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GLOBSEC Tatra Summit Insight Report 2020

Unlocking New Growth Narrative in CEE

1st Edition
October 2020

Strategic Partners

MINISTRY OF FINANCE OF THE SLOVAK REPUBLIC

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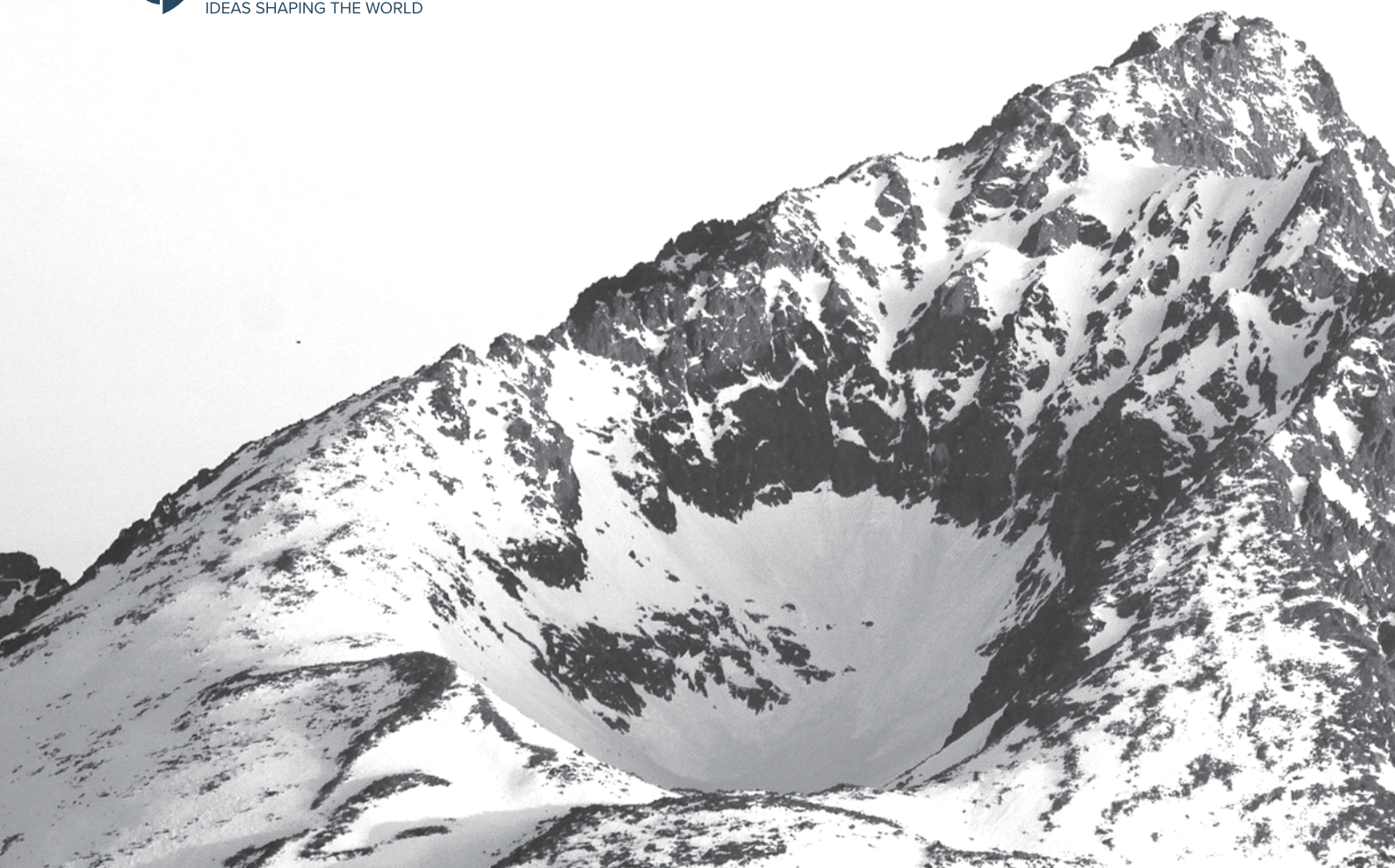

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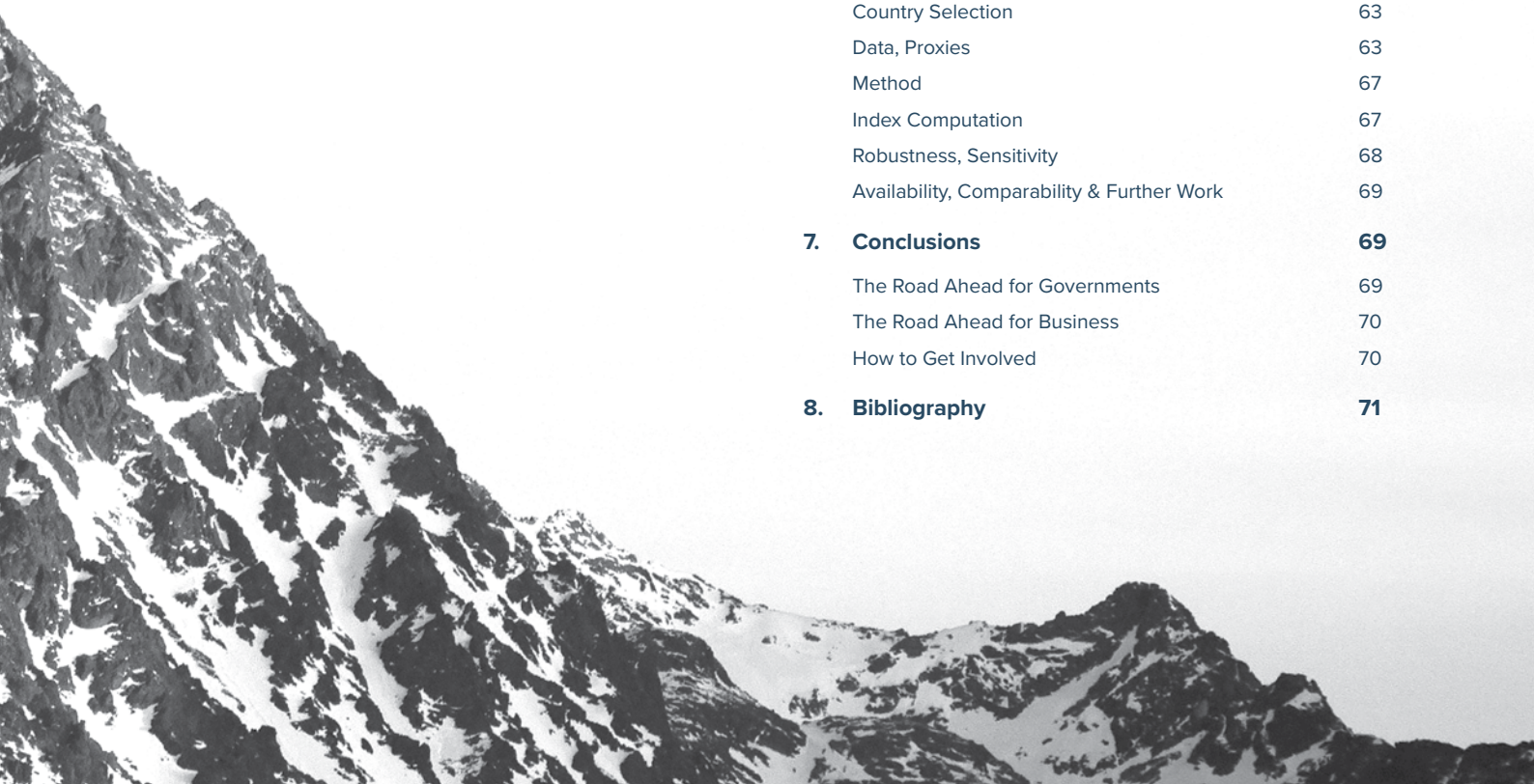


1. Preface

Dear readers,
Dear friends,

We are happy to present you with the first edition of the new flagship initiative at the Tatra Summit platform, the GLOBSEC CEE Strategic Transformation Index (STI). The report represents several months of vigorous work led by our Chief Economist Sona Muzikarova who, despite the challenges posed by COVID-19, managed to produce this thought-provoking analysis.

When we decided to launch this annual publication one year ago, we couldn't imagine a world influenced by the COVID-19 pandemic, with enforced masks, cities and economies on lockdown, and hospitals frantically handling increasing numbers of patients. At that time, I used to fly to at least 3-4 destinations on European Investment Bank (EIB)-related missions. Life is very different today!

The coronavirus pandemic triggered a disruptive change in the global economy, which on the positive side has accelerated the transformation towards green and digital frontiers. Europe and the economies of the CEE9 analysed in the STI are a part of this process. Major sources of financing including the EU Recovery and Resilience Facility provide opportunities for strategic change within CEE economies. The scale of challenge and opportunity can be compared with the revolutionary years of 1989-1990!

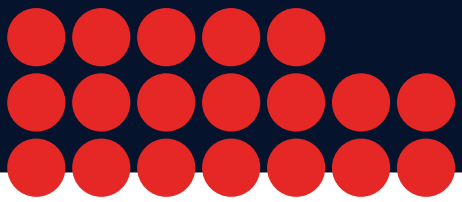
We hope that this STI will provide a guidance to decision-makers about the direction in which to steer strategic choices while they are developing national recovery plans. STI should also serve as a compass and diagnostic tool for the high-level policy discussions of key stakeholders taking place at the Tatra Summit platform.

In closing, I would like to thank the team of experts who produced STI. We also hope to hear your feedback, in order to make next year's STI even better.

Yours Sincerely,

Vazil Hudák
EU Envoy for SMEs
Vice Chairman, GLOBSEC

2. Executive Summary



The 2020 edition of The Tatra Summit Insight Report marks the birth of the CEE Strategic Transformation Index (STI), a new composite measure of economic progress for the region of Central and Eastern Europe (CEE). As the past decade concluded, 2020 began abruptly with an unprecedented and violent shock to the global economy caused by the COVID-19 pandemic. This placed the global economy into a standstill – with the European economy plunging by almost 14% annually in the second quarter alone – sending seismic shockwaves across our economies and societies, making it evident that its effects will long outlive the virus' onset.

The COVID-19 pandemic likely marks an inflection point for the global economy and the global order more broadly. Its arrival has also reset the clock for CEE. The disruptions brought on by COVID-19 have magnified the shortcomings of its existing macroeconomic model, accentuated its vulnerabilities and structural deficiencies, and further underscored the need to leave behind the largely manufacturing-reliant, low value-added production narrative, and replace it with an alternative governed by an exhaustive macro-financial framework where key economic actors – firms and workers – could flourish.

The STI caters to such plea, as it offers insights into the past multi-faceted economic performance of nine CEE economies, while emphasizing key forward-looking policy areas to unlock sustainable long-term growth, including innovation, education, and the twin green and digital transition. As such, it provides a composite quantitative diagnostic tool for capturing economic progress in the region, by benchmarking the CEE region at an aggregate level and the nine CEE economies – Austria, Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, the Slovak Republic, and Slovenia – individually, within a broader context of selected control group of advanced European economies.

Unsurprisingly, Austria sets the overall mark for the CEE region, with an overall STI score of 63.9 points. The index value is interpreted as being almost at a 2/3rd point between the worst and the best performer in the sample between 2010 and 2018. Thus, the index benchmarks each country and places it on a scale, positioning its historical progress and vis-à-vis future potential advancement, as set by a global top performer in the broad sample. Austria is followed by Slovenia (56.3), Czechia (53.7), Poland (50.8), Hungary (49.6), the Slovak Republic (45.9), Croatia (40.7), Romania (35.2) and Bulgaria (32.4).

The index is further split into two main pillars, a more backward-looking element, Macroeconomic Performance & Resilience (Pillar 1); and, a forward-oriented element, the Innovation Economy (Pillar 2). Each of these two pillars is further split into four thematic sub-indices, revealing country strengths and weaknesses at a more granular level. The choice of the eight thematic clusters and selected data proxies aim at a tailored and well-rounded diagnostic tool. Region-specific macroeconomic and resilience pillar captures openness, external vulnerability, productivity & value-added and financial structure. The innovation pillar tracks education outcomes, green and digital economies, and a country's ability of to innovate. Overall, STI results make it clear that the CEE economy is fuelled more

pronouncedly by Pillar 1 than Pillar 2, as evidenced by the relative higher scores of CEE in the former.

The results are intuitive and provide clues for policy action to unlock economic growth and continued rise of CEE societies' living standards. The report findings specifically highlight that progress for all CEE countries is overdue on the education dossier. Most CEE would, furthermore, benefit from an actionable and targeted policy approach to move towards higher value-added domestic activities. This requires prior identification of where in the macro-economy such 'moving-up' can be feasibly and rapidly achieved. Importantly, STI results across most countries underscore the need for a country-wide innovation strategy. These long-term policy priorities – targeting education, productivity, value-added and the capacity innovate – should be pursued alongside the green and digital twin transitions, and whilst using it as the means to an end, and a stable element of the CEE growth paradigm. Even top performers need improvements in these policy arenas to close the gap vis-à-vis the control group of advanced European economies and to move closer to the 'distance to frontier' – the aggregate 'ideal' across all sub-indices of strategic economic transformation. Specific policy leads for each CEE country are drawn and presented in the Country Profiles section.

However, to rewrite CEE growth narrative, bold leadership, political will and a proactive, mission-oriented and collaborative approach to policymaking will be required to achieve a meaningful change. Public-private crossovers to design workable solutions for the new, post-COVID-19 terrain may be also a key to success. Furthermore, the pandemic has highlighted that economic, health, social and environmental portfolios can no longer be approached in isolation, but should be pursued together, as a part of integrated growth policy agenda.

Against such a backdrop, the STI is being launched as a flagship initiative at the GLOBSEC Tatra Summit 2020. GLOBSEC Tatra Summit is an annual high-level gathering of political elites, top-of-the-line policy experts and researchers, private sector leaders, academia and third sector frontrunners which every October take pulse of the European and global economy by gathering over most pressing challenges and conundrums our economies and societies are facing. The GLOBSEC Tatra Summit platform thus serves to anchor the STI project and amplify its impacts. STI can be used as an evidence-basis to underpin the high-level policy dialogues taking place at the Tatra Summit platform by identifying key weakness areas, and as such, it is designed to provide policymakers and other stakeholders with a timely and handy macroeconomic policy compass for the CEE region.

The index is to be periodically updated before each Tatra Summit to provide a well-timed basis for policy dialogue on this platform. Availability at an aggregate regional-level and individual country-level offer insights into overall year-on-year regional and country performance, respectively. Eight disaggregated thematic clusters (i.e. sub-indices) offer more granular insights into macro-resilience and innovation developments and enable the identification of country strengths and weaknesses and the formulation of corresponding policy leads.

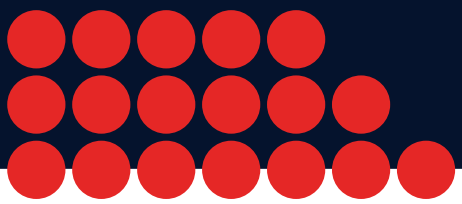
The 2020 Tatra Summit Insight Report builds the conceptual basis for the STI, presents the key findings and policy insights, and the research and methodology behind the index. The Report is organized as follows. Part 1 builds the theoretical and conceptual case for the index, reviewing CEE historical stylized facts, discussing the cost of doing nothing, and presenting cross-country evidence as to what has worked to escape the middle-income trap in the past. It finally arrives at – and presents – the STI conceptual building blocks. The second part of the reports offers insights provided by the index, rankings and detailed country profiles. The final part discusses the research and methodology behind the index.

Box 1. GLOBSEC CEE Strategic Transformation Index (STI) in Brief

- Caters to the need to formulate a new growth narrative & the underlying policy blueprint in CEE
- Ideal timing to take the leap, as a part of post-pandemic momentum
- GLOBSEC Tatra Summit 2020 as a launchpad amplifies & multiplies the index's impacts
- Support of strategic policy dialogue taking place at the GLOBSEC Tatra Summit platform
- Creates evidence-based pressure to act on policy weak points
- Enhances decision transparency, accountability, and integrity of policymaking
- Potentially boosts policy strategy-to-execution by providing a measurable basis for progress

3.

