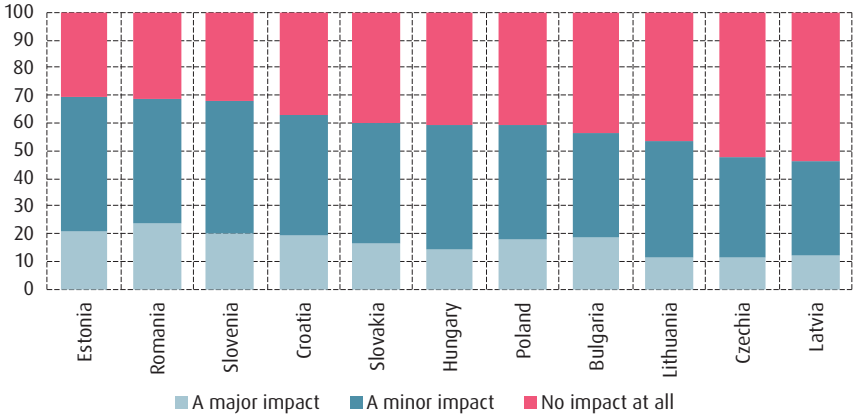
5 Bolt is a mobility company, offering ride-hailing but also food delivery, micro mobility (scooters, bikes) and carsharing services, which was founded in 2013 in Estonia. Bolt currently has 150 m customers in all countries. In recent years, the company received later stage VC rounds of EUR 120 m in 2020, EUR 600 m in 2021 and 628 m in 2022.

Climate change is not anymore a distant reality

Climate change is more and more visible in the everyday life of firms operating in Europe, having economic and financial implications. It is not any more an abstract concept but a tangible reality, with around three-fifths (59%) of firms in the CEE region reporting that the weather events had an impact on their businesses. This is up from EIBIS 2022 (51%), although slightly below the current EU average (64%).

The highest shares of firms reporting weather events having an impact to their business are in Estonia (70%), Romania (69%) and Slovenia (68%), while Latvia (46%) and Czechia (48%) have the lowest shares (see Figure 14).

Figure 14. Impact of climate change and physical risk by country in the firm's assessment by country (%)



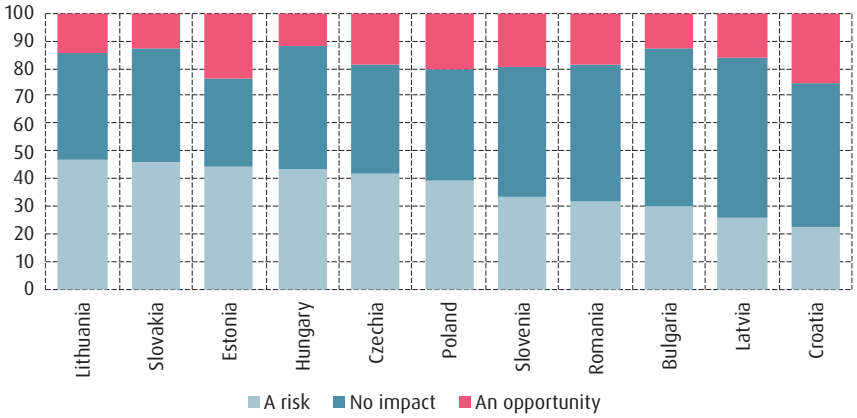
Question: Thinking about the impact of climate change on your company, such as losses due to extreme climate events, including droughts, flooding, wildfires or storms or changes in weather patterns due to progressively increasing temperature and rainfall. What is the impact, also called physical risk, of this on your company? Base: all firms (excluding "don't know" / "refused" responses).

Source: EIBIS.

The transition risk is of particular concern for firms in the region as well. It is generated by the actions taken towards a lower carbon economy, which make firms to change their businesses of production methods. Due to high shares of fossil fuels in power generation in CEE, and due to energy-intensive production methods, firms in the region are particularly exposed to this kind of risk. As a result, the share of firms in CEE seeing the transition to stricter climate standards and regulations as a risk is higher than those that see it as an opportunity (38% and 18%, respectively). This is in contrast to the EU as a whole, where there is a fairly even balance (33% risk, 29% opportunity).

Firms in the services sector are less likely than those in other sectors to see the climate transition as an opportunity (12%). Large firms are significantly more likely than SMEs to see the transition as a risk (42% vs. 34%). Firms in Lithuania and Slovakia are the most likely to see the transition to a net zero emission economy over the next five years as a risk (47% and 46%, respectively). Firms in Croatia and Estonia are the most likely to see it as an opportunity (26% and 23%, respectively; see Figure 15).

Figure 15. Impact of climate change and transition risk in the firm's assessment by country (%)



Question: Thinking about your company, what impact do you expect this transition to stricter climate standards and regulations will have on your company over the next five years? Base: all firms (excluding "don't know" / "refused" responses).

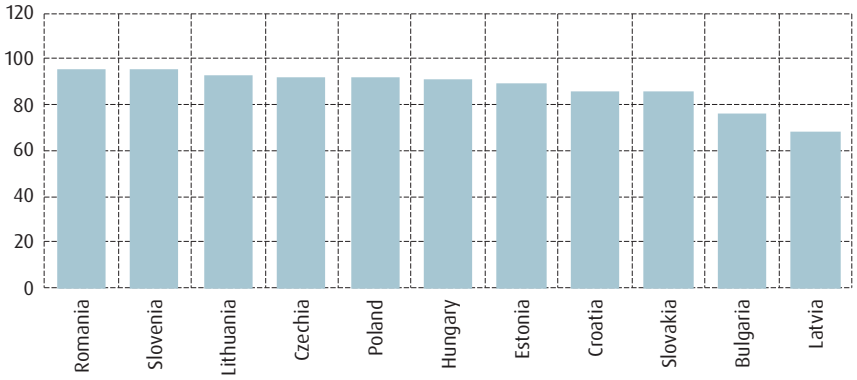
Source: EIBIS.

The CEE firms are taking action to bridge their economies and firms towards a greener business model. More specifically, almost 91% of firms in CEE take actions in order to reduce the Greenhouse Gas (GHG) emissions, similar to the EU average (89%). The main actions in CEE are waste minimisation and recycling (74%) and investments in energy efficiency (60%), which both increased compared to EIBIS 2022. Compared to the EU average, firms in CEE were less likely to be investing in or implementing sustainable transport options (36% vs. 46%). Across CEE, nearly all firms in Romania and Slovenia (both 96%) took action to reduce GHG emissions, while firms in Latvia (68%) and Bulgaria (76%) were the least likely to do so (Figure 16).

Around half (51%) of firms in CEE report that they invested in measures to improve energy efficiency in 2022, which is the same as the EU average, and an improvement compared with the figure recorded for CEE in EIBIS 2022 (39%). Among firms in CEE, those in the manufacturing sector (60%) and large firms (62%) are the most likely to have invested in energy efficiency. The figures are higher than in EIBIS 2022

in each sector, and for both large firms and SMEs. In the CEE region, Slovenia (58%), Hungary (58%) and Poland (55%) have the largest share of firms that invested in energy efficiency in 2022, while Bulgaria (36%) has the lowest share. The figures in many countries are higher than in EIBIS 2022, most notably in Lithuania (up from 20% to 41%; see Figure 17).

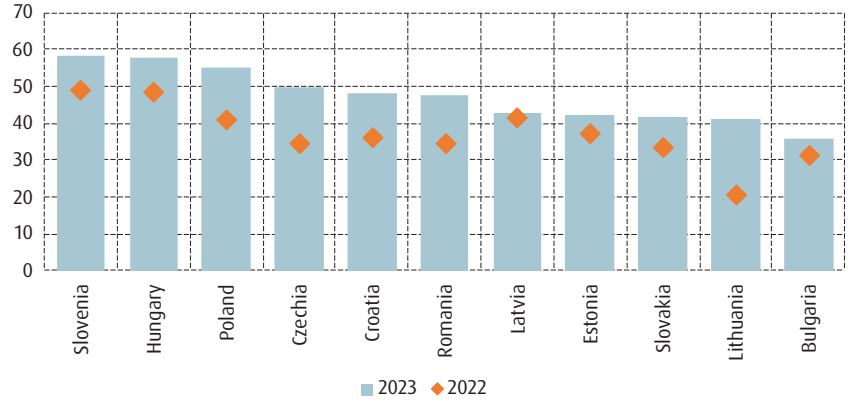
Figure 16. Share of firms taking action to reduce GHG emissions by country (%)



Question: Is your company investing or implementing any of the following, to reduce Greenhouse Gas (GHG) emissions? Base: all firms (excluding "don't know" / "refused" responses).

Source: EIBIS.

Figure 17. Share of firms investing in measures to improve energy efficiency by country (%)



Question: What proportion of the total investment in the last financial year was primarily for measures to improve energy efficiency in your organisation? Base: all firms (excluding "don't know" / "refused" responses).