CEE Strategic Transformation Index



Global Rankings at a Glance

Figure 1. The CEE Strategic Transformation Index 2020: Global Ranking

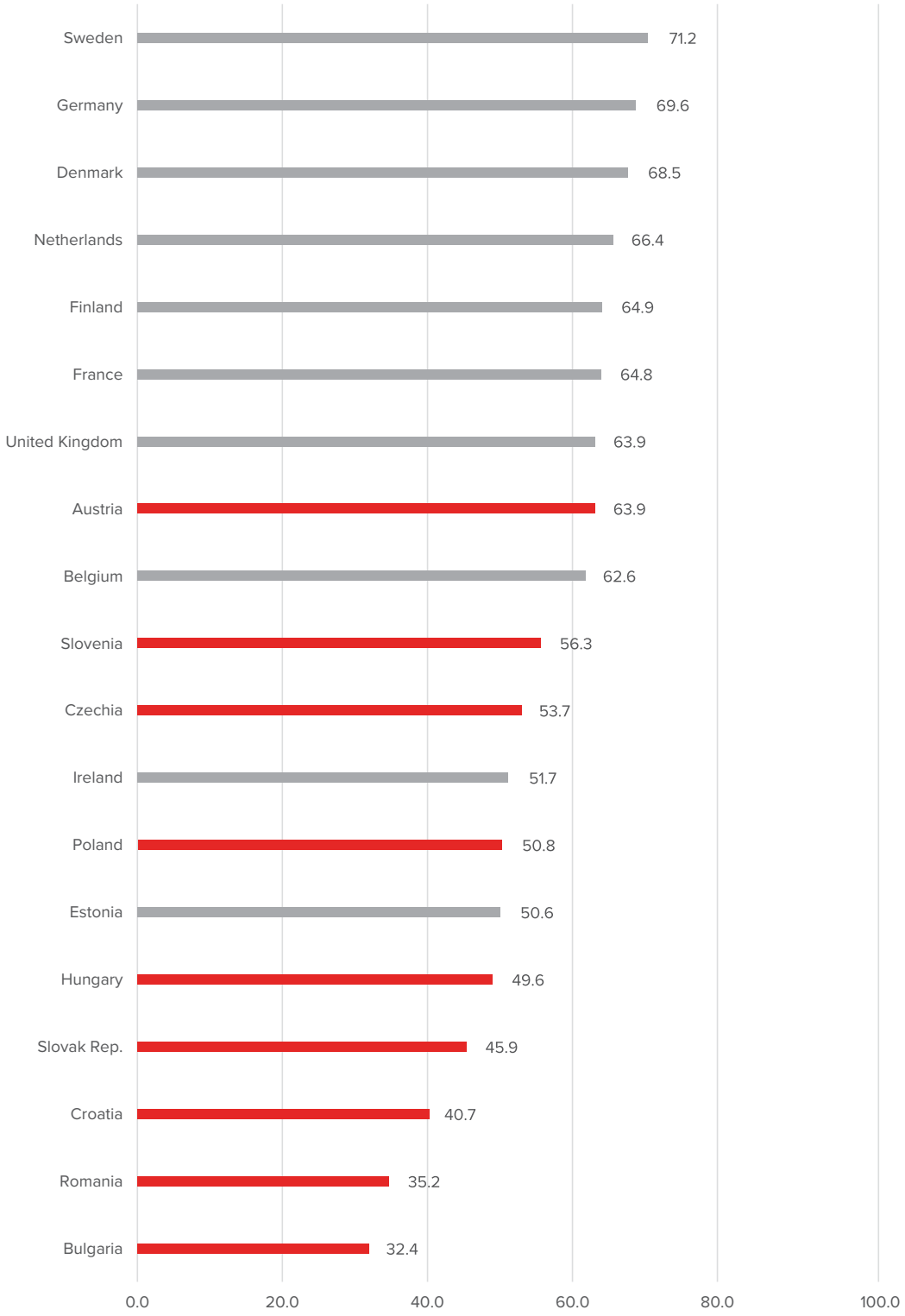
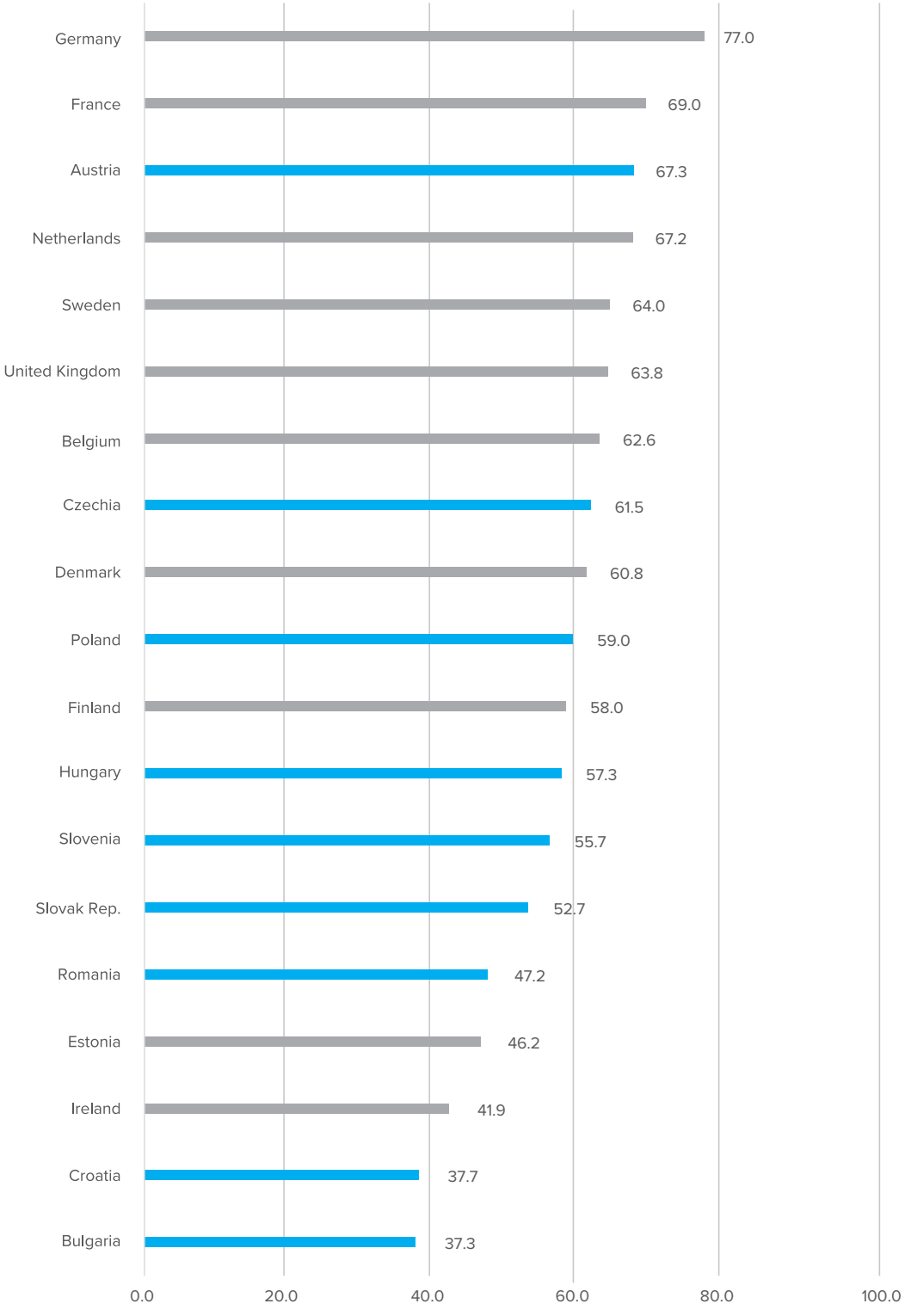
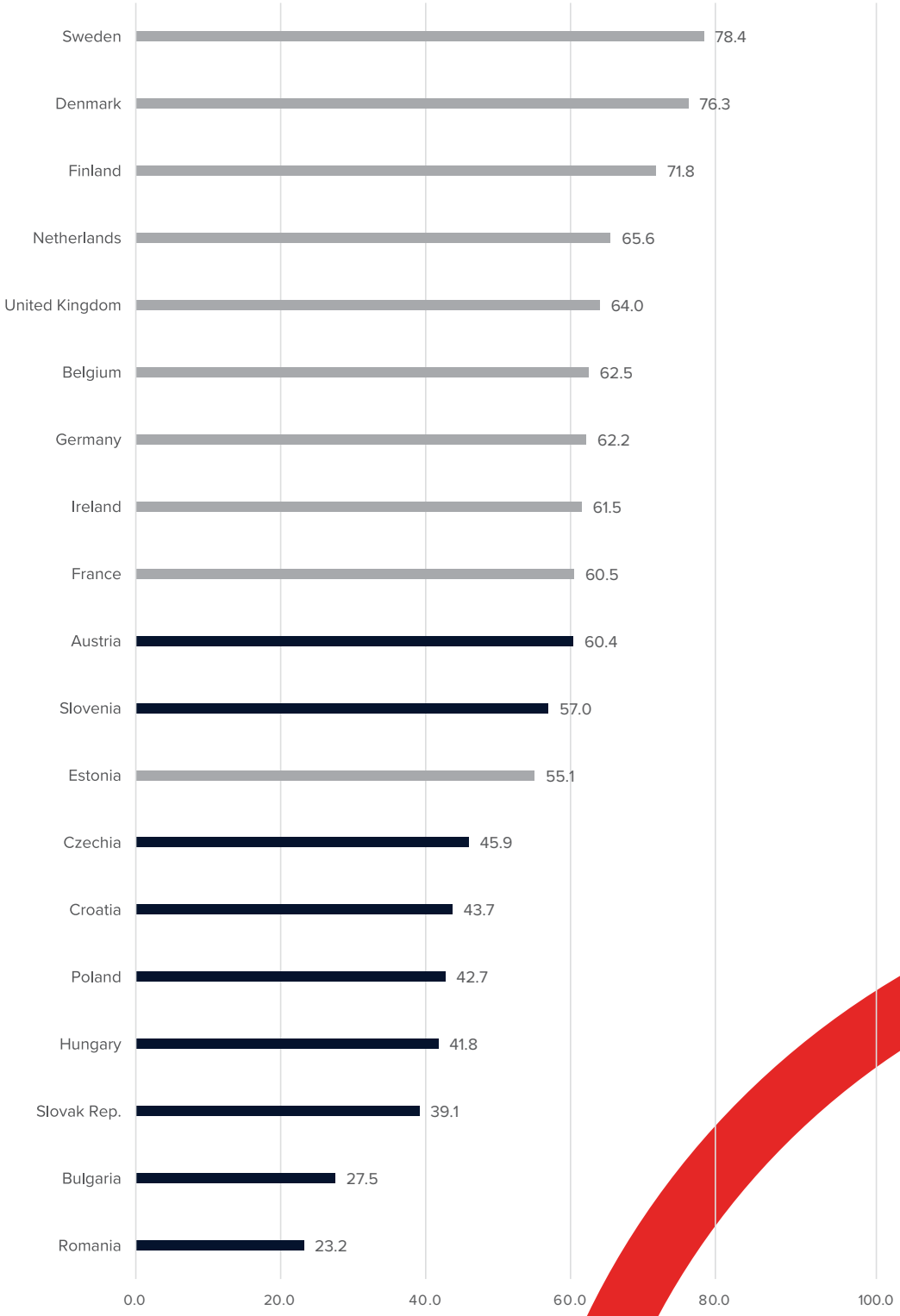


Figure 2. The CEE Strategic Transformation Index 2020:

Pillar 1. Macroeconomic Structure & Resilience



Pillar2. Innovation Economy



4.

The Tatra Summit Insight Report

Introduction: The Great Post-Pandemic Leap

Crises are potent catalysts of change. As economies, economic systems, societies, businesses, policymakers, and other key economic actors get drawn outside their comfort zones due to disruption – and as Schumpeterian creative destruction[1] ensues – crises have the power to make or break.

The coronavirus pandemic, with its massive economic, political, social global-scale ramifications, has been no different. In fact, dubbed as "a war" by French president Emmanuel Macron, or a "crisis like no other" by the International Monetary Fund[2], it has perhaps illustrated such transformational power more ostentatiously than other crises. The COVID-19 pandemic has derailed people from their routines, workers from their offices, children from schools, businesses from their normal operations, countries from their beaten policy tracks and the list goes on, all with far-reaching implications for all stakeholders and the future shape of the global economy.

The pandemic-induced changes are presenting economies and societies globally with new opportunities but also distinct challenges. In the meantime, the pre-COVID-19 challenges have not gone anywhere. While – having barely crossed over to the new decade, – the pandemic has taken centerstage, the terrain of the global economy is being simultaneously impacted by peripheral transformational forces that have been lurking in the pipelines before the pandemic's onset, including a 4th Industrial Revolution, unrelenting technological progress, climate change, human capital outflows and growing demographic challenges.

The COVID-19 calamity has derailed the inertia of the past decades. The momentum should be seized and capitalized on by CEE economies, whose macroeconomic model has fizzled. Numerous calls were put forth toward this end before the pandemic hit, converging at the notion that the region's one-sided manufacturing-reliant, export-oriented model is obsolete, its growth engine is losing traction and the region needs a new economic narrative[3]. To recover sustainably for the new post-COVID-19 economic terrain, and successfully navigate the transition towards a more dynamic, sustainable and resilient growth path, now is the time to strategically rethink CEE's existing macroeconomic growth paradigm, identify strong and weak points, and formulate workable policy strategies to transform it.

Incremental non-structural pre-pandemic approaches to resuscitating CEE growth momentum will not suffice. The coronavirus pandemic has been brutally blatant in uncovering deficiencies across economic structures, business models and public and private leadership. The region needs to jump on the bandwagon of exhaustive and deep economic restructuring to bring itself on par with the new economic age, where relentless and rapid change is the only constant.

The coronavirus pandemic has, moreover, intensified the plea to accelerate the digital transition. Besides easy and sizeable productivity gains that can be reaped fast from new digital technologies in a relatively underdigitalized and undercapitalized region, recent reports conclude that e-commerce, e-government and digitalization have emerged as a major pillar of entrepreneurship in an age where physical contact has been severely restricted[4]. The digital transition has, moreover, surfaced as a resilience and coping strategy to preserve jobs, business operations, supply and trade flows in disruptive times. A winning digital transition must be greased from the bottom-up by enhanced digital literacy.

One of the more encouraging "side effects" of the pandemic, moreover, **is that sustainability, the pursuit of green growth, resource- and energy-efficiency have**, thankfully, **not been side-tracked** when formulating a whole-of-Europe response. In fact, it has become a part of the solution at a European level. The release of funds from the EU deal flagship facility – the Recovery and Resilience Facility[5] – is conditional upon sensible national plans, with sustainability as one of their core pillars.

In response to these developments and challenges – and in an effort to multiply the momentum created by the pandemic response at both, national and supranational levels – **GLOBSEC along with its partners has created a new, composite diagnostic tool** that caters to the challenge to formulate a new growth narrative and the underlying policy blueprint in the CEE region: The CEE Strategic Transformation Index (STI).

STI benchmarks a country's ability, and that of the region, **towards the strategic transformation frontier.** It measures the extent to which the underlying macroeconomic, resilience and innovation drivers – both old and new – are in place, benchmarks relative progress of countries in terms of these drivers and presents country strengths and weaknesses. Covering 9 CEE economies and 47 indicators in this first edition, the index identifies the best-performers in the CEE9 region when it comes to openness, external resilience, productivity and value-added, and financial structure; as well as innovation cluster of variables, including education, green and digital transition and innovative capacity.

The index is designed to suit policymakers and leaders in the quest of taking an informed action on a revived economic transformation policy dossier with a useful diagnostic tool. It can also help businesses in formulating their business strategies and establishing practices, buttressing economic transformation outcomes from bottom-up. The bottom line is that the broad policy priority leads STI articulates are to offer a compass for strategic policy and business action in the CEE9 region on the path towards more dynamic, resilient and sustainable economies.

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1 Schumpeter. A. J. (1975). Capitalism, Socialism and Democracy. New York: Harper. [orig. pub. 1942]
2 International Monetary Fund. (2020). WORLD ECONOMIC OUTLOOK UPDATE, A Crisis Like No Other, An Uncertain Recovery. https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020
3 Marciniak, T., Novak, J., & Purta, M. (2020, February 23). Central and Eastern Europe needs a new engine for growth. McKinsey & Company. https://www.mckinsey.com/featured-insights/europe/central-and-eastern-europe-needs-a-new-engine-for-growth
4 Ungerer, C., Portugal, A., Molinuevo, M., & Rovo, N. (2020, May 12). RECOMMENDATIONS TO LEVERAGE E-COMMERCE DURING THE COVID-19 CRISIS. World Bank Group. http://documents1.worldbank.org/curated/en/280651589394091402/pdf/Recommendations-to-Leverage-E-Commerce-During-the-COVID-19-Crisis.pdf
5 European Commission. (2020, May 28). Questions and Answers on the EU budget for recovery: Recovery and Resilience Facility [Press release]. https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_949

Chapter 1. CEE's Golden Days: Stylized Facts

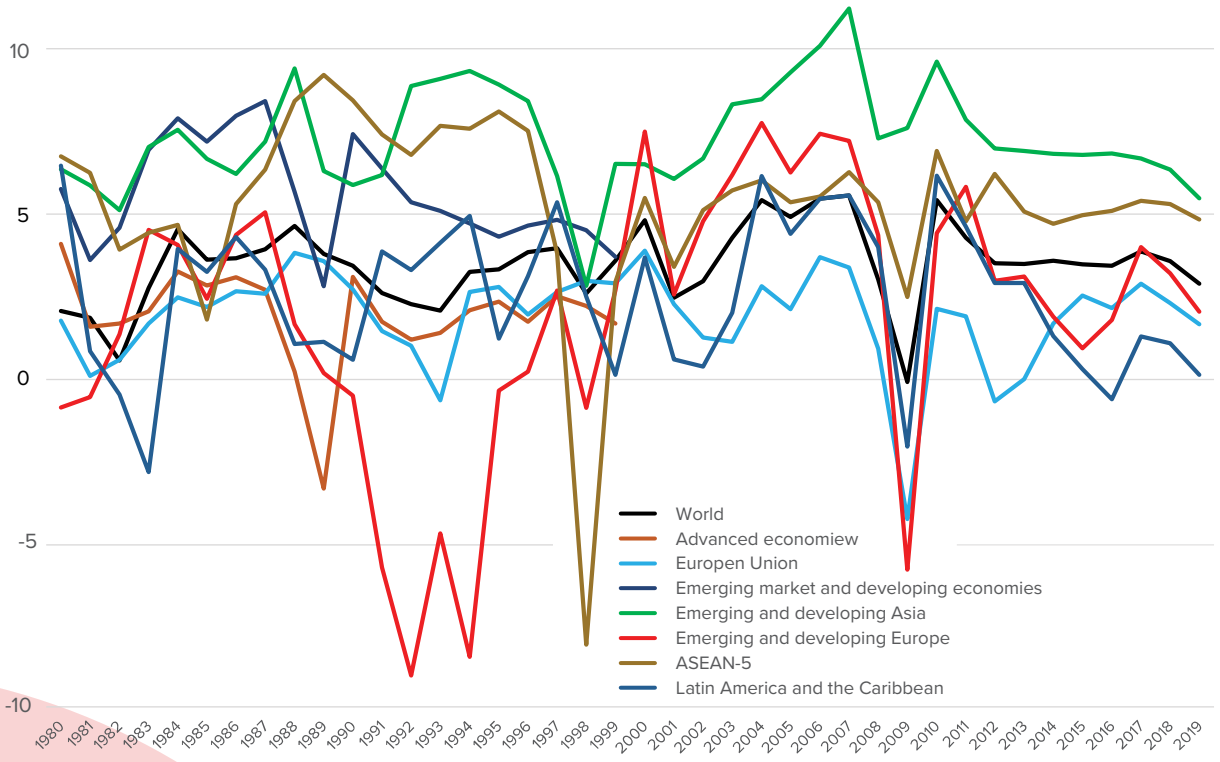
CEE is an economic success story. The region of Central and Eastern Europe (CEE)[6] displayed some of the fastest growth rates globally prior to the 2008-2009 Great Recession (Figure A, displayed as a part of 'Emerging and developing Europe').

Most CEE countries[7] embarked on their transitional path from command to market economy in the early 1990s. Despite extensive transitional costs and overall varied economic performance in the early stages of the transition, CEE economies have posted impressive economic gains since 2000, driven by their underlying strengths, including skilled yet low-cost labor, foreign capital inflows, dynamic export activity buttressed by manufacturing, and more recently also funding from the European Union (EU). The post-transitional, pre-crisis economic performance has, in turn, fueled CEE's real economic convergence, narrowing the prosperity gap vis-à-vis western peers and enabling CEE residents to enjoy a substantial rise in living standards.

There is a prevailing view[8] that the post-communist varieties of capitalism do not represent a tabula rasa. In other words, **the shared post-communist legacy[9] of the region has shaped the region's economies**, including its institutions, organization of production, economic structures and attitudes[10]. Admittedly, many scholars rightly concluded 'legacy' to be a slippery concept, and the need to at last specify 'which past' if it is assumed to affect the present[11]. Without embarking on a historical detour about the world's comparative economic systems, it is useful to recount some leading features of CEE economies broadly believed to have at least partly resulted from its shared communist past.

Neoclassical growth models attach great importance to the accumulation of capital for convergence purposes across economies at different stages of development. The theory – assuming mobility of capital flows, and conditional on equal TFP and human capital in both countries – predicts that capital will

Figure A. CEE region belonged to regions with fastest growth globally before 2009
(Gross domestic product at constant prices, annual percent change)



6 For the purpose of the current report, CEE is defined as: the Slovak Republic, Czechia, Poland, Hungary, Austria, Slovenia, Croatia, Romania and Bulgaria. Authors have deliberately targeted a narrower sample of CEE countries, leaving out the Baltic states (Estonia, Lithuania and Latvia) and the Balkan countries (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, Serbia) that are sometimes included in broader compositions. For example, the Organisation for Economic Co-operation and Development (OECD) defines the Central and Eastern European Countries (CEECs) as a group comprising of Albania, Bulgaria, Croatia, the Czechia, Hungary, Poland, Romania, the Slovak Republic, Slovenia, and the three Baltic States: Estonia, Latvia and Lithuania. Authors duly acknowledge the existence of other definitions/country compositions of the CEE region. The country choice is largely arbitrary. Authors elaborate on the rationale behind country selection, the absence of some countries, and the special status of Austria in the Methodology section of the current report. The country composition can change in future vintages of the Index/Report.

7 The transition economies are Slovak Republic, Czechia, Hungary, Poland, Slovenia, Croatia, Romania and Bulgaria.

8 Pop-Eleches, G., & Tucker, J. A. (2011). Communism's shadow: postcommunist legacies, values, and behavior. Comparative Politics, 43(4), 379-408. https://www.jstor.org/stable/23040635?seq=1

9 Austria is an exception

10 Goetz, K. H. (2001). Making sense of post-communist central administration: modernization, Europeanization or Latinization?. Journal of European Public Policy, 8(6), 1032-1051. https://doi.org/10.1080/13501760110098332

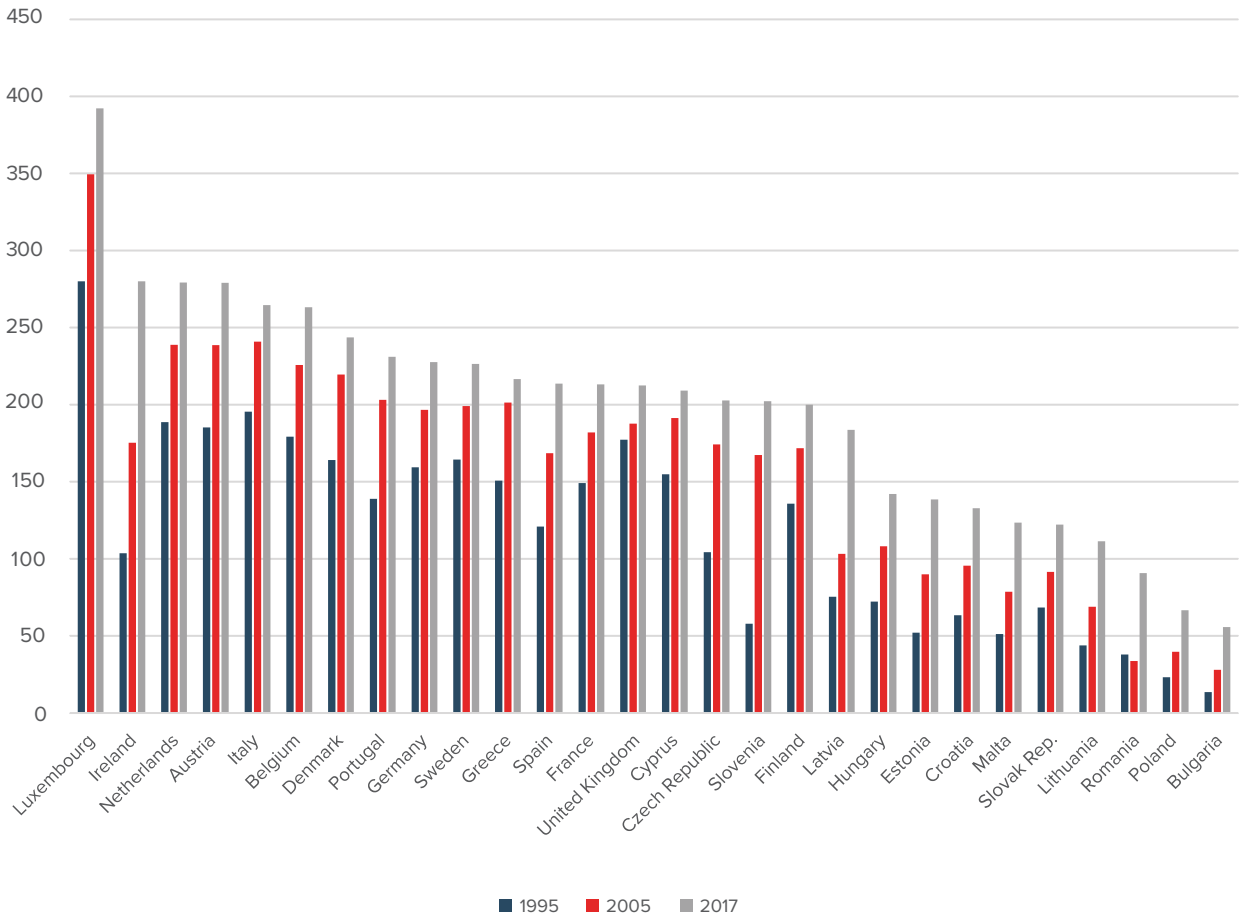
11 Pop-Eleches, G., & Tucker, J. A. (2011). Communism's shadow: postcommunist legacies, values, and behavior. Comparative Politics, 43(4), 379-408. https://www.jstor.org/stable/23040635?seq=1; Kopstein, J. (2003). Postcommunist democracy: legacies and outcomes. 35(2), 231-250.; http://individual.utoronto.ca/kopstein/publications/post_communist_democracy.pdf

flow from capital-abundant, rich countries to capital-scarce, poor ones, until the differences disappear. In practice, CEE countries embarked on their transitional paths with low and obsolete capital stocks (except Austria)[12]. Their capital stocks, measured as total gross fixed assets per employee, have increased over time but are still considerably lower compared to western EU counterparts (Figure B).

The post-transitional capital gap has been financed from abroad, primarily in the form of foreign direct investment (FDI), as opposed to domestic sources (i.e. savings), another financing possibility predicted by the theory. Post-transition inward FDI flows to CEE were volatile, partly owing to privatization of large energy companies, banks, etc. (Figure C). One noticeable trend is that inflows gradually intensified over time, as the macroeconomic and institutional environments stabilized, i.e. post-transition inflation was tamed, and basic predictable governance structures were set up. They peaked pre-crisis and then levelled off (Figure C).

Figure B. Most CEE countries remain relatively under-capitalized even today

(Capital stock per capita, in PPP USD)

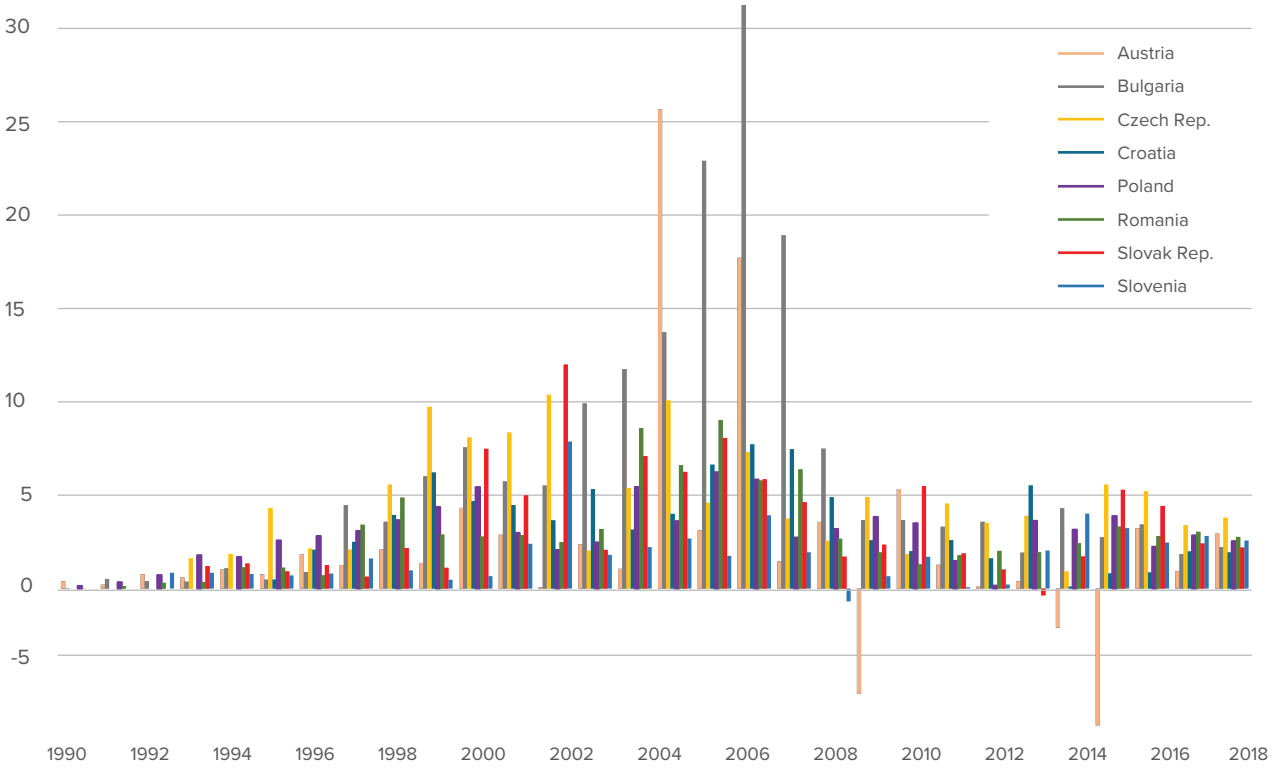


Source: Penn World Tables 9.1.

12 Arratibel, O., Heinz, F. F., Martin, R., Przybyla, M., Serafini, R., Zumer, T., & Rawdanowicz, L. (2007). Determinants of growth in the central and eastern European EU member states-a production function approach. ECB occasional paper, (61). https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp61.pdf

However, it is not just volume of registered FDI inflows that matters but also sectoral composition, its quality, and investors' motives. At a sectoral level, the bulk of FDI in CEE has been channeled to traditional industry, notably manufacturing (ranging between 9-39% of the total inflows in 2018), finance/insurance/business services (ranging between 11-27% in 2018), and other services, with these three sectors accounting for the majority of total FDI stocks in CEE[13]. A few countries received substantial FDI inflows in additional country-specific sectors, such as Romania in energy and agriculture, Poland in construction, and Slovak Rep. in energy. Factors like geography, country size, market proximity, resource endowments, cost and quality of labor and capital, government FDI policies and governance more broadly, as well as investment conditions influence multinational companies' decisions on where to invest across countries and sectors based on country-specific cost-benefit tradeoffs[14].

Figure C. Most CEE countries enjoyed FDI-assisted pre-crisis growth
(Foreign direct investment, net inflows, in % of GDP)



Source: World Bank.

In CEE, FDI entry and subsequent inflows were greatly motivated by relatively low unit labor costs (ULCs). Research shows that low ULCs have played a significant role in vertical FDI by multinational firms[15], especially in sectors with labor-intensive production. However, traditionally low labor costs have been on the rise in many CEE countries, particularly in the latter half of the past decade (Figure D), leading to losses in relative competitiveness vis-à-vis competitors.

To the extent that price and wage increases should mirror productivity gains from investment activity and enhancements in knowledge and skills, these developments are a normal part of convergence process and not a cause for concern per se. But countries where costs are rising consistently faster than productivity risk losing competitiveness. Underlying labor productivity in the CEE – measured as GDP per hour worked as compared to the EU15 average – has been subdued post-crisis, and is still lagging pronouncedly behind EU15 average, with Austria being an exception (Figure E).

The wage-labor productivity decoupling – fueled by perpetual wage moderation and declining labor shares – has been rampant across advanced economies in recent years and subjected to much scrutiny. For example, a 2020 report by WIIW[16] offers several important insights about the perceived decoupling in CEE. Firstly, it is weaker in CEE than across many

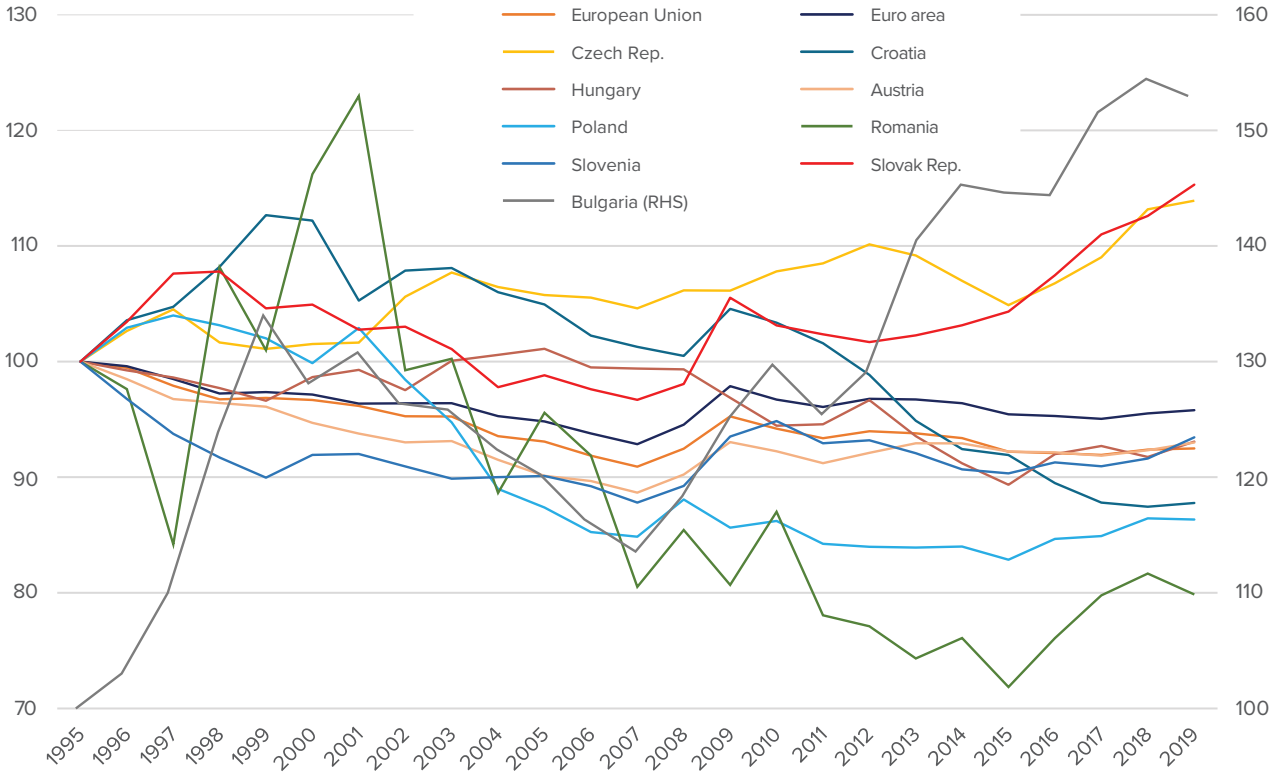
13 OECD. (2020). Inward FDI stocks by industry. [Data file]. doi: 10.1787/2bf57022-en
14 Mateev, M. (2009). Determinants of foreign direct investment in Central and Southeastern Europe: New empirical tests. Oxford Journal, 8(1), 133-149.
15 Popescu, G. H. (2014). FDI and economic growth in Central and Eastern Europe. Sustainability, 6(11), 8149-8163. https://doi.org/10.3390/su6118149
16 Schröder, J. M. (2020). Decoupling of Labour Productivity Growth from Median Wage Growth in Central and Eastern Europe (No. 448). The Vienna Institute for International Economic Studies, wiiw. https://wiiw.ac.at/decoupling-of-labour-productivity-growth-from-median-wage-growth-in-central-and-eastern-europe-dlp-5356.pdf

major markets such as the US, corroborating other empirical studies[17].

Secondly, the perceived decoupling has been softer for manufacturing-heavyweights, where underlying productivity gains were considerable compared to a non-manufacturing control group, where the decoupling was more pronounced driven by fast wage growth over the period 2002-2017. Thirdly, the decoupling intensified post-crisis driven by a declining labor share and by worsening terms of trade, but shrank again in recent years, driven by strong compensation/wage growth. Among CEE countries, Poland and Slovak Rep. experienced the most pronounced decoupling[18].

Proximity to EU markets has been another strong FDI catalyst, supported by the fact that together with other central Europe countries about 80% of investment was received from western European partners[19]. In fact, CEE's integration in international and European regional clubs has played a vital role in its transitional experience and is inextricably linked to the internal policies of transition from communism to capitalism[20]. Besides the obvious benefit connected to the EU internal market, free movement of goods, services, capital and people, admission to these clubs is automatically a guarantor of some basic level of macroeconomic and institutional development. For example, EU accession requires proper functioning of markets (goods, services, labor), macroeconomic stability (prices, sustainable finance, external balances) and economic governance[21]. Euro accession requires formal meeting of nominal convergence criteria, including price stability, exchange rate and long-term interest rate stability, and fiscal criteria[22]. All CEE economies included in the present analysis are current EU members, several are also euro area members (Austria, Slovak Rep., Slovenia), and a few are now in an advanced stage of the euro accession process (Bulgaria,

Figure D. Traditionally low relative labor costs in CEE have recently been on the rise
(Real unit labor costs in total economy, in ECU/EUR, index 1995=100)



Source: European Commission AMECO database.

17 Nolan, B., Roser, M., & Thewissen, S. (2019). GDP per capita versus median household income: What gives rise to the divergence over time and how does this vary across OECD countries?. Review of Income and Wealth, 65(3), 465-494. OECD (2008), Public-Private Partnerships: In Pursuit of Risk Sharing and Value for Money, OECD Publishing. doi: 10.1787/9789264046733-en

18 Schröder, J. M. (2020). Decoupling of Labour Productivity Growth from Median Wage Growth in Central and Eastern Europe (No. 448). The Vienna Institute for International Economic Studies, wiiw. https://wiiw.ac.at/decoupling-of-labour-productivity-growth-from-median-wage-growth-in-central-and-eastern-europe-dlp-5356.pdf

19 Rahman, J., & Jirasavetakul, F. L. (2018). Foreign Direct Investment in New Member States of the EU and Western Balkans: Taking Stock and Assessing Prospects. IMF Working Paper, WP/18/187.

20 Lane, D. (2007). Post-communist states and the European Union. Journal of Communist Studies and Transition Politics, 23(4), 461-477. https://www.tandfonline.com/doi/full/10.1080/13523270701674558

21 Economic accession criteria. (2016, April 10). European Commission. https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/international-economic-relations/enlargement-and-neighbouring-countries/enlargement/economic-accession-criteria_en#:~:text=The%20economic%20criteria%20to%20be,market%20forces%20within%20the%20Union

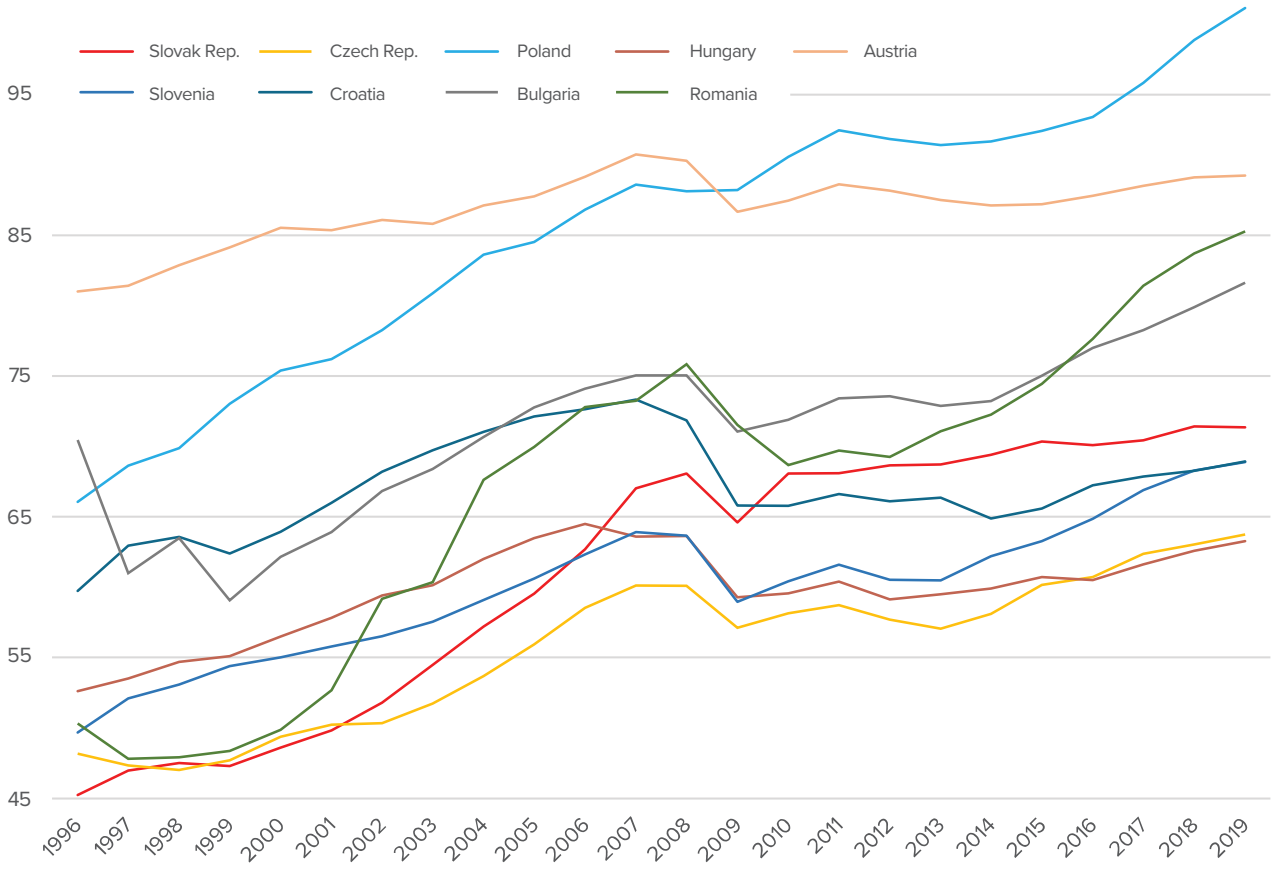
22 Convergence criteria for joining. (2016, October 10). European Commission. https://ec.europa.eu/info/business-economy-euro/euro-area/enlargement-euro-area/convergence-criteria-joining_en

Croatia). Characterized as mostly small and open, CEE regional economies have benefitted from close proximity, access and strong economic ties to the larger European markets.

Overall, CEE experience suggests that FDI inflows have significantly contributed to the transformation and reforming of these economies, especially pre-crisis. CEE may have reaped large benefits from technology, know-how, and managerial spillovers from foreign investors early post-transition, although especially late evidence is mixed. For example, IFP (2018) based on firm-level data in Slovak Rep. and across other CEE countries observed that domestic firms lag behind foreign-owned firms in terms of productivity[23]. This could be because foreign-owned enterprises are often larger and benefit from greater returns to scale. Nevertheless, aggregate productivity developments have been found to be driven by a handful of foreign-owned superstar firms, while domestic firms remain laggard, with productivity gains low and flat over time. Notwithstanding such mixed spillover effects, FDI-assisted development has been a key ingredient and driver in the CEE to catalyze internationally competitive export-oriented industries, with the German-CEE automotive industry cluster serving as a case in point[24].

Evidence suggests that post-communist economies which joined the EU grew faster than their non-EU peers (Figure F). In more recent years, CEE growth has benefitted from EU cohesion funds, with the latter becoming one of the region's leading motors of growth in the post-crisis decade. The programming period was just about to expire in 2020, and as a part of the post-pandemic response it has been extended in both, scale and scope. Surging household consumption – and domestic demand more broadly – has also become one of the region's important growth pillars as CEE economies converged and climbed the income-bracket ladder from low- to more seasoned middle-income rank.

Figure E. CEE still has a sizeable labor productivity gap to close vis-à-vis EU-15
(Gross domestic product at current prices per hour worked in PPS: EU-15 = 100)



Source: European Commission AMECO database.

23 Výškrabka, M. (2018). Lesk a bieda firiem na Slovensku, Analýza údajov firiem na individuálnej úrovni. Inštitút Finančnej Politiky. https://www.mfsr.sk/files/archiv/85/Firmy_komentar.pdf
24 Havlik, P. (2018, January 14). FDI in the Eastern Europe and EAEU: too little and from the wrong places? Eurasian Studies. http://greater-europe.org/archives/4165

In sum, the pre-pandemic state of affairs of the CEE economy ensued as a mixture of factors, including its historical heritage, transitional trajectory, reforms undertaken, institutions established, as well as its regional integration as a part of its broader transition strategy. These factors have jointly massaged the terrain of the CEE economy and defined its growth paradigm as we know it today.

But the tailwinds to CEE growth had been waning and its engine losing traction in the past decade. According to many observers[25], the Great Recession has put a critical dent in the active growth model of CEE, and marks an inflection point. Despite post-crisis policy efforts, the CEE growth rates had failed to redeem their pre-crisis dynamism. Its competitive advantages, such as cost competitiveness, have been waning, productivity has been stalling, and the export-oriented manufacturing over-reliant paradigm that once sufficed to place the CEE region among the best performers is becoming a liability in the disruptive post-COVID-19 terrain. CEE remains not only undercapitalized but lags behind on the twin green and digital transitions, a necessary metamorphosis to stay on par with a rapidly changing world.

The COVID-19 pandemic, dubbed a global 'crisis as no other', is both a wakeup call and a vehicle of change. Just like the Great Recession a decade ago, it is an inflection point with the power to further undermine the current model or serve as a motor for its reinvention. Reinvigorating CEE's growth to pre-pandemic levels – let alone, pre-Great Recession levels – will require an integrated, balanced and well-rounded growth agenda and practical policy strategies directed at improving productivity outcomes in strategically selected domestic sectors, expanding higher-value-added exports, and tactically investing in innovation. The theoretical and conceptual underpinnings of such a prospective strategy supported by empirical evidence are discussed in the section that follows.