Source: EIBIS.

Financing investments: intra-group, banks or internal finance?

The banking sector in Central Eastern Europe is dominated in a large part by a few big international cross-border banking groups, which control more than 50% of total banking assets of the region. In most of the countries, with the only exception of Hungary and Poland, the share of foreign banks is between 70% and 95% of total banking assets.

The CEE banking sector is well developed, and has been liquid, stable and profitable in the last years, following the harsh turbulences of the global financial crisis and the subsequent years. Loans to deposit ratios have stabilised, on average, between 70% and 80%, significantly lower than in the past. In particular, abundant liquidity from local deposits made the CEE banking markets more resilient and not any more dependent on foreign funding from headquarters of parent banks.

In the last two years banks benefitted from a traditional and solid business model, with high interest margins generated by higher lending rates (and relatively stable and low rates on sticky deposit accounts). Major groups operating in the CEE countries have been extremely profitable in recent years, both regarding the business in the region and in the home country. Profits of these banks more than doubled in the last two years, thanks to higher interest margins, which contributed for 85% of the additional profitability in 2021–2023.

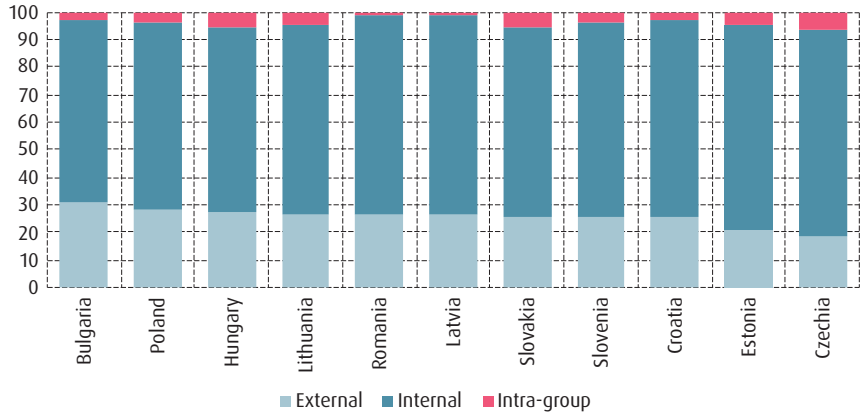
While the role of commercial banks is relevant in financing firms in the region, internal financing still accounted for the largest share of finance for CEE firms in EIBIS 2023 (70%), followed by external finance (26%). The use of intra-group financing made up, on average, 4% of overall investment by firms in CEE. All proportions are similar to EIBIS 2022 and are in line with the EU average (Figure 18).

In all sectors, over half of investment finance came from internal sources. It was highest in the construction and services sectors (77% and 78%, respectively). Infrastructure firms received the highest share of investment from external sources (31%), while manufacturers' investment finance was more heavily weighted than the other sectors towards intra-group funding (7%). Large firms financed a higher proportion of their investment than SMEs through external (28% vs. 24%) and intra-group finance (6% vs. 2%). In the CEE region, the share of external finance is highest in Bulgaria (31%) and lowest in Czechia (19%).

Just under half of firms in CEE (49%) which invested in the last financial year, financed at least some of their investment through external finance, which is higher than reported in the EU overall (43%). The share of firms which used external finance in the last financial year ranged from 54% in the infrastructure sector to 40% in the services sector. Large firms were more likely than SMEs to use external finance (53% vs. 44%).

More than half of firms in Poland (54%) financed at least some of their investment through external finance. The proportion was lowest in Estonia (36%; see Figure 19).

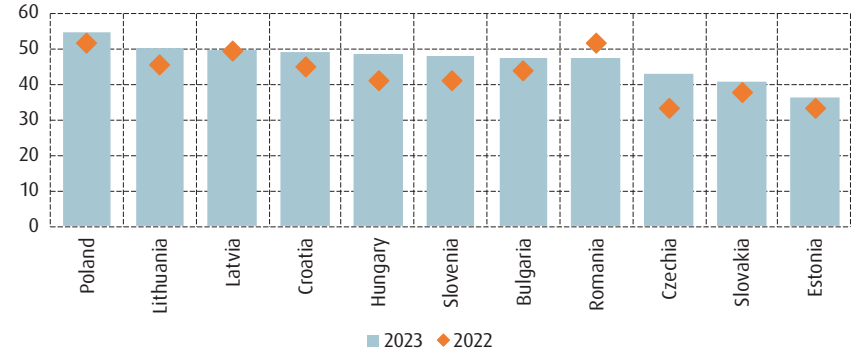
Figure 18. Source of investment finance by country (%)