Figure F. Post-communist economies which joined the EU grew faster

(Gross domestic product per capita, in constant PPP USD)

Source: Penn World Tables 9.1.

25 Galgóczi, B., & Drahokoupil, J. (Eds.). (2017). Condemned to be Left Behind?: Can Central and Eastern Europe Emerge from Its Low-wage Model?. ETUI aisbl. Marciniak, T., Novak, J., & Purta, M. (2020, February 23). Central and Eastern Europe needs a new engine for growth. McKinsey & Company. https://www.mckinsey.com/featured-insights/europe/central-and-eastern-europe-needs-a-new-engine-for-growth

Chapter 2. The Cost of Doing Nothing: The Middle-Income Trap Predicament

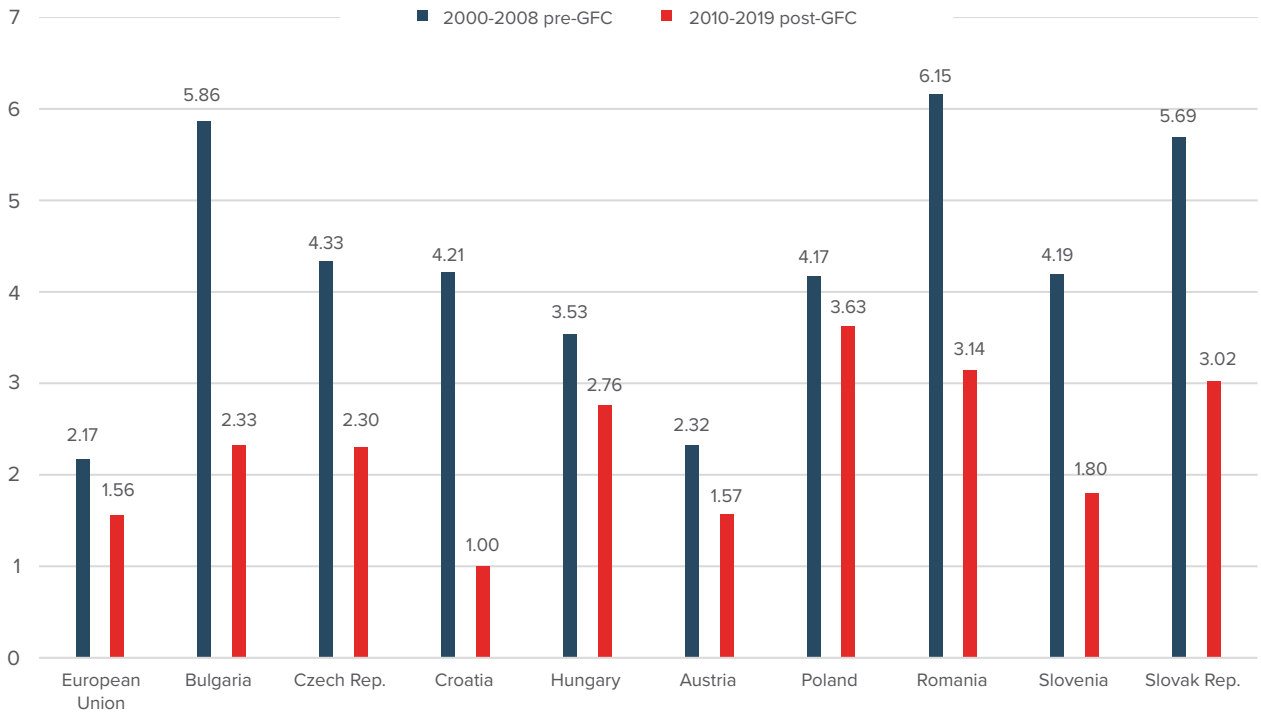
The middle-income trap is a tale of growth stagnation. The apprehensions surrounding sluggish global growth have intensified post-Great Recession and have reclaimed attention post-pandemic. Economic theory predicts that countries with low-income levels will see fast economic growth and subsequently catch up to high-income countries. As demonstrated in the previous section, CEE countries have enjoyed robust economic growth since their transition to market economies, rapidly closing the income gap with richer European economies, and exploiting "easy" productivity gains from sectoral reallocation, foreign technology spillovers and later surging domestic demand[26]. Since the Great Recession, however, their growth rates slowed down (Figure G), and convergence rates decelerated (Figure I). Even before the pandemic, this had raised the issue of whether the region had tapped the "low-hanging fruit", and that many CEE countries were headed for the middle-income trap.

The middle-income trap is best described as a situation, where rapid growth from low-income to middle-income levels – fueled by cheap labor, rudimentary technology catch-up, and the reallocation of labor and capital from low-productivity sectors to export-driven manufacturing – is often followed by lower growth[27]. In that way, "*a middle income country can no longer compete internationally in standardized, labor-intensive goods because wages are relatively too high, but it can also not compete in higher value-added activities on a broad enough scale because productivity is relatively too low*[28]".

As such, a middle-income trap is framed by an analytical framework where the composition of production and export are key, along with structural and institutional makeup, education systems, all set firmly in the context of international competitiveness[29]. This is as opposed to a competing framework[30] based in neoclassical economics, which assumes that these aspects do not matter. Reconciling these approaches is important as they yield different policy prescriptions.

Economists and analysts agree that comprehensive advancement of domestic innovation capabilities is the

Figure G. Growth rates in CEE countries post-Great Recession have slowed
(Gross domestic product at 2015 reference levels, average annual growth rates)



Source: European Commission AMECO database.

26 Grela, M., Majchrowska, A., Michałek, T., Mućk, J., Stążka-Gawrysiak, A., Tchorek, G., & Wagner, M. (2017). Is Central and Eastern Europe converging towards the EU-15?. Narodowy Bank Polski, Education & Publishing Department. https://www.nbp.pl/publikacje/materialy_i_studia/264_en.pdf
27 Gill, I. S., & Kharas, H. (Eds.). (2007). An East Asian renaissance: ideas for economic growth. The World Bank.
28 Paus, E. (2017). Escaping the middle-income trap: Innovate or perish. ADBI Working Paper, (685). Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/escaping-middle-income-trap-innovate-or-perish
29 Gill, I. S., & Kharas, H. (Eds.). (2007). An East Asian renaissance: ideas for economic growth. The World Bank. Paus, E. (2017). Escaping the middle-income trap: Innovate or perish. ADBI Working Paper, (685). Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/escaping-middle-income-trap-innovate-or-perish
30 Robertson, P. E., & Ye, L. (2013). On the existence of a middle income trap. Available at SSRN 2227776

foundation of escaping the middle-income trap[31]. For that to happen, labor and capital must be reallocated to the most productive firms and sectors in the economy[32], so they are deployed most effectively, fueling growth in total factor productivity (TFP). Economic growth will typically involve greater complexity and an increased use of technology. Moving to the high-income bracket is thus dependent on the ability of economic actors to achieve increasing complexity and to ensure the continuous improvement of education, training, research, and innovation. A comprehensive innovation-centered strategy with mission-oriented policies is a necessary ingredient to enabling domestic innovation.

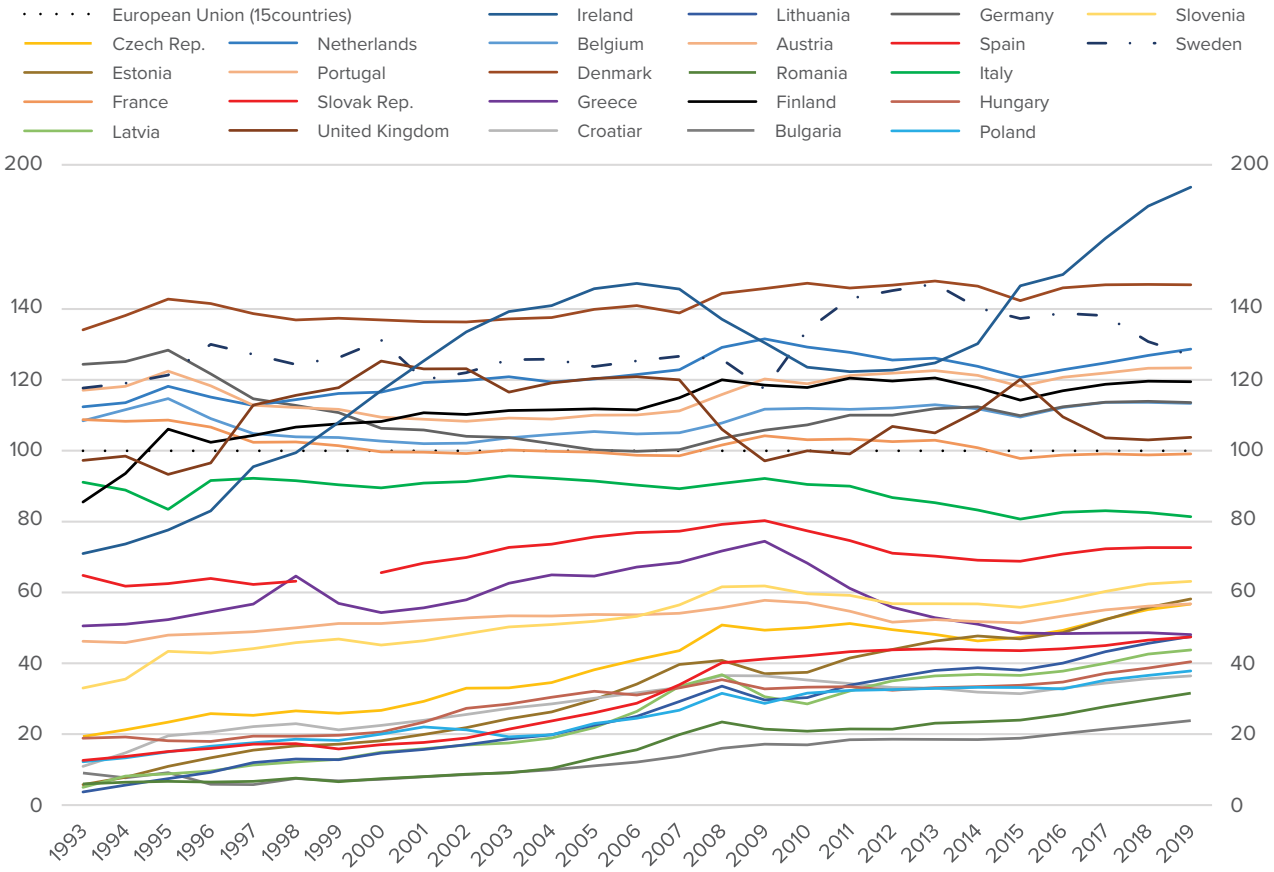
A middle-income trap may also originate from a lack of coordination among many different actors in the economy[33] holding back the growth of productive capacities. In particular, empirical evidence suggests that such an outcome may result from a self-fulfilling prophecy where workers in a trapped middle-income country have no incentives to invest in upgrading education because only few highly educated workers can be gainfully placed in such an economy[34]. At the same time, firms operating in the trapped economy have difficulty moving into highly productive innovation and design activities, as they lack highly educated workers. Policy can help correct for such an outcome by redressing the incentives.

Breeding innovation is a complex endeavor, however. Pre-pandemic, globalization has intensified international competition for middle-income countries, compressing the temporal window where trapped countries can do the necessary learning and lay an institutional groundwork to progress[35]. As discussed in previous sections, the pandemic has further underscored the CEE region's structural weaknesses, making the plea for the upgrading of domestic productive capacities towards high value-added activities both more challenging and more urgent.

i. Economic Growth and Convergence in CEE

Figure H. Different convergence performances across EU members post-Great Recession

(Gross domestic product in current prices per head of population relative to EU-15; ECU/EUR, Index EU15=100)



Source: European Commission AMECO database.

31 Paus, E. (2017). Escaping the middle-income trap: Innovate or perish. ADBI Working Paper, (685). Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/escaping-middle-income-trap-innovate-or-perish

32 Diaz del Hoyo, J. L., Dorrucci, E., Heinz, F. F., & Muzikarova, S. (2017). Real convergence in the euro area: a long-term perspective. ECB Occasional Paper, (203). ISBN: 978-92-899-2865-6, Available at SSRN: https://ssrn.com/abstract=3082205

33 Staehr, K. (2015). Economic Growth and Convergence in the Baltic States: Caught in a Middle-Income Trap? Intereconomics, 50(5), 274–280. https://doi.org/10.1007/s10272-015-0551-1

34 Agénor, P. R., Canuto, O., & Jelenic, M. (2012). Middle-income growth traps. World Bank Policy Research Working Paper (6210).

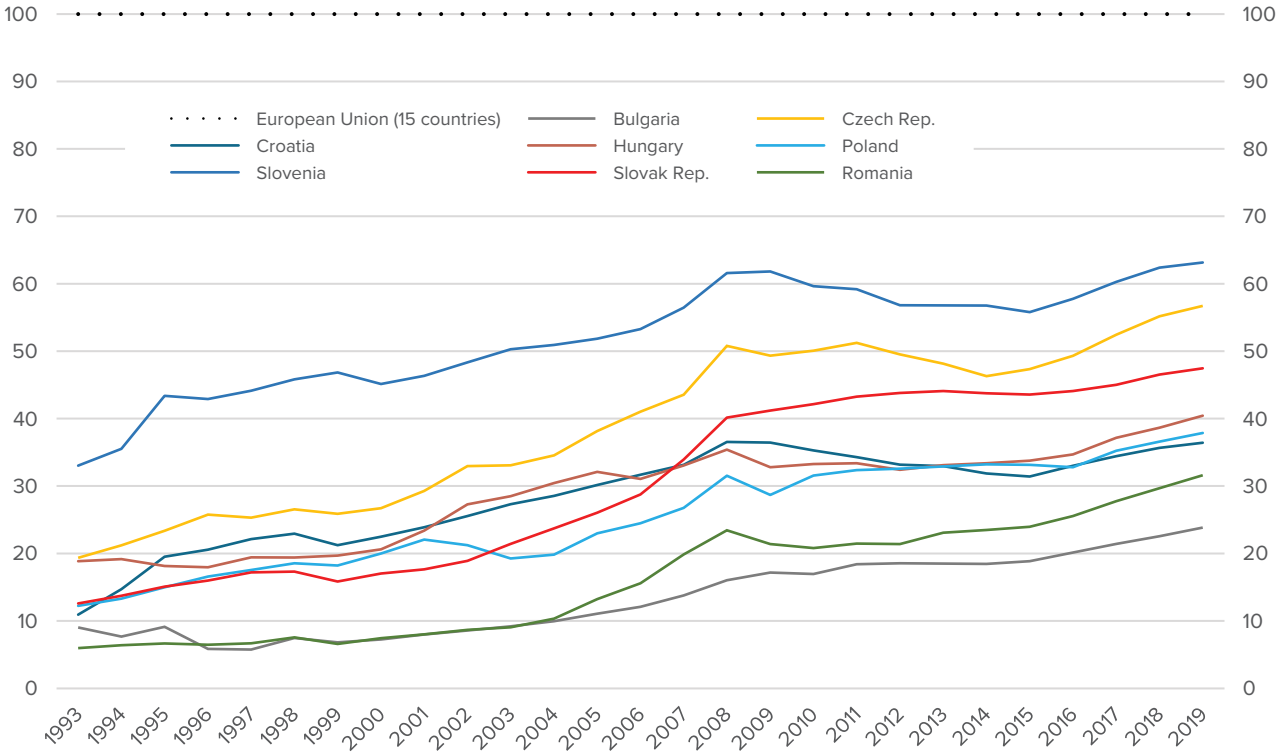
35 Doner, R. F., & Schneider, B. R. (2016). The middle-income trap: More politics than economics. World Politics, 68(4), 608-644.

Some empirical studies suggest that crises tend to exacerbate growth slowdowns[36]. This seems to hold true for EU convergence performance post-Great Recession, as supported by GDP per capita in PPS for selected EU economies over the period of 1993-2019. As in Figure H, most EU countries on average continued to converge to the EU-15 benchmark income level but at a slower pace than pre-crisis. Some countries – Italy, Spain and most notably Greece – even started diverging pronouncedly from the EU-15 average. France has been wavering at around the 100% benchmark, stagnating. Ireland has posted most notable development, first diverging and then mid-decade posting impressive convergence gains to almost 200% of the EU-15 average.

CEE economies have exhibited a more consistent, post-crisis trend (Figure I). On average, they have continued growing and converging to the EU-15 average, albeit at a slower post-recession pace. In particular, the growth and convergence process slowed between 2009-2014, again picking up pace in 2015. As of 2019, CEE countries have converged to between 25 to 65 per cent of the EU-15 income level[37], with a hefty gap still to be closed.

Figure I. Slower convergence gains of CEE countries[38] post-Great Recession

(Gross domestic product in current prices per head of population relative to EU-15; ECU/EUR, Index EU15=100)



Source: European Commission AMECO database.

36 For example, and empirical study by Eichengreen, B., Park, D., & Shin, K. (2013). Growth slowdowns redux: New evidence on the middle-income trap (No. w18673). National Bureau of Economic Research. on a sample for the period 1957-2010 finds a financial crisis appears to increase the probability of a slowdown.
37 The developments discussed leave out Austria, which has already converged above the EU-15 benchmark
38 Austria is left out as it has reached above EU-15 levels and distorts the developments

ii. The Role of Governments in Fostering Innovation: Lessons, Evidence, Trends

There is no universal recipe provided by research and country experience, **as to how governments should foster innovation**. Every country is unique. The next section presents a few selected propositions that have worked to propel innovation across countries and over time.

The coronavirus pandemic spurred a seismic policy reaction of a scale and scope unseen in recent modern economic history. Revolutionary policy steps have been taken to finance the recovery, notably, a common European Commission debt instrument has been institutionalized for the first time with strong symbolic messaging for the solidarity, unity and cohesion of Europe, and ample potential macro-financial implications, including for EU financial markets, the international role of the euro, and the EU's power in the global arena. Notwithstanding these robust reactionary efforts, **innovation strategy requires targeted policy efforts on a long-standing, perpetual basis**. Various empirical evidence suggests that long-term policy underpinnings in select areas help prevent protracted slowdowns. For example, high education-levels, large share of high technology in exports, strong institutions, and diversified trade and production make middle-income countries less prone to periods of muted growth. A 2013 study by Eichengreen et al. based on a 1957-2010 sample concludes that education and high-technology intensity of exports reduce exposure to protracted growth slowdown[39]. An IMF Working Paper by Aiyar et al. (2013) comes to similar conclusions with respect to having a vigorous institutional base and diversified exports, as based on a 1955-2009 sample[40].

Not only can policy focus strategically on key areas over a long-time horizon, **the role of governments in the quest for innovation-led growth could be more active**. Mazzucato (2013) argues that governments should participate in "steering the ship" of innovation, as opposed to the more traditional notion of merely fixing market failures[41]. Her seminal work demonstrates that despite the popular perceptions of the US being a liberal *laissez-faire* -leaning economy, the US government has historically actively co-created innovation and co-shaped markets by participating in early-stage development and the financing of various strategic industries.

Public-private partnerships (PPPs) are increasingly used to promote innovation[42]. These are not a new tool for stimulating innovation through joint collaborative efforts between private and public actors. Similar past efforts have included grants and vouchers to boost cooperation between businesses and universities, R&D tax credits to encourage collaborative research between industry and science (e.g. in France) and industrial networks (e.g. Ireland, UK) to formal PPPs. Over the span of the past decade, however, more "strategic" PPPs orientated towards addressing social, environmental, and economic challenges emerged[43]. Traditional PPPs are motivated by marrying academic research with application fields or enabling businesses to capitalize on public research where markets fail. Strategic PPPs are bigger in scope (more partners involved for longer) and scale (larger funding commitments for longer) and aim to address longstanding problems (such as, combating climate change, unemployment, the demographical shift) or achieve leadership at the technological frontier (e.g. in areas of strategic importance, such as manufacturing)[44]. Well-designed PPPs have worked because they are mutually beneficial: they reduce risk for the private sector, while they enable governments to harness private sector's on-the-ground creative capacity and maximize gains from research investments at times of constrained budgets. Importantly, such schemes may be successful because they operate in a rare space, where incentives of actors are uniquely aligned, as emanating from the intersection of private-public interests[45], shared financial exposure and risks, and goals.

The "side-effects" of the coronavirus pandemic, such as mounting debt levels, large deficit spending on the one hand, and constrained public budgets on the other, make the plea to come up with an effective innovation strategy particularly pressing. More than ever, governments need to ask the right questions as a starting point in formulating a successful innovation strategy. Universally, it is useful to define **where in the economy to focus the innovation/upgrading of domestic capacities to leap forward in terms of productivity and greater value-added.** Focusing on the enhancement of skill-intense services is usually the general answer for middle-income, manufacturing-reliant economies. In CEE, where an valuable part of GDP is associated with international value chains, policymakers should concern themselves with how to increase the share of domestic value-added. There is some evidence that reliance on first-tier global producers has been hampering domestic producers' ability to capture a larger share of domestic-value added[46]. However, this may change as the global economy diversifies suppliers and the localization of production partly ensues in the post-pandemic era. PPPs can also help answer which activities should be targeted to achieve greatest efficiency gains. Government can play the middleman between foreign investors/large players and domestic low-value added firms, and mediate the quest for the latter to seize more value-added. The bottom line is that in the efforts to define means and ends, governments should play a proactive and coordinating function in soliciting inputs from all key actors in the economy.