Question: What proportion of your investment was financed by each of the following? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

Figure 19. Share of firms using external finance by country (%)



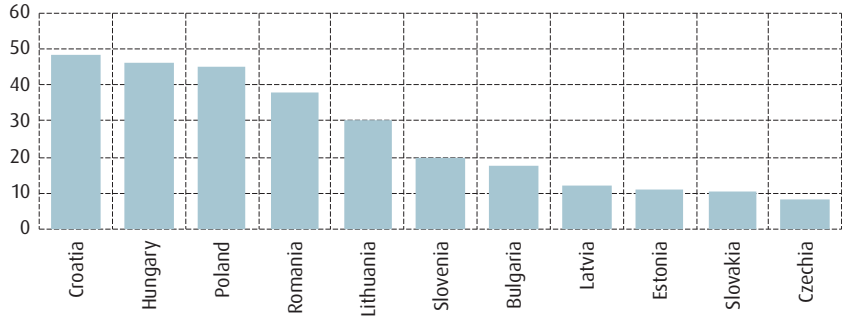
Question: Approximately what proportion of your investment in the last financial year was financed by each of the following? Base: all firms which invested in the last financial year (excluding "don't know" / "refused" responses).

Source: EIBIS.

A third (33%) of firms in CEE using external finance received grants. It is related to the use of EU funds, vehiculated via the banking sectors in various forms (lending, guarantees, grants). In CEE this proportion is two times higher than the EU, on average (16%). Firms receiving grants in CEE finance 36% of their investment in this way.

There are large differences across the CEE region in the share of firms which received grants as part of their external financing, the highest in Croatia (48%), Hungary (46%) and Poland (45%), and the lowest in Czechia (8%), Estonia (11%) and Slovakia (11%; see Figure 20).

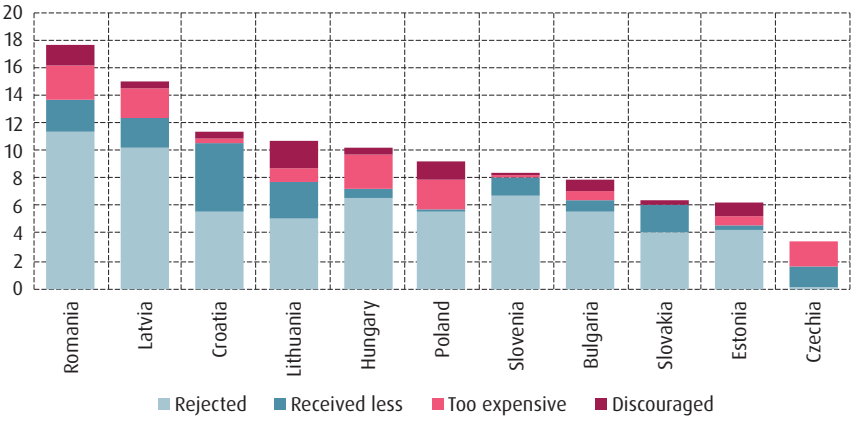
Figure 20. Share of firms with finance from grants by country (%)



Question: What proportion of your total investment in your last financial year was financed by grants? Base: all firms which received grants (excluding "don't know" / "refused" responses).

Source: EIBIS.

Figure 21. Share of finance-constrained firms by country (%)



Notes: Finance-constrained firms include those dissatisfied with the amount of finance obtained (received less), firms that sought external finance but did not receive it (rejected) and those which did not seek external finance because they thought borrowing costs would be too high (too expensive) or they would be turned down (discouraged). Base: all firms (excluding "don't know" / "refused" responses).

Source: EIBIS.

The share of financially constrained firms in CEE (9.1%) is higher than the EU average (6.1%). The main constraint reported by firms in CEE is rejection of loan appli-

cations (5.3%). The share of finance-constrained firms in CEE is higher among construction firms (12.9%) than manufacturing firms (6.8%). It is also higher among SMEs than large firms (12.8% vs. 5.6%). Romania (17.6%) and Latvia (15.0%) have the largest shares of financially constrained firms, driven by particularly high shares of rejection. Czechia (3.4%) has the lowest share of financially constrained firms (Figure 21). The loosening of monetary policy since the survey was conducted should gradually help reduce financing constraints for some borrowers. However, structural problems with access to external finance are likely to persist for younger, smaller, and innovative companies that have less collateral to offer.

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