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39 Eichengreen, B., Park, D., & Shin, K. (2013). Growth slowdowns redux: New evidence on the middle-income trap (No. w18673). National Bureau of Economic Research.

40 Aiyar, M. S., Duval, M. R. A., Puy, M. D., Wu, M. Y., & Zhang, M. L. (2013). Growth slowdowns and the middle-income trap (No. 13-71). International Monetary Fund.

41 Mazzucato, M. (2013). Financing innovation: creative destruction vs. destructive creation. Industrial and Corporate Change, 22(4), 851-867.

42 The OECD (2005), "Public/Private Partnerships for Innovations", in OECD, OECD Science, Technology and Industry Outlook 2004, OECD Publishing. has defined PPP as a formal arrangement over a defined period of time between private and public entities, where both sides interact in the decision-making process, and co-invest scarce resources to achieve common goals across a variety of fields, including in science, technology, innovation etc.

43 Selected examples of such initiatives include the Netherland's Top Sectors, Germany's Innovation Alliances, Israel's Magnet Consortium, and France´s Strategic Industrial Innovation Programme (ISI) etc.

44 Cervantes, M., & Watanabe, T. (2014). Strategic Public/Private Partnerships In Science, Technology And Innovation-Final Report (No. JT03367772). OECD. https://era.gv.at/object/document/1991/attach/Beilage_5a_OECD-_PPP_in_science_and_technology.pdf

45 Many such grave challenges lie at the intersection of private and public realms, including public transport, pollution, provision of services to ageing populations etc.

46 UNCTAD. (2016). Trade and Development Report 2016. Geneva: United Nations Conference on Trade and Development.

Box 1. Conceptual Framework Of Real Economic Growth Convergence

The table below presents classic approaches to real economic convergence and related theoretical underpinnings. For the purposes of the current project, **β-convergence** and **conditional convergence** concepts are the most apt theoretical approaches to describe and frame the CEE experience. If convergence is not a process that results as spontaneously as the absolute convergence concept implies, **determinants** and **conditions** conducive of economic growth do matter for policy prescriptions. While early works exogenize **capital accumulation** and treat it as main growth driver[47], later works endogenize capital accumulation and augment it with the **accumulation of human capital**[48]. Subsequent literature focuses on **institutions** as a key to unlock convergence, having a resource allocator to innovation, human capital upgrades, R&D and other underlying factors driving growth. Importantly, institutions – broadly understood as the 'rules of the game'[49] – shape **incentives** and thereby the direct decision-making of key economic actors to invest, to accumulate human and physical capital etc. Indeed, institutional quality has been empirically shown an important driver of sustainable, long-term economic growth in the EU[50]. Late studies have focused on **geographical proximity**, conglomeration and **clusters** that multiply and procreate growth through creation of ecosystems, which enhance and develop productivity anchored in human capital cultivation, which can be facilitated through spillovers within cluster ecosystems, resulting in **economies of scale** and **network effects**[51].

Frequent convergence concepts	Main proposition	Theoretical underpinning	Key theoretical claims	Standard measurement
Beta (β)-convergence	Lower-income countries tend to grow more quickly than richer ones.	Neoclassical growth framework: Solow, 1956; Swan, 1956; Ramsey, 1928.	Capital-scarce (low-income) economies exhibit higher returns on this factor of production than capital-abundant (high-income) ones, which promotes fast capital accumulation and rapid economic growth in low-income countries. Results from the assumption of decreasing returns on capital.	Measued as a relationship between growth of real GDP per capita during a period and intial level of real GDP per capita (possibly after controling for other determinants of growth).
Sigma (σ)-convergence	The dispersion in real incomes among countries tends to diminish over time. β-convergence is a necessary but not sufficient condition for σ-convergence.	Neoclassical growth framework; Barro and Sala-i-Martín, 1992 and 1997	Due to factors such as free trade, technology spillover and direct foreign investment countries converge to the same economic level. Distribution of income across economies is becoming more equitable.	Measured by standard deviation of (log of) real GDP per capita.
Absolute (unconditional) convergence	Posits that low-income economies exhibit faster per capita growth than high-income ones, without conditioning, irrispective of institutions, policies or any other characteristics of those economies.	Neoclassical growth framework: Rodrik, 2013.	Countries with access to identical technologies should converge to a common income level. Poorer countries with higher marginal productivity of capital should grow faster in the transition to the long-run steady state. However, existence of unconditional convergence is not supported by the data for whole economies. Rodrik (2013) documents unconditional convergence of manufacturing industries.	Measued as a relationship between growth of real GDP per capita during a period and intial level of real GDP per capita without controling for other determinants of growth.
Conditional convergence	Posits that the institutions and policies may differ across countries, and influence convergence outcomes. Economies may converge towards different steady states. Economic growth in poorer economies is not automatically faster than in richer ones.	Mankiw-Romer-Weil,1995; Islam, 2005; Barro, 2015	Economies, subject to with similar characteristics are likely to converge to the same, or similar steady states over the long run. Economies may differ in fundamental characteristics despite access to identical technologies.	Measued as a relationship between growth of real GDP per capita during a period and intial level of real GDP per capita after controling for other characteristics.
Club convergence	Economies subject to memberships in international and regional clubs (such as OECD or the EU; or regions with similar historical heritage and resulting characteristics, such as CEE), with similar characteristics, are likely to converge to the same, or similar income levels over the long run.	Baumol and Wollf, 1988; Baumol, 1986; De Long, 1988; Ben-David, 1997	Since memebers of same clubs share common characterstics, convergence is observed within clubs. Different clubs do not converge to the same level of economic development.	Measured by dispersion of real GDP per capita within regional/international clubs or relative performance at a point of time vis-à-vis a club-benchmark or average.

47 Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics, 70(1)*, 65-94; Swan, T. W. (1956). Economic growth and capital accumulation. *Economic record*, 32(2), 334-361.
48 Romer, P. M. (1986). Increasing returns and long-run growth. Journal of political economy, 94(5), 1002-1037; Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy, 98(5, Part 2)*, S71-S102; Lucas, R. (1988). On the mechanics of economic development. *Journal of monetary economics*.
49 North, D. (1990). Institutions, Institutional Change, and Economic Performance. Cambridge: Cambridge University Press; Acemoglu, D., Johnson, S, Robinson, J. A. (2001): The Colonial Origins of Comparative Development: An Empirical Investigation. The American Economic Review, 91(5), 1369-1401; Dell, M. (2010): The Persistent Effect of Peru's Mining Mita. Econometrica, 78(6), 1863-1903.
50 Masuch, K., Moshammer, E., & Pierluigi, B. (2016). Institutions and growth in Europe. CEPS Working Document, (421).
51 Krugman, P. (1991). Increasing returns and economic geography. Journal of political economy, 99(3), 483-499.

iii. The Leadership Conundrum

Past country experience and empirical data jointly point to the fact that moving to the high-income bracket is a lengthy and complex process. On the one hand, it necessitates long-term backing of sound policies to maintain fundamental growth drivers, on the other hand, it needs to be adequately adaptable as to accommodate different stages of the transition process over time. Typically, deep innovation-conducive reforms take time to filter through the economy and show up in economic growth, let alone result in increased well-being and social prosperity.

The success of an innovation strategy additionally depends on its governance and execution, including trust in government action and the commitment to learn from experience. **Short-sighted political leadership further undermines the long-term innovation imperative.** In the absence of a patient, coherent but unrelenting political leadership, it needs to be outsourced from other strata of the economy. Likeminded national, regional and even European coalitions may partly fill in the void, particularly, if organized around subsets of shared interests[52].

Likeminded coalitions can focus on removing barriers that inhibit innovation, e.g. streamlining rules, regulation, and policy in the face of institutional failure. Common interests may include an overhauled industrial strategy, financing strategy for small and medium-sized enterprise (SME) scale-ups and new business start-ups etc.

Governments can also do a better job at "packaging" and "selling" the innovation paradigm. Long-term coalitions of like-minded stakeholders to lead and uphold the long-term innovation imperative is key but this coupled with a strong political mandate would be better in order for progress to be stable and deep-seated. Hence, policymakers need to concern themselves with how to make the innovation narrative politically more popular and digestible. This plea is two-fold: the political narrative should posit what the innovation paradigm can do for the lives of ordinary citizens, while economic and financial literacy programs can work in a bottom-up fashion and raise awareness and understanding of constituencies from the ground.

iv. The Role of Regional Alliances

Regional integration and cooperation can serve as a compelling tool for forging innovation and advancing towards the production of higher value-added functions. The CEE region can leverage alliances at both regional and EU levels.

As shown in Chapter 1, **integration in regional clubs has played a vital role in CEE broad transition strategy in the past.** By the same token, it can and should play a role in CEE strategic economic transformation going forward. Especially in the current climate, given the coronavirus pandemic response momentum as embodied by an ample financing package, most notably, the Resilience and Recovery Facility, the timing is right to bring the main pillars of the CEE strategic transformation in line with European priorities. This can be done in a decentralized manner: through national policy coordination, synergies and spillovers; but also by more centralized strengthening of common frameworks addressing the most vital elements of the EU as a single economic entity, including common freedoms, the single market, a push towards integrated financial markets, and a stronger monetary union.

At a regional level, the CEE region can maximize and capture its full potential through mutual collaboration. CEE nations share many common characteristics and face shared challenges. As shown previously, the countries depart from similar starting points due to historical commonalities, a great degree of market openness and other structural economic factors. The region also faces similar challenges such as the need to upskill its workforce or upgrade its industry. Regional synergies could be obtained from regional innovation clusters organized around shared sectoral pursuits, such as industrial clusters, or start-up clusters, beneficial especially to small countries that could reap the regional scale and network effects[53]. Sharing best practice can also accelerate the course of the CEE economy's strategic transformation.

As stressed throughout Chapter 2, there is no one-size-fits-all for engineering innovation. Nevertheless, learning from past country experience, noticing what data and recent research suggest works, joining forces around shared interests across economic silos within economies, and across countries and regions, forging likeminded coalitions to protect the innovation endeavor in a turbulent and unstable political climate, and meanwhile building relevant institutional environment constitute the groundwork for a conceivable and sound innovation strategy – a way out of the middle-income trap predicament, the means to ascend in value-added activities, and a switch of gears towards dynamic, resilient and sustainable growth. The cost of doing nothing – heading for a protracted period of stagnant growth and low wages – is worse for all key actors. With the coronavirus pandemic, the downside of doing nothing has increased exponentially.

Having adequately contextualized the plea and its urgency, this report next turns to the building blocks of CEE strategic transformation providing the conceptual underpinnings for the CEE Strategic Transformation Index.

52 Paus, E. (2017). Escaping the middle-income trap: Innovate or perish. ADBI Working Paper, (685). Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/escaping-middle-income-trap-innovate-or-perish

53 Marciniak, T., Novak, J., & Purta, M. (2020, February 23). Central and Eastern Europe needs a new engine for growth. McKinsey & Company. https://www.mckinsey.com/featured-insights/europe/central-and-eastern-europe-needs-a-new-engine-for-growth

Chapter 3. CEE Strategic Transformation Building Blocks

The CEE economy's strategic transformation is a winning transformation that leans heavily on innovation, while being intensely aware of the region's past and present, its growth drivers to-date, and its regional macroeconomic, financial, and structural makeup. As such, the conceptual framework is formulated with awareness and sensibility for the region's past performance and current economic structure in mind (a backward-looking element), while placing an emphasis on innovation as a means to address pain points and shared challenges (the forward-looking element). It is conducive to the sustainable growth of its economies and the long-term prosperity of its societies, enabled and buttressed by the strategic policy playbook.

GLOBSEC has pooled and leveraged regional expertise – as embodied by data, empirical evidence, international institutions' country surveillance, and the know-how of institutions/individuals partnered on this project – **to identify the big areas where change is necessary in order to reroute the CEE region onto a dynamic and sustainable growth trajectory**. As shown in the chapters leading up to this point, there is a shared basis – a set of common macroeconomic features among CEE countries – that provide a viable foundation for this exercise.

The section that follows presents an overview of the main concepts and building blocks of the CEE Strategic Transformation index. The composite index consists of two main pillars: (1) Macroeconomic structure and resilience, and (2) The innovation economy. The former broadly captures the performance and structure of the CEE economy, which is closely linked to the regional economies' economic and financial vulnerabilities that need to be addressed to foster resilient economies. The latter draws on the discussions in preceding chapters, which amount to the prediction that innovation is a key to unlocking/increasing the region's growth potential, escaping the middle-income trap predicament, and raising the standards of living permanently and sustainably.

• Trade Openness and the Position in Global Value Chains (GVCs)

Economic growth in CEE countries after 1995 was driven mainly by exports, as is documented by numerous empirical analyses that decompose historical growth in CEE into value-added absorbed at home and that exported[54]. In terms of trade openness – hereby defined as exports plus imports as a percentage of GDP – the CEE9 economies under review frequent top openness rankings at the global scale. For example, the World Bank based on a 2018 global sample of 162 countries ranks Slovak Rep. #8 globally, followed by #10 Hungary, #12 Slovenia, #17 Czechia, #25 Bulgaria, #46 Austria and #47 Poland[55].

Against a backdrop of rapid economic globalization and intensifying trade integration, businesses over the past two decades have disaggregated their production operations and allocated input sourcing across the globe according to their specific country cost-benefit trade-offs[56]. This has been particularly true for the CEE9 economies, which had become gradually more integrated in cross-border value chains, at both global and regional levels.

The decisions at the firm level to fragment their production, and extend it across borders based on unique efficiency trade-offs at different stages, were reinforced by the removal of trade barriers, suppressed transport costs and general streamlined EU rules and standards as a part of the EU Single Market[57]. However, the perpetual geopolitical turbulence marking the past five years, including Brexit, the US-China trade wars, and most recently the coronavirus pandemic have eroded the production paradigm in favor of greater localization, regionalization, and reshoring from China to mitigate risk[58]. The debate has intensified especially in the aftermath of the global lockdown, which paralyzed global value chains. A recent report by IFO Institute has, for example, alleged that Germany's dependence on international suppliers could jeopardize the economy's post-pandemic recovery[59].

Nevertheless, the nine CEE countries under review have strong trade ties with and are well integrated into the eurozone and the EU. Over the past two decades, the euro area has been the recipient of more than 50% of the total exports of these nine countries (see Chart J). Moreover, on average between 2012-2016, over 45% of gross exports of Slovak Rep. and Hungary were GVCs-related, as measured by their foreign content of exports, followed by below 40% for Czechia, above 35% for Bulgaria, and slightly below 35% for Slovenia within the EU27 country sample (Chart K).

54 Hagemejer, J., & Mućk, J. (2019, May 29). Export-led growth in Central and Eastern Europe. VOX, CEPR Policy Portal. https://voxeu.org/article/export-led-growth-central-and-eastern-europe

55 The Global Economy. (2018). Trade openness: exports plus imports as percent of GDP, 2018 - Country rankings. (indicator). (Accessed on 20 August 2020) https://www.theglobaleconomy.com/rankings/trade_openness/ based on World Bank data

56 Lund, S., Manyika, J., Woetzel, J., Bughin, J., Krishnan, M., Seong, J., & Muir, M. (2019, January). Globalization in transition: The future of trade and value chains. McKinsey Global Institute.

57 Chiacchio, F., & Semjonovs, A. (2020). Integration of non-euro area central and eastern European EU countries in global value chains, export dynamics, and business cycle synchronisation with the euro area. Economic Bulletin Boxes, 1. https://www.ecb.europa.eu/pub/economic-bulletin/focus/2020/html/ecb.ebbox202001_04~6994e4179c.en.html

58 Cerulus, L. (2020, March 6). Coronavirus forces Europe to confront China dependency. POLITICO. https://www.politico.eu/article/coronavirus-emboldens-europes-supply-chain-security-hawks/

59 Skolimowski, P. (2020). Germany's Supply Chain Reliance Threatens Post-Pandemic Restart. Bloomberg. https://www.bloomberg.com/news/articles/2020-05-14/germany-s-supply-chain-reliance-threatens-post-pandemic-restart

Box 2. GLOBSEC CEE Strategic Transformation Index (STI) Building Blocks

PILLAR 1. Macroeconomic structure and resilience

OPENNESS

- Global value chains (GVC) participation
- Foreign direct investment (FDI) openness
- Index of export market penetration

PRODUCTIVITY & VALUE-ADDED

- Total factor productivity (TFP)
- Medium/high-tech industry value-added in total value-added
- Sophistication of exports
- Employment in knowledge-intensive activities
- High-technology exports as share of total manufacturing

EXTERNAL RESILIENCE

- Economic complexity
- Terms of trade volatility
- Herfindahl-Hirschman Product/Market Concentration

FINANCIAL STRUCTURE

- Long-term interest rate for convergence purposes
- Bank lending margins on business loans
- Non-performing loans
- Household loans to disposable income
- House price to disposable income index

PILLAR 2. Innovation economy

EDUCATION CLUSTER

- Education Outcomes: PISA scores reading, math, science
- Adult participation rate in education and training
- Early leavers from education and training
- Government expenditures on education
- Tertiary educational attainment
- Teaching quality: Classroom teachers and academic staff

DIGITAL ECONOMY

- Internet use and access
- E-commerce, internet purchases
- E-government

GREEN ECONOMY

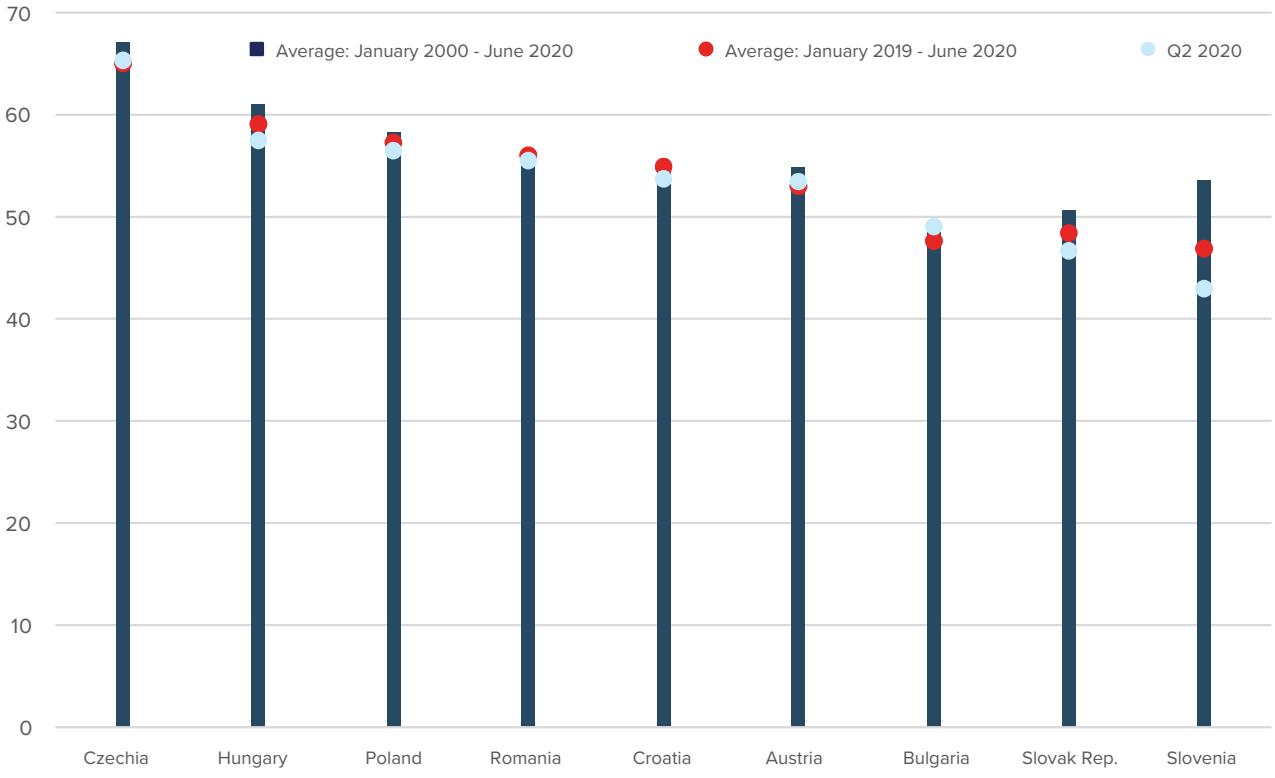
- Production-based CO2-productivity
- Resource productivity and domestic material consumption
- Domestic material consumption per capita
- Renewable energy share in final energy consumption
- Recycling rate of municipal waste
- Air quality: Mean population exposure to PM2.5

INNOVATIVE CAPACITY

- Patents, trademarks, and industrial designs
- Research and Development (R&D) expenditures
- Research and Development (R&D) personnel
- Researchers head count
- Human resources in science & technology
- Venture capital (VC) expenditures

Figure J. Share of exports from CEE to the Eurozone

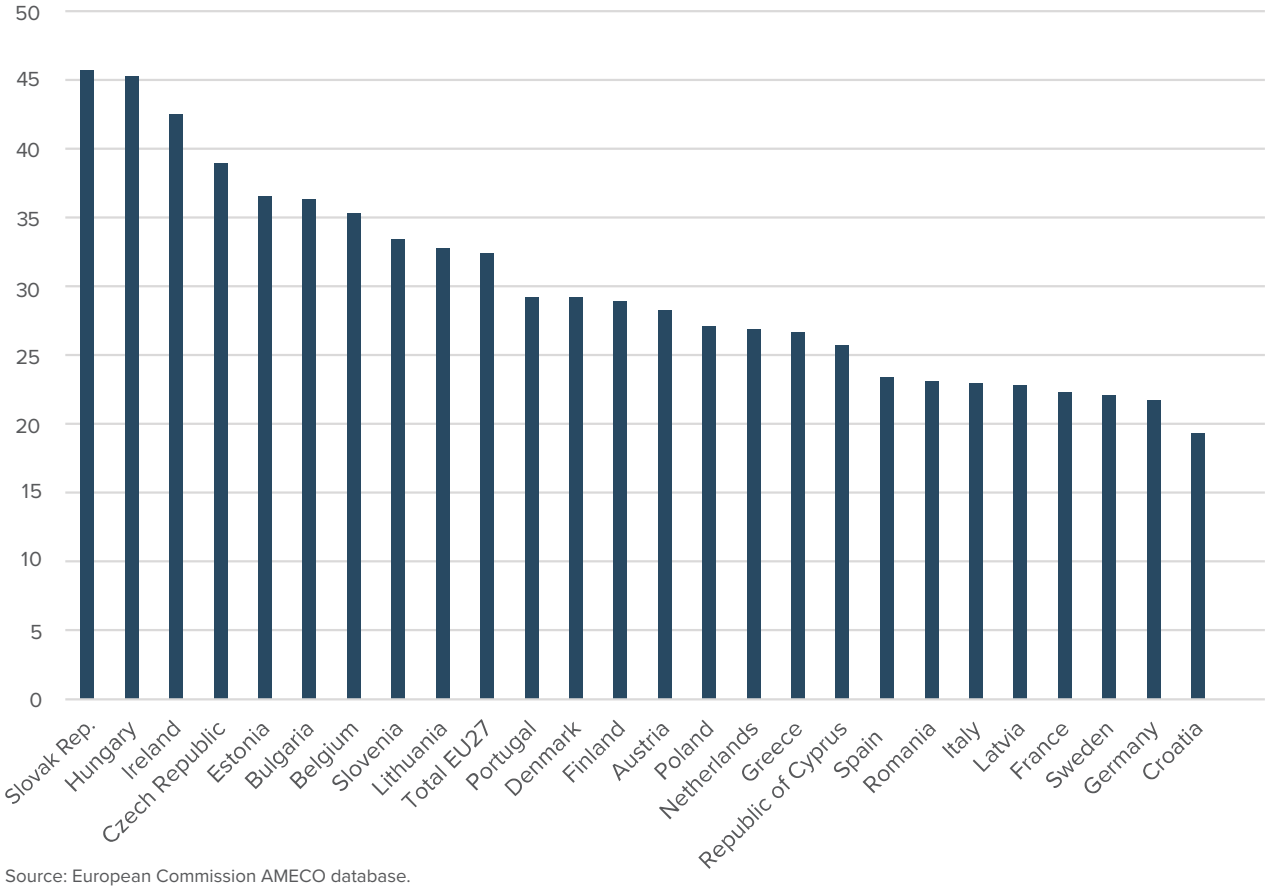
(in % of total exports, average values Jan-2000 to last available observation)



Source: Eurostat, authors' calculations.

Figure K. CEE region is integrated in international value chains

Foreign content of exports, in % of gross exports, average values 2012-16



Source: European Commission AMECO database.

Likewise, it is well-documented that on average the nine economies are positioned downstream[60] in euro area value chains[61]. As detailed in previous sections, CEE economies are specialized in handling and in assembly functions with low domestic value-added content in exports and are typified by a more concentrated use of foreign intermediate inputs.

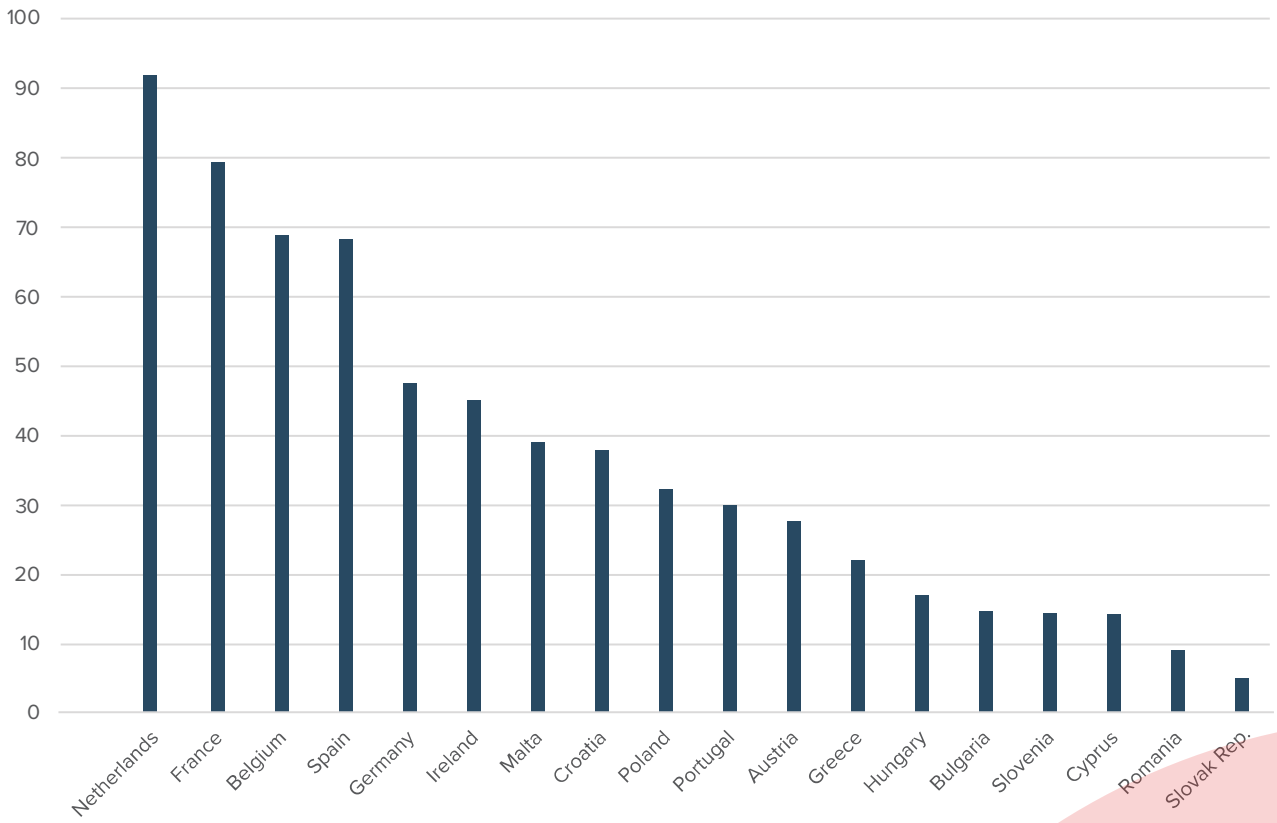
- **FDI Openness**

Earlier discussions recognized the CEE's FDI-led growth paradigm, especially in its early stages of transitional development. Furthermore, as shown in Figure B, most CEE economies remain under-capitalized to-date, compared to the EU average, with local financial and capital markets in early development stages compared to western peers[62].While government bond markets are comparable in size, as measured by capitalization in percentage of GDP, the private bond, private credit, and equity markets pronouncedly lag behind (Figure L)[63].

It is widely accepted that lacking local capital markets may hamper economic growth. Capital markets can improve risk-sharing, maximize capital allocation efficacy in the real economy, improve the transmission and implementation of monetary, fiscal and exchange rate policies – jointly enhancing economic welfare[65]. On the flip side, dysfunctional local capital markets may pose an important obstacle to economic development mainly via capital misallocation[66]. Some research finds that such capital misallocation frequently occurs in the case of domestic bank financing that is not allocated the most productively due

Figure L. CEE region's capital markets are underdeveloped

Market capitalization of listed domestic companies, in % of GDP, average values 2010-19 (or as available)



Source: World Bank.

60 As explained in Wang, Z., Wei, S. J., & Zhu, K. (2013). Quantifying international production sharing at the bilateral and sector levels (No. w19677). National Bureau of Economic Research., a country is situated downstream in the value chain when foreign inputs (in terms of value-added) in the production of its exports are greater than the inputs it provides to produce other countries' exports

61 Chiacchio, F., & Semjonovs, A. (2020). Integration of non-euro area central and eastern European EU countries in global value chains, export dynamics, and business cycle synchronisation with the euro area. Economic Bulletin Boxes, 1.

62 Köke, F. J., & Schröder, M. (2002). The prospects of capital markets in Central and Eastern Europe. DOI: 10.2139/ssrn.439763

63 Tchaidze, R., & Adarov, A. (2011). Development of Financial Markets in Central Europe: the Case of the CE4 Countries. IMF Working Papers, 1-33. https://www.imf.org/external/pubs/ft/wp/2011/wp11101.pdf

64 Market capitalization (also known as market value) is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end of year values.

65 Laeven, L. (2014). The development of local capital markets: rationale and challenges (No. 14-234). IMF Working Papers. https://www.imf.org/external/pubs/ft/wp/2014/wp14234.pdf; Cœuré, B. (2019). Benoît Cœuré: European capital markets-priorities and challenges. European Central Bank. https://www.ecb.europa.eu/press/key/date/2019/html/ecb.sp190625_1~49befd1908.en.html

66 Bau, N., & Matray, A. (2019). Should low-income countries open up to foreign capital? The India. VoxDev. https://voxdev.org/topic/firms-trade/should-low-income-countries-open-foreign-capital-india-experiment.

to historical, political, or regulatory reasons[67]. An IMF study focusing on the capital markets of Slovak Rep., Czechia, Poland and Hungary concludes that they are underdeveloped and shallow given these countries' macroeconomic fundamentals, and the observed divergence can be explained by their institutions, and the availability of external financing (for equity and private credit markets) that fills in the gap[68].

The current narrative of laggard domestic capital markets in CEE, thus, upholds and underscores the importance of openness to foreign capital, motivated by the right regulatory conditions to attract and retain it. Based on data, foreign capital inflows can also improve the allocative function, especially where local capital markets are less formed.[69] The debate on how to capture FDI in the CEE context additionally remains relevant against the backdrop of the current post-pandemic debate of production reshoring from China. The exponential surge of risk due to over-extended global value chains has prompted producers to entertain moving parts of their supply chains out of China, closer to home, even if that meant higher costs[70]. Some CEE9 countries have already pitched to attract such reshoring[71], leveraging their existing links, EU membership, and relatively moderate labor costs.

• Economic Complexity and External Resilience

Drawing on prior discussions of the middle-income trap predicament and the broad agreement to innovation being the key exit route, **graduating from the middle-income bracket and climbing the development ladder involves the accrual of productive knowledge and its use in a greater number of more complex industries**[72]. Such productive knowledge encompasses country capabilities required to produce, funding, technology, human capital and other resources, and overall determines the country's potential for economic growth. The number of products in country exports baskets (i.e. its exports diversity) is a good proxy of countries' productive knowledge: more competitive countries exploit their know-how and resources to diversify their export baskets[73]. This hold true even more in case of small, open economies with considerable share of exports in gross domestic product, like CEE9. The accumulation of such productive knowledge and its use manifests in increased number of products they successfully export, as well as the product sophistication[74].

The concept of economic complexity is closely linked to that of external vulnerability and resilience-building. The interest in country-specific macro-financial vulnerabilities has been more visibly ignited by the Great Financial Crisis in 2008-2009, as world GDP fell by 5.5 percentage points, while world exports contracted by 20 percentage points[75]. With the perpetual disturbances of the past decade (including crises, financial disruptions, Brexit, trade wars, natural disasters and climate events, civil and political unrest, and more recently the pandemic), the notion that trade has become one of the leading channels of external shock transmission has gained further prominence. The external vulnerability/resilience debate has been recently fixated on various aspects, including the already mentioned supply chain-resilience, reducing vulnerability of core/strategic industries[76], and the concept of strategic sovereignty and self-sufficiency for essential products, such as food, pharmaceuticals and medical supplies[77]. Nevertheless, these are in the present moment largely political discussions, in the absence of sufficient evidence of 'turning inward' being the appropriate coping strategy to counteract shocks[78]. While self-sufficiency is conceivable for large and powerful players, it may be a dead-end for small open economies; additionally, it may reduce economies of scale, fragment the global marketplace, and crowd out investment from abroad for all players[79]. Also 'strategic industry' is potentially a sweeping concept that could result in a dangerous, massive-scale 'self-sufficiency' beyond just food and drugs. Besides, there are other sound coping mechanisms to facilitate economies' robustness (i.e. the ability to withstand a shock and continue operations) besides

67 Banerjee, A., & Munshi, K. (2004). How efficiently is capital allocated? Evidence from the knitted garment industry in Tirupur. The Review of Economic Studies, 71(1), 19-42. https://academic.oup.com/restud/article-abstract/71/1/19/1590097?redirectedFrom=fulltext; Cole, S. (2009). Fixing market failures or fixing elections? Agricultural credit in India. American Economic Journal: Applied Economics, 1(1), 219-50. https://www.aeaweb.org/articles?id=10.1257/app.1.1.219

68 Tchaidze, R., & Adarov, A. (2011). Development of Financial Markets in Central Europe: the Case of the CE4 Countries. IMF Working Papers, 1-33. https://www.imf.org/external/pubs/ft/wp/2011/wp11101.pdf

69 Bau, N., & Matray, A. (2019). Should low-income countries open up to foreign capital? The India. VoxDev. https://voxdev.org/topic/firms-trade/should-low-income-countries-open-foreign-capital-india-experiment

70 Beattie, A. (2020, May 28). Will coronavirus pandemic finally kill off global supply chains? Financial Times. https://www.ft.com/content/4ee0817a-809f-11ea-b0fb-13524ae1056b

71 Wilczek, M. (2020, June 2). Poland could be among Europe's biggest beneficiaries of post-pandemic production shift from China: report. Notes From Poland. https://notesfrompoland.com/2020/05/21/poland-could-be-among-europes-biggest-beneficiaries-of-post-pandemic-production-shift-from-china-report/ ; ROTONDI, F., SKOLIMOWSKI, P., NEUMANN, J., & LIMA, J. (2020, July 5). Hard to cut ties with low-cost China, Europe finds. Arkansas Online. https://www.arkansasonline.com/news/2020/jul/05/hard-to-cut-ties-with-low-cost-china-europe-finds

72 Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M., & Simoes, A. (2014). The atlas of economic complexity: Mapping paths to prosperity. Mit Press.

73 Hidalgo, C. A., & Hausmann, R. (2009). The building blocks of economic complexity. Proceedings of the national academy of sciences, 106(26), 10570-10575.

74 Harvard's Growth Lab. (1995–2018). The Atlas of Economic Complexity by @HarvardGrwthLab [Dataset]. https://atlas.cid.harvard.edu/rankings

75 Hollweg, C. H., Lederman, D., & Reyes, J. D. (2012). Monitoring export vulnerability to changes in growth rates of major global markets. The World Bank.. https://openknowledge.worldbank.org/handle/10986/16385 License: CC BY 3.0 IGO

76 The idea of greater European sovereignty in healthcare is anchored in the Franco-German proposal: Bundesregierung. (2020, May 18). A French-German Initiative for the European Recovery from the Coronavirus Crisis [Press release]. https://www.bundesregierung.de/resource/blob/973812/1753772/414a4b5a1ca91d4f7146eeb2b39ee72b/2020-05-18-deutsch-franzoesischer-erklaerung-eng-data.pdf?download=1

77 US leadership has called for reduced and "dangerous over-dependence on global supply chains" for drugs, medical supplies, and equipment: Brady, J. S. (2020, April 3). Remarks by President Trump, Vice President Pence, and Members of the Coronavirus Task Force in Press Briefing [Press release]. https://www.whitehouse.gov/briefings-statements/remarks-president-trump-vice-president-pence-members-coronavirus-task-force-press-briefing-17/

78 In fact, leading economic thinkers have suggested these concepts to have little economic merit. See Baldwin, E. R. & Evenett, J. S. (Eds.). (2020, April). COVID-19 and Trade Policy: Why Turning Inward Won't Work. Centre for Economic Policy Research. CEPR Press. https://voxeu.org/content/covid-19-and-trade-policy-why-turning-inward-won-t-work; Wolf, M. (2020, June 23). The dangerous war on supply chains. Financial Times. https://www.ft.com/content/e27b0c0c-1893-479b-9ea3-27a81c2506c9 and Miroudot, S. (2020, June 18). Resilience versus robustness in global value chains. VOX, CEPR Policy Portal. https://voxeu.org/article/resilience-versus-robustness-global-value-chains

79 Wolf, M. (2020, June 23). The dangerous war on supply chains. Financial Times. https://www.ft.com/content/e27b0c0c-1893-479b-9ea3-27a81c2506c9

the supposed turning inward. They include diversification of supplier bases or introduction of digital infrastructures, business operations continuance strategies that minimize job losses, losses on the demand-side, and overall cushion shocks to the economy.

These timely meditations aside, **using various approaches to capture sensitivity of exports to swings in foreign GDP**, evidence suggests export complexity to be a sensible determinant explaining cross-country differences in external vulnerability[80]. Country experience also speak loud and clear: e.g. China, India and Singapore have boosted their economic complexity to higher levels during recent years, joining the rich countries cluster over 1995–2017[81]. Such results further corroborate the notion that economic complexity matters for exporting countries' raising their living standards sustainably and reinforces the call for export markets diversification.

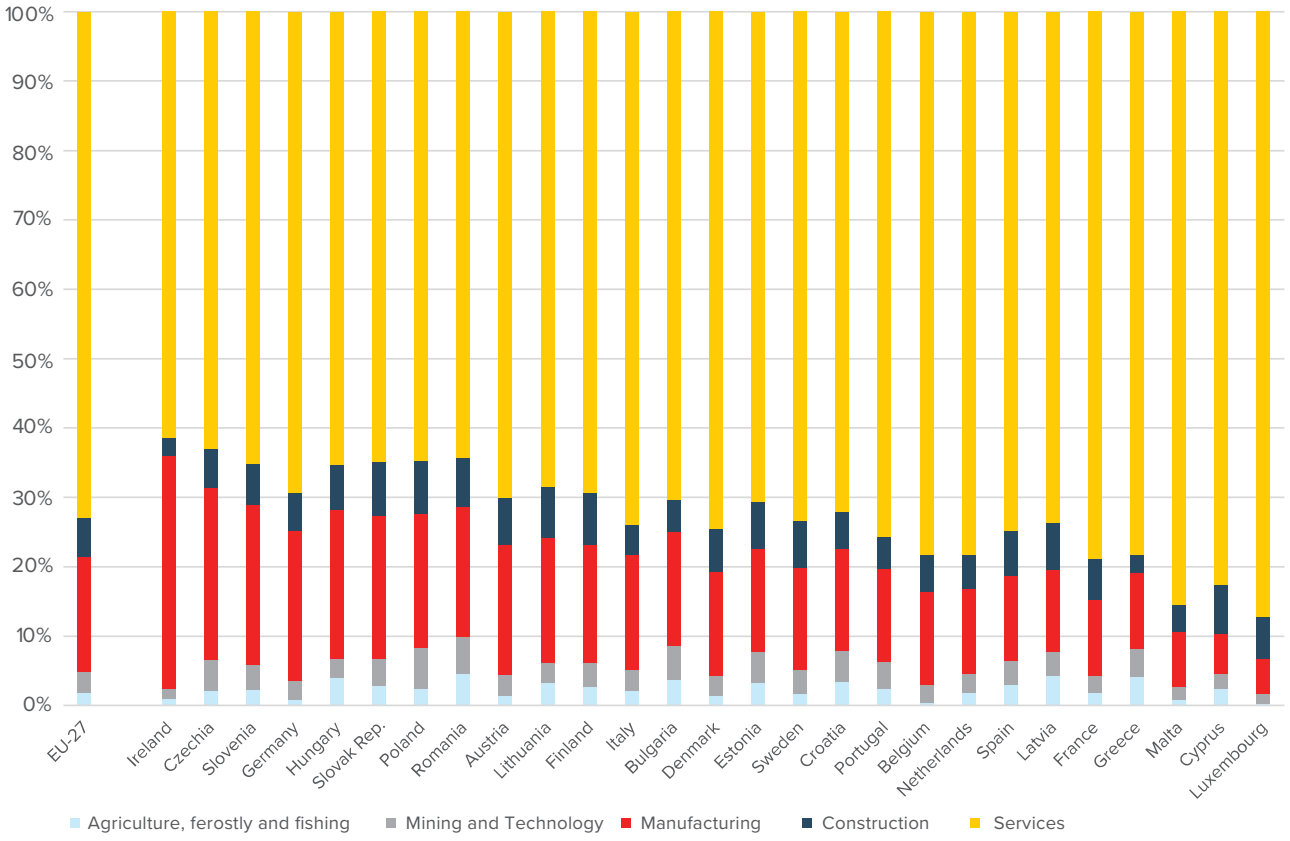
- **Total Factor Productivity and Manufacturing Value-Added Position**

As a part of a broader effort to understand, measure, and assess the process and drivers of long-term growth in CEE9, particularly the dynamism associated with technological change and the complex set of interrelationships underlying it, total factor productivity (TFP) is included. Most economists and leading thinkers agree that technological change is the major determinant of long-term economic growth, throughout history. Despite the well-documented measurement issues with TFP[82], including a general measure of economy's productivity aligns well with the economic value creation the CEE9 should be targeting in its next economic chapter.

A more specific and tailored measure of productivity is embodied by the share of high-tech and medium-tech manufacturing value-added in total manufacturing value-added. The inclusion of this productivity concept was inspired by other innovation indices/scoreboards[83], but makes sense specifically in the context of countries under review, as their economic

Figure M. CEE9 region's sectoral structure is leaned towards manufacturing

Gross value added by economic activity, 2019 (% of total gross value added)



Source: Eurostat.

80 For example, origin-destination specific gravity models of trade suggest that export exposure in global markets matters more than other factors, such as export elasticities across product classes, regions etc. (Hollweg, C. H., Lederman, D., & Reyes, J. D. (2012). Monitoring export vulnerability to changes in growth rates of major global markets. The World Bank.)

81 Sciarra, C., Chiarotti, G., Ridolfi, L., & Laio, F. (2020). Reconciling contrasting views on economic complexity. Nature communications, 11(1), 1-10. https://www.nature.com/articles/s41467-020-16992-1.pdf

82 Lipsey, R. G., & Carlaw, K. (2000). What does total factor productivity measure?. International Productivity Monitor, 1, 31-40.

83 In particular, European innovation scoreboard. (2017, August 30). Internal Market, Industry, Entrepreneurship and SMEs - European Commission. https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en#:%7E:text=Sweden%20continues%20to%20be%20the,the%20group%20of%20strong%20innovators.

structure is heavily leaned towards manufacturing (Figure M). Manufacturing industries account for a substantial portion of research and development in many successful innovating countries[84]. However, not all manufacturing is equally innovative, this is why we focus on high- and medium-tech shares that need to capture an increasingly greater share of total manufacturing, if the region stays manufacturing-intensive and aims at moving up in terms of value-added.

• Ease of Finance and Financial Stability

The exposure to international crises is felt not only through trade but also through financial channels. Studying observed disturbance over the 2007-2014 period when the Great Financial Crisis and Eurozone debt crisis took place, some empirical studies suggest that credit disruption was the leading contagion driver[85]. These shocks have showcased that the extent of disturbances, the efficacy of ensuing policy measures, speed of the recovery, and overall financial stability depend on different financial structures, including financial instruments used, organization of finance, institutional composition, as well as financial supervision and regulation.

Bank loans still dominate the European landscape and remain a leading source of financing. Euro area firms source about 55% of their debt-financing from banks, compared to just 30% in the US[86]. Bank-related products remain the most relevant financing source for euro area small and medium-sized enterprises (SMEs), ahead of market-based instruments, such as equity (11%), debt securities (4%) and factoring (9%).[87] According to the ECB Survey on the Access to Finance of Enterprises in the euro area, this is a longstanding trend. In non-euro area CEE countries, the landscape is similar.

The CEE banking sector is, furthermore, dominated by banks with foreign ownership that ensure bulk of credit provision to CEE companies. Pre-pandemic, the regional banking sector was characterized by improved profitability, stable capital adequacy ratios, and improved asset quality with steadily decreasing non-performing loans (NPLs) ratios[88], and one of the main sources of financial instability in recent years in the region. Profitability in the challenging low-interest environment has been aided by increased lending volumes[89], in the future is expected to be helped by digitalization strategies and fintech. CEE banks have learned from the past, being vigilant regarding the currencies of the loans they grant to their customers in CEE, as well as liquidity lines they offer to borrowers in the face of pre-COVID-19 Basel III-related stricter capital, liquidity and funding requirements for banks.

In the COVID-19 aftermath, the regulatory-macroprudential policy responses were swift and cohesive, drawing on the 2008-2009 playbook. They followed promptly, featuring relaxed credit provision requirements and alleviated capital buffers, while assisted by post-crisis readily mobilized financial oversight[90]. In Europe, the response was calibrated for the region's financial landscape, making sure the crucial bank lending channel and the banking system by-and-large remain intact[91]. Since the eruption of the pandemic, the financing needs of all key economic actors, including sovereigns, corporations, SMEs and households, surged manifold, which has been addressed at national and EU levels through the availability of various public COVID-19 rescue facilities.

Banks remain the region's financial recovery backbone insofar as they are well-capitalized, liquid, and sound. As discussed, their importance is further under-scored by the lack of capital market-funding alternatives in the region. Although the lines are increasingly blurring with technology and alternatives disrupting conventional banking, banks have been traditionally tapped as conservative, low-risk sources of business financing, seldom used for financing risky start-up ventures[92]. Developing local entrepreneurship however – be it startup or deep tech SMEs – is crucial to fostering innovation and competitiveness in CEE9, promoting sustainable economic development, and addressing societal challenges[93]. While banks can – and some do – play an intermediary function by linking business ventures to their network of financial partners to obtain funding[94], venture capital (VC) providers and business angels are usually the leading source of risk capital for startups and SMEs, and are also active innovation ecosystem shapers, movers, and co-creators[95]. Other, potentially disruptive alternatives to VC have recently materialized in the region as a source of funding to new

84 As well as: Coy, P., & Lu, W. (2015). The Bloomberg innovation index. URL: http://www. bloomberg. com/graphics/2015-innovative-countries/(Accesed: 20.08. 2020).
85 E.g. Grant, E. (2015, November). Exposure to international crises: trade vs. financial contagion. In 28th Australasian Finance and Banking Conference. https://www.esrb.europa.eu/pub/pdf/wp/esrbwp30.en.pdf
86 WSBI-ESBG. (2015). Financial systems in Europe and in the US: Structural differences where banks remain the main source of finance for companies. https://www.wsbi-esbg.org/SiteCollectionDocuments/Financial%20systems%20in%20Europe%20and%20in%20the%20US.FINAL.pdf
87 European Central Bank. (2019). Survey on the Access to Finance of Enterprises in the euro area − April to September 2019. https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/ecb.safe201911~57720ae65f.en.html#toc1
88 CEE Banking M&A Study 2019. (2019). Deloitte. https://www2.deloitte.com/content/dam/Deloitte/ce/Documents/finance/ce-banking-study-2019.pdf
89 CEE Banking M&A Study 2019. (2019). Deloitte. https://www2.deloitte.com/content/dam/Deloitte/ce/Documents/finance/ce-banking-study-2019.pdf
90 Under ECB's Single Supervisory Mechanism (SSM), European Systemic Risk Board (ESRB) and European Supervisory Authorities (ESAs). Moreover, longstanding analytical capabilities enable instant comparisons of the soundness of Europe's systemic financial institutions. Macroprudential rules harmonization and past experience provide pointers how to adjust the rules in adverse circumstances
91 Through various ways, including supporting financial markets with securities purchases, repo operations in money markets for short-term liquidity, encouraging bank lending via direct lending support to banks, relaxing bank regulatory requirements, and other direct lending schemes, including to corporate employers, SMEs.
92 Nguyen, X. T., & Hille, E. (2018). Disruptive Lending for Innovations Signaling Model and Banks Selection of Startups. U. Pa. J. Bus. L., 21, 200. https://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1577&context=jbl
93 Launch of the Digital Innovation and Scale-up Initiative for Central, Eastern and South Eastern Europe. (2019, June 14). Shaping Europe's Digital Future - European Commission. https://ec.europa.eu/digital-single-market/en/news/launch-digital-innovation-and-scale-initiative-central-eastern-and-south-eastern-europe
94 For example, From financing to other types of backing, how banks support startups. (2019, March 7). BNP Paribas. https://group.bnpparibas/en/news/financing-types-backing-banks-support-startups
95 Cavallo, A., Ghezzi, A., Dell'Era, C., & Pellizzoni, E. (2019). Fostering digital entrepreneurship from startup to scaleup: The role of venture capital funds and angel groups. Technological Forecasting and Social Change, 145, 24-35. https://doi.org/10.1016/j.techfore.2019.04.022 ; Bocken, N. M. (2015). Sustainable venture

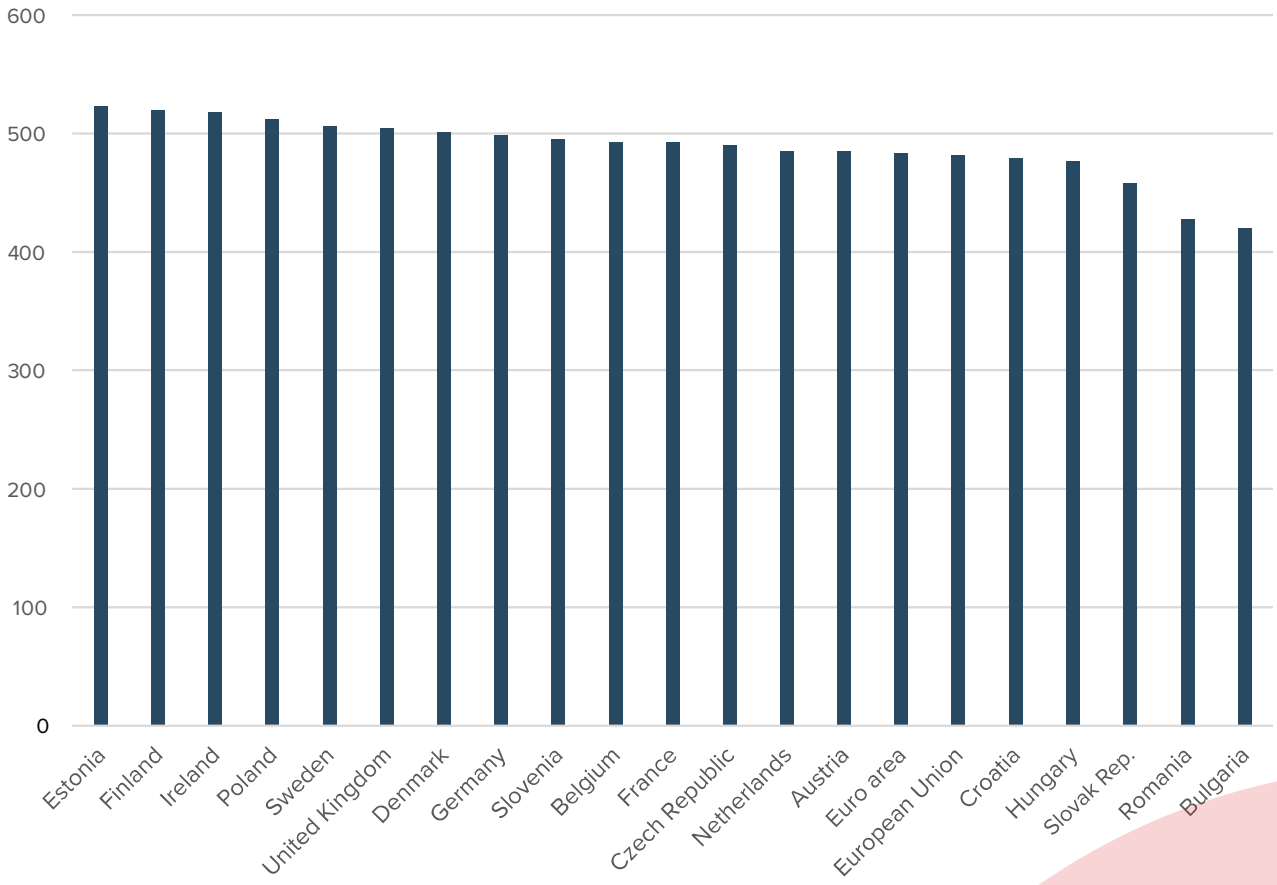
entrepreneurs, such as crowdfunding[96], but currently remain at the margin of CEE9 financial systems. To capture some of this dynamic (constrained by data availability), VC expenditures are included to measure capital provided for new ideas to take off in the region.

- **Education Impacts, Research & Development, Intellectual Assets**

Education is a necessary ingredient of innovation-led growth. Achieving middle-income status can be both, a blessing and a curse. While, for the CEE9 countries post-communist scarcity has been overcome, growth has hit a plateau pre-pandemic with an uncertain trajectory post-pandemic. Moreover, as shown in Chapter 1, productivity in the CEE9 has on average levelled out, without which it is impossible to support a sustainable increase in overall living standards. Both research and country evidence clearly point to the fact that improving education outcomes is the key to the progression towards a high-income bracket, especially in forward-looking and labor market-relevant areas such as science, technology, engineering and math (STEM)[97]. But recent PISA scores show that most CEE9 economies score relatively low in STEM subjects (Figure N).

Figure N. Most CEE9 countries have STEM skills gap to close

PISA scores in STEM subjects, 2018



Source: OECD.

capital–catalyst for sustainable start-up success?. Journal of Cleaner Production, 108, 647-658. https://doi.org/10.1016/j.jclepro.2015.05.079

96 Stevenson, R. M., Kuratko, D. F., & Eutsler, J. (2019). Unleashing main street entrepreneurship: Crowdfunding, venture capital, and the democratization of new venture investments. Small Business Economics, 52(2), 375-393. https://doi.org/10.1007/s11187-018-0097-2; Metelka, A. (2014). Crowdfunding: Startups' alternative funding source beyond banks, business angels and venture capitalists. https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A831531&dswid=-7752

97 A more detailed account of most relevant skills for the new era is offered for example by OECD. (2019). Knowledge for 2030 concept note. https://www.oecd.org/education/2030-project/teaching-and-learning/learning/knowledge/Knowledge_for_2030_concept_note.pdf. These skills generally include knowledge in STEM subjects, critical thinking skills, soft skills that cannot be automated. More detailed account on such soft skills is provided by Kosslyn, S. M. (2019, November 22). Are You Developing Skills That Won't Be Automated? Harvard Business Review. https://hbr.org/2019/09/are-you-developing-skills-that-wont-be-automated

Policymakers should be concerned not only with increasing human capital stocks, but also with their quality and market-efficient allocation. For example, the sheer number of PhD graduates may not be an ideal measure of skill-level in an economy, where education systems are divorced from labor market needs (i.e. 'labor market-skill mismatches'). Such skill mismatches have been documented in the case of CEE9 economies under review[98], and they are further corroborated by regular assessments and consultations by international institutions (Table II, Methodology Annex). Market-relevant education improvements and upskilling, however, shows in employment impacts[99], especially increased employment in knowledge-intense activities, and those related to the production of high-tech exports. It also demonstrates in other outcome-oriented variables, such as country intellectual assets, (patents, trademarks and designs). To convey a well-rounded picture, we additionally include a measure of expenditures on research and development, following most other innovation frameworks[100].

• Digital Economy, Sustainability and Resource Efficiency

COVID-19 arrived in Europe at just about the same time that European Commission Chief Ursula Von der Leyen unveiled the Commission's Climate Law proposal on March 4 to make the EU the world's first climate neutral continent by 2050, the first domino to drop in the planned 2020 procession of European Green Deal measures. One could say subsequent proposal packages, like everything else, became tertiary in proceeding days and months with a full focus on the twin health and economic crises at hand. At the same time, however, very early on, the Commission and a core group of EU Member States that swelled to 17 committed to putting the European Green Deal at the 'heart' of economic recovery measures.

The twin green and digital transition received special attention as a part of the broader EU rescue response in the pandemic's aftermath. It came out high on the EU priority list and became firmly anchored in the post-COVID-19 anticipated EU growth strategy. It is not only mentioned in all major rescue package proposals – including the Franco-German proposal[101], the subsequent von der Leyen address to the European Parliament[102], and Charles Michel's proposal gone into the 17-21 July 2020 European Special Council[103] – but it has made it to the final deal[104] and is paramount to the EU's new industrial strategy[105].

The twin transition lies at the core of the EU's rhetoric to 'recover better'. The digital and green transformations are in many ways one and the same: modernizing infrastructure and maximizing efficiencies for more sustainable and resilient economic growth. They were strategic priorities before the pandemic that now stand to benefit from the added firepower of recovery funds. Furthermore, the EU is widely expected to raise its 2030 emissions reduction target in the lead up to COP 26, adding impetus to the energy transition over the next decade that, especially in CEE, will rely on EU funds to leverage the massive levels of investment required.

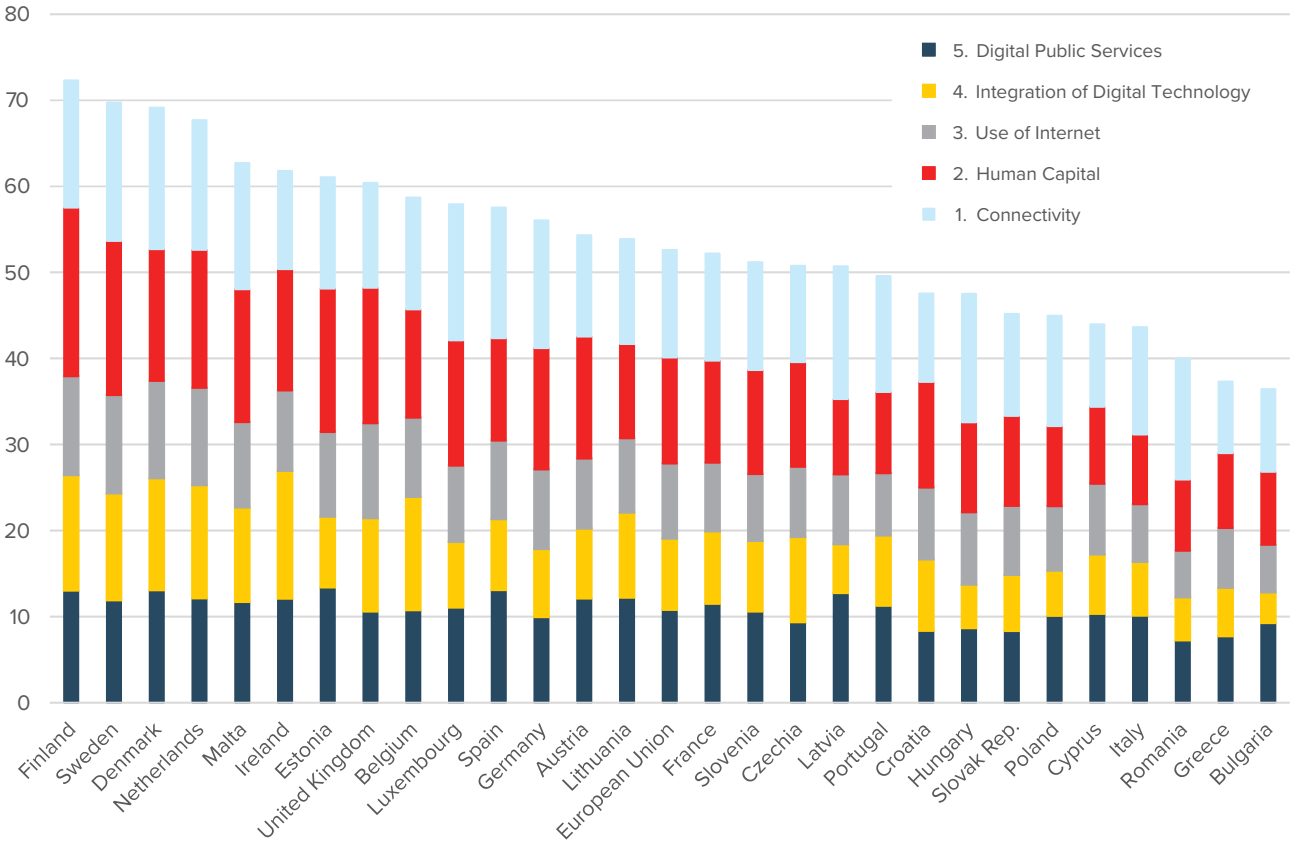
The ability to engage in the increasingly digital nature of the global economy is key to building resilience to economic and social shocks. Digital technologies emerged as important coping tools when shocks like the pandemic hit[106]. Even before the pandemic, automation fueled by artificial intelligence (AI) and robotics was already looming as a potentially major source of economic disruption and widening inequalities. In addition to the already discussed need to equip students with skills that will help them thrive in the increasingly digital nature of the economy, policy instruments for the development of digital businesses are essential to kickstart the post-COVID-19 growth. These could include support for creation of innovative companies via systematic funding for accelerators and incubators and improved access to early-stage funding. Governments and businesses should also actively participate in discussions on the upcoming Digital Services Act[107] and on the ethical and legal requirements for AI[108] at the European level at early stage, to ensure that all parties involved can make the most of digitization.

As in terms of digital economies, **CEE9 has consistently exhibited laggard performance in various measures of green growth** (Figure O). The gaps evident in data are corroborated by recommendations to step up policy efforts towards a greener and smarter growth of international institutions, such as the OECD and IMF as a part of their regular CEE9 country surveillance (Table I.).

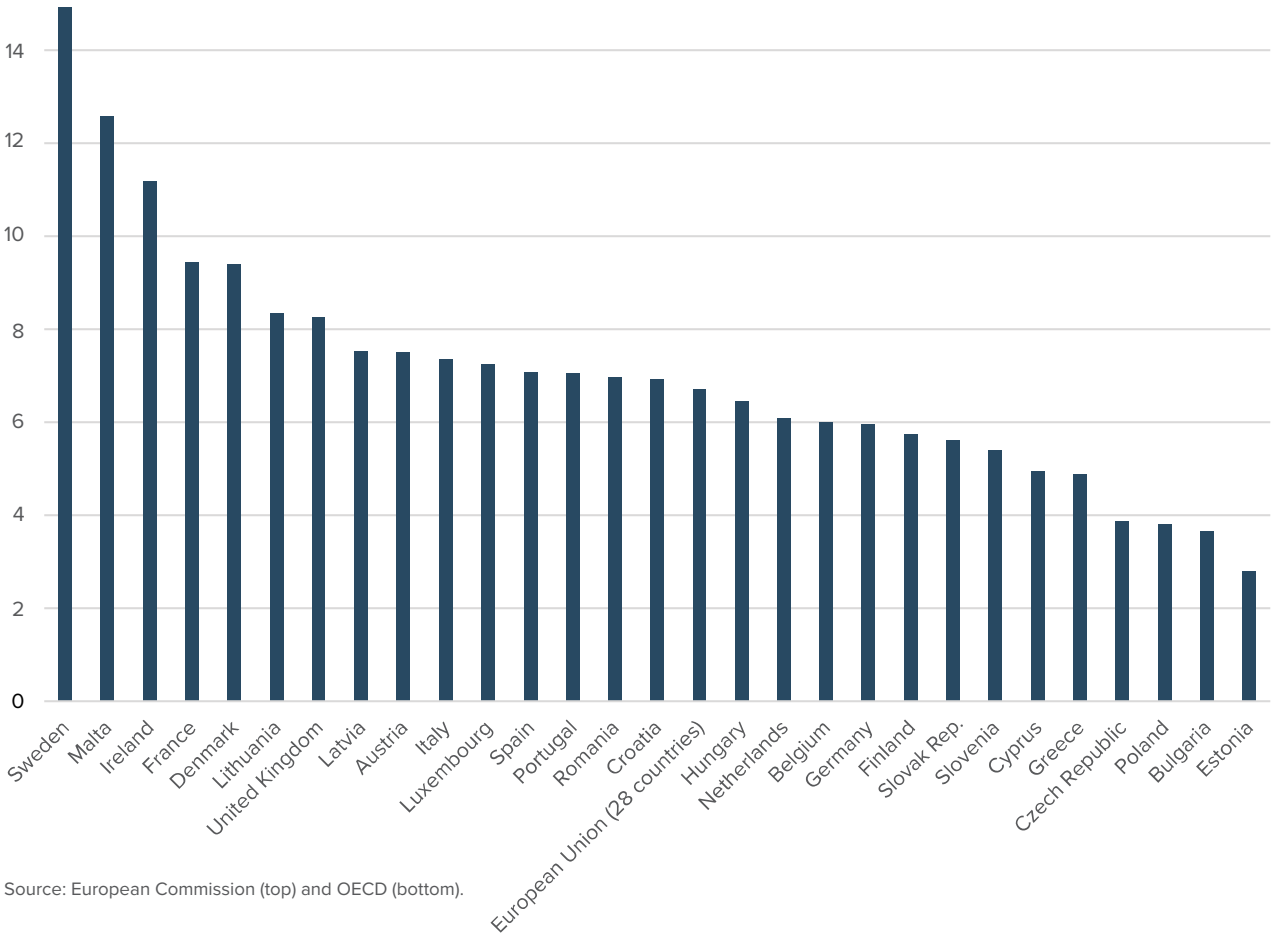
98 See here: Kupets, O. (2015). Skill mismatch and overeducation in transition economies. IZA World of Labor. https://doi.org/10.15185/izawol.224
99 Hollanders, H. (2020). European Innovation Scoreboard 2020- Methodology Report. European Commission. https://ec.europa.eu/docsroom/documents/41861
100 Including European Innovation Scoreboard, the Bloomberg Innovation Index and WIPO Global Innovation Index
101 Bundesregierung. (2020, May 18). A French-German Initiative for the European Recovery from the Coronavirus Crisis [Press release]. https://www.bundesregierung.de/resource/blob/973812/1753772/414a4b5a1ca91d4f7146eeb2b39ee72b/2020-05-18-deutsch-franzoesischer-erklaerung-eng-data.pdf?download=1
102 European Commission. (2020, May 27). Speech by President von der Leyen at the European Parliament Plenary on the EU Recovery package. https://ec.europa.eu/commission/presscorner/detail/en/speech_20_941
103 European Council. (2020, July 10). President Charles Michel presents his proposal for the MFF and the recovery package [Press release]. https://www.consilium.europa.eu/en/press/press-releases/2020/07/10/president-charles-michel-presents-his-proposal-for-the-mff-and-the-recovery-package/
104 Special European Council, 17-21 July 2020. (2020, July 17). European Council. https://www.consilium.europa.eu/en/meetings/european-council/2020/07/17-21/
105 Making Europe's businesses future-ready: A new Industrial Strategy for a globally competitive, green and digital Europe [Press release]. https://ec.europa.eu/commission/presscorner/detail/en/IP_20_416
106 Ungerer, C., Portugal, A., Molinuevo, M., & Rovo, N. (2020, May 12). RECOMMENDATIONS TO LEVERAGE E-COMMERCE DURING THE COVID-19 CRISIS. World Bank Group. http://documents1.worldbank.org/curated/en/280651589394091402/pdf/Recommendations-to-Leverage-E-Commerce-During-the-COVID-19-Crisis.pdf
107 Digital Services Act package – ex ante regulatory instrument of very large online platforms acting as gatekeepers. (2020). European Commission. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12418-Digital-Services-Act-package-ex-ante-regulatory-instrument-of-very-large-online-platforms-acting-as-gatekeepers
108 Artificial intelligence – ethical and legal requirements. (2020). European Commission. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12527-Requirements-for-Artificial-Intelligence

Figure O: CEE9 region has a twin transition gap to close

The Digital Economy and Society Index (DESI), 2020



Production-based CO2 productivity, GDP per unit of energy-related CO2 emissions 2018, US dollars per kilogram



Source: European Commission (top) and OECD (bottom).

Table I. CEE Strategic Transformation Index conceptual framework reflects on the policy recommendations of international economic institutions (IMF, OECD)

Country	Vintage	IMF article IV. consultations: selected key policy messages
Slovak Rep.	2019/2019	Support domestic firms to move up the value chains through enhanced skills and innovation, adequate physical and digital infrastructure, and better institutions. To accommodate large investment needs in infrastructure and education and increase social inclusion, policy space should be created through higher efficiency of public spending and tax collections and full and effective absorption of EU funds.
Czechia	2019/2018	Policies should balance risks of overheating against a faster-than-expected slowdown and aim to boost potential growth. Maintaining convergence over the medium term will require high employment and productivity growth as the population ages and the workforce shrinks. Bottlenecks in the labor force, infrastructure, and housing are holding the economy back and need attention.
Poland	2018/2018	Sustaining rapid income convergence as working-age population declines calls for durable increases in investment and productivity. Reforms should focus on removing existing barriers to investment, facilitating more reliable access to skilled labor, enhancing predictability of policy changes, and providing a level playing field for all investors by protecting the rights of minority shareholders and ensuring competition.
Hungary	2019/2019	Wages outstripping labor productivity growth, slower export growth, and shortcomings in the business environment for SMEs call for invigorating structural reform efforts. Improvements in competitiveness are needed to sustain rapid income convergence and address demographic challenges. The government's competitiveness program contains important elements. Focus should be on improving the business environment (especially for SMEs), enhancing the legal and regulatory framework, and increasing labor force participation.
Austria	2018/2019	The current window of opportunity should be used to put in place efficiency-boosting expenditure reforms, in particular in the health sector and in subsidies. More broadly, structural reforms could help raise Austria's growth potential. Lowering unemployment sustainably to pre-GFC levels requires additional measures, including strengthening the education system; special efforts to integrate foreign nationals into the labor market; and structural and fiscal policy measures to raise labor demand. These would also boost potential growth.
Slovenia	2018/2020	Policies should focus on fiscal and structural reforms to rebuild fiscal buffers and increase productivity. Continue structural fiscal reforms in the areas of pensions, health and long-term care, public wage policy, and tax rebalancing. Deepen labor market reforms by increasing labor market flexibility. Accelerate the privatization program, notably in non-financial and non-network sectors.Macro-financial legacy issues remain in bank and corporate balance sheets, including small and medium enterprises' (SME) nonperforming loans (NPLs). Structural challenges persist with low productivity growth, skills shortages, high tax wedge, heavy regulatory system, and extensive presence of state-owned enterprises (SOEs)
Croatia	2019	Place renewed focus on structural reforms and increasing investment and productivity. Evaluate long-term public investment priorities and rebalance spending to areas of relative deficiency. Improve the efficiency of essential State-Owned Enterprises. Renovate the capital stock and create conditions for a broader economic base. Continue improvements to the business environment to create ripe conditions for deeper economic integration with Europe. Increase EU funds absorption to close remaining gaps in physical and technological infrastructure. In parallel, the skills of students at all levels, as well as those of workers, need to keep pace with technological change.
Bulgaria	2019	Focus on medium-term reforms to improve public goods provision and raise potential growth and on near-term policies to enhance financial sector stability. Priority reform areas include the quality of institutions (notably government efficiency), infrastructure, education and healthcare. Stronger public investment management would improve investment efficiency and transparency. Better performance of state-owned enterprises (SOEs) would help raise growth potential and mitigate fiscal risks.
Romania	2019	Take advantage of strong growth and start durable fiscal consolidation underpinned by high-quality measures to rein in the twin deficits and improve the macroeconomic policy mix. Modernize revenue administration and improve expenditure efficiency. Reassess the new pension law to balance social needs and fiscal sustainability. Strengthen public investment management institutions and governance of state-owned enterprises (SOEs) to better absorb EU funds and provide high-quality infrastructure. Set wage policies in line with productivity gains. Renew the fight against corruption.

OECD latest economic survey: selected key policy messages
Environmentally related tax revenue is low, while environmental outcomes need to improve. Align the implicit taxation on emissions of CO2 and other pollutants across different fuels and uses. Vocational education has little work-based learning and does not focus sufficiently on general and digital skills, which are necessary to diversify the economy and increase the domestic value added of exports. Increase the time spent on general and digital training in vocational education. Structural unemployment remains high, and spending on active labour market policies is low. Continue to simplify work visa and residence procedures for highly skilled workers. Judicial redress is lengthy, hampering trust in institutions and business competition. This is likely to contribute to perceptions among the population that corruption is widespread. The quality of tertiary education is low, and resources are too thinly spread. It is not well aligned with labour market needs. Spending on research is weak, and the share of innovative companies is low, hampering the conditions for improving Slovak Rep.'s position in global value chains.
Low productivity is limiting progress towards OECD living standards. R&D and innovation are needed for the upgrading of the economy. Introduce a carbon component in energy taxation for carbon emissions outside the EU system. Increase resources to education, skilling, reskilling and upskilling. Accelerate immigration procedures and facilitate immigrants integration, including language classes.
Strengthen environmentally related taxes,develop and implement clear and stable climate-change policies aligned with European and international objectives to reduce uncertainty for innovative green investments. Ensure the stability and clarity of policies affecting investment decisions. Include a simplification component for SME's to the governments tax compliance strategy. Strengthening higher education, research and innovation: Enhance industry-science collaboration. Continue to increase funding for higher education and research over time, to merge small universities and independent research institutes to build strong research universities, and to allow underperforming institutions that do not improve over time to shut down. Improve the quality of doctoral training by structuring it through coursework and tutoring and tightening entry criteria. Offer well-remunerated academic positions, and base career progression on an evaluation of research and teaching quality by faculty and external experts. If the take-up of the new R&D tax allowance is low among small innovative firms, adjust its provisions. Plan for national financing of business R&D and innovation programmes beyond the current EU budgetary cycle.
Continue to reduce public work schemes and to enhance training of participants and other job seekers in programmes that improve their employability. Extend duration of unemployment benefits and provide geographical mobility support and activation measures. Sharing the benefits of growth: Increase the autonomy of local authorities to execute projects, such as in tourism, that develop their local economy and further incentivise local governments to co-operate. Allow vocational education and training schools greater freedom to specialise and adjust courses and curriculums to the needs of the local labour market. Enhance research co-operation incentives between local and foreign-owned firms. A dedicated anti-corruption agency should be established. Increase the reliance on road tolls and car taxes that take vehicles' environmental performance into account. Introduce congestion charges and strengthen public transport.
Business sector dynamism, jobs and skills : Make the licensing system more open to competition without undermining the quality of services and the training and skill standards of workers. Further identify and address the remaining shortages in the ecosystem for equity investments in firms of all sizes. Further draw on the completion of EU capital market union. As intended in the tax reform strategy of the previous government, modify corporate taxes to reduce disincentive effects and the debt-bias. Involve employer organisations in the design and administration of life-long learning programmes. Continue to attract high-skilled foreign workers and retain more foreign graduates of Austrian universities by facilitating their access to red-white-red cards. Closely monitor the economic and social integration of low-skilled migrants and refugees. Phase in additional measures if emission trajectories diverge from targets. Raise and harmonise carbon prices across activities, along a predictable path supported by international co-operation.
Focus on efficient spending and growth-enhancing investment projects. Redirect employment and training subsidies to job-seekers with high assistance needs. Introduce in-work benefits. Continue to reduce labour tax rates by broadening their bases and bolstering property taxation. Determine more of the framework conditions at the sectoral level, such as seniority bonuses and minimum wage levels. Give social partners greater responsibilities in the wage bargaining process at the firm level. Tax owner-occupied housing as other assets to remove investment bias. Promote the private rental market by introducing regulation that better balance the interest of landlords and tenants. Tax commuting allowances along with other wage income. Promote green growth: Supplement the replacement bonus for old wood and oil boilers with regulatory requirements and financial sanctions. Align effective tax rates on different forms of energy to reflect their environmental damage.
n/a
n/a
n/a

Source: IMF and OECD.

5.

Benchmarking Strategic Transformation

Chapter 4. CEE Strategic Transformation Index, Rankings & Policy Recommendations

A basic roadmap of the key considerations leading up to the choice of the conceptual dimensions is presented in Chapters 1 through 3. The CEE Strategic Transformation Index rests on two main conceptual pillars: *(1) Economic Structure & Resilience*; and, *(2) Innovation Economy*. These two basic pillars are further disaggregated into eight sub-dimensions (four each) that provide more granular insight into dimensions of strategic transformation of the CEE economy. These sub-dimensions are broadly in line with the conceptual building blocks presented in Chapter 3. The section that follows presents the sub-dimensions, detailing their conceptual components and corresponding data series/proxies that represent them:

PILLAR 1. Economic Structure & Resilience

OPENNESS

- Global value chains (GVC) forward participation
- Foreign direct investment (FDI) openness
- Index of export market penetration

FINANCIAL STRUCTURE

- Long-term interest rate for convergence purposes
- Loans to households as a ratio of gross disposable income
- MFIs lending margins on loans to non-financial corporations (NFC)
- House price-to-income ratio
- Bank non-performing loans as a share of gross loans

EXTERNAL RESILIENCE

- Economic complexity
- Terms of trade volatility
- Herfindahl-Hirschman Product/Market Concentration

PRODUCTIVITY & VALUE-ADDED

- Total factor productivity (TFP)
- Medium/high-tech industry value-added in total value-added
- Sophistication of exports
- Employment in knowledge-intensive activities
- High-technology exports as share of total manufacturing

PILLAR 2. Innovation economy

EDUCATION CLUSTER

- PISA scores: reading
- PISA scores: mathematics
- PISA scores: science
- Participation rate in education and training
- Early leavers from education and training
- Public expenditure on education
- Tertiary education enrollment
- Tertiary educational attainment
- Classroom teachers & academic staff
- Ratio of pupils and students to teachers and academic staff

GREEN ECONOMY

- Production-based CO2-productivity
- Domestic material consumption per capita
- Resource productivity and domestic material consumption (DMC)
- Renewable share in final energy consumption
- Recycling rate of municipal waste
- Air quality: Mean population exposure to PM2.5
- Greenhouse gas emissions

INNOVATIVE CAPACITY

- Patents
- Trademarks
- Designs
- Gross domestic expenditures on R&D
- Venture capital expenditures
- R&D Personnel
- Researchers head count
- Human resources in science and technology

DIGITAL ECONOMY

- Households - level of internet access, Percentage of households
- Individuals - internet use, Percentage of individuals
- Internet purchases by individuals in 3 months as a percentage of individuals
- E-government activities of individuals via websites (last 12 months), as a %
- Value of e-commerce sales, Enterprises' total turnover from e-commerce sales
- E-commerce sales, Enterprises with e-commerce sales of at least 1% turnover, % of enterprises

The broad concept results from a combination of theoretical, conceptual, empirical and agnostic underpinnings. It departs from relevant empirical literature and evidence, lets historical data 'speak', reflects on the recent policy recommendations of international institutions as a part of its regular country surveillance (Table I), and considers other composite measures of innovation (Table II). It also falls back on and leverages authors' and partners' background with the CEE regional macroeconomy.

The resulting index is compiled as eight sub-indices (i.e. by thematic cluster) at a country-level on a normalized dataset on an annual basis, using weights derived from the first loading obtained through Principal Component Analysis. The aggregate is computed as an unweighted average across components, which are then averaged into the final index. More detailed notes on the methodology are provided in 3. Research and Methodology.

Compared to the concepts of selected innovation measures – the Bloomberg Innovation Index and European Innovation Scoreboard – the CEE Strategic Transformation Index overlaps in numerous core notions (Table II). The comparison, moreover, elucidates that STI – in addition to a strong innovation emphasis – comprehensively captures macro-financial structures and vulnerabilities, as well as the forward-looking element of the twin green and digital transition.

Table II. How does CEE Strategic Transformation Index conceptual framework compare to other composite indicators capturing innovation?

	Composite Measure	GLOBSEC CEE Strategic Transformation Index	Bloomberg Innovation Index	European Innovation Scoreboard
	Openness	Global value chains (GVC) forward participation	-	-
A	Openness	Foreign direct investment (FDI) openness	-	-
	Openness	Index of export market penetration	-	-
	External vulnerability	Economic complexity	-	-
B	External vulnerability	Terms of trade volatility	-	-
	External vulnerability	Herfindahl-Hirschman Product/Market Concentration Index	-	-
	Productivity & Value-added	Total factor productivity	Productivity	-
	Productivity & Value-added	Medium/high-tech industry value-added in total manufacturing value-added	Manufacturing value-added	-
	Productivity & Value-added	Sophistication of exports	Technology company density	-
C	Productivity & Value-added	Employment in knowledge intense activities	-	Employment in knowledge intense activities
	Productivity & Value-added	Medium/high-tech product exports as a share of total	-	Employment in fast-growing enterprises
	Productivity & Value-added	-	-	Medium/high-tech product exports
	Productivity & Value-added	-	-	Knowledge-intense services exports
	Financial structure	Loans granted to households as a ratio of gross disposable income	-	-
	Financial structure	Non-performing loans as a share of gross loans	-	-
D	Financial structure	MFIs lending margins on loans to non-financial corporations (NFC)	-	-
	Financial structure	House price to income ratio	-	-
	Financial structure	Long-term interest rate for convergence purposes - 10y maturity	-	-
	Education	PISA scores: reading, science, mathematics (individual series)	Research personnel concentration	New PhD graduates
	Education	Participation rate in education and training	Tertiary education	Population with tertiary education
	Education	Early leavers from education and training	-	Lifelong learning
E	Education	Public expenditure on education	-	International scientific co-publications
	Education	Tertiary education enrollment	-	Most cited publications
	Education	Tertiary educational attainment	-	Foreign doctorate students
	Education	Classroom teachers & academic staff		Public-private co-publications
	Education	Ratio of pupils and students to teachers and academic staff		
	Green economy	Production-based CO2-productivity	-	-
	Green economy	Domestic material consumption per capita	-	-
F	Green economy	Resource productivity and domestic material consumption (DMC)	-	-
	Green economy	Renewable share in final energy consumption	-	-
	Green economy	Recycling rate of municipal waste	-	-
	Green economy	Air quality: Mean population exposure to PM2.5	-	-
	Green economy	Greenhouse gas emissions	-	-
	Digital economy	Households - level of internet access, Percentage of households	-	Broadband penetration
	Digital economy	Individuals - internet use, Percentage of individuals	-	-
	Digital economy	Internet purchases by individuals in 3 months as a percentage of individuals	-	-
G	Digital economy	E-government activities of individuals via websites (last 12 months), as a %	-	-
	Digital economy	Value of e-commerce sales, Enterprises' total turnover from e-commerce sales	-	-
	Digital economy	E-commerce sales, Enterprises with e-commerce sales of at least 1% turnover, % of enterprises	-	-
	Innovative capacity	Patent applications per 1000 inhabitants	Patent activity	PCT patent applications
	Innovative capacity	Trademark applications per 1000 inhabitants	-	Trademark applications
	Innovative capacity	Design applications per 1000 inhabitants	-	Design applications
H	Innovative capacity	Gross domestic expenditures on R&D	R&D expenditures	R&D expenditure public sector
	Innovative capacity	Human resources in science and technology	-	R&D expenditure private sector
	Innovative capacity	R&D Personnel	-	Private co-funding of R&D expenditures
	Innovative capacity	Researchers head count	-	Non-R&D innovation expenditure
	Innovative capacity	Venture capital expenditures	-	Venture capital expenditure
	Other	-	-	SMEs innovating in-house
	Other	-	-	Innovative SMEs collab with others
	Other	-	-	Sales of innovations
	Other	-	-	SMEs marketing/org innovations
	Other	-	-	SMEs product/process innovations
	Other	-	-	Enterprises providing ICT training
	Other	-	-	Opportunity-driven entrepreneurship

Source: Bloomberg, European Commission.

Country Rankings

Figure 1. The CEE Strategic Transformation Index 2020: Global Ranking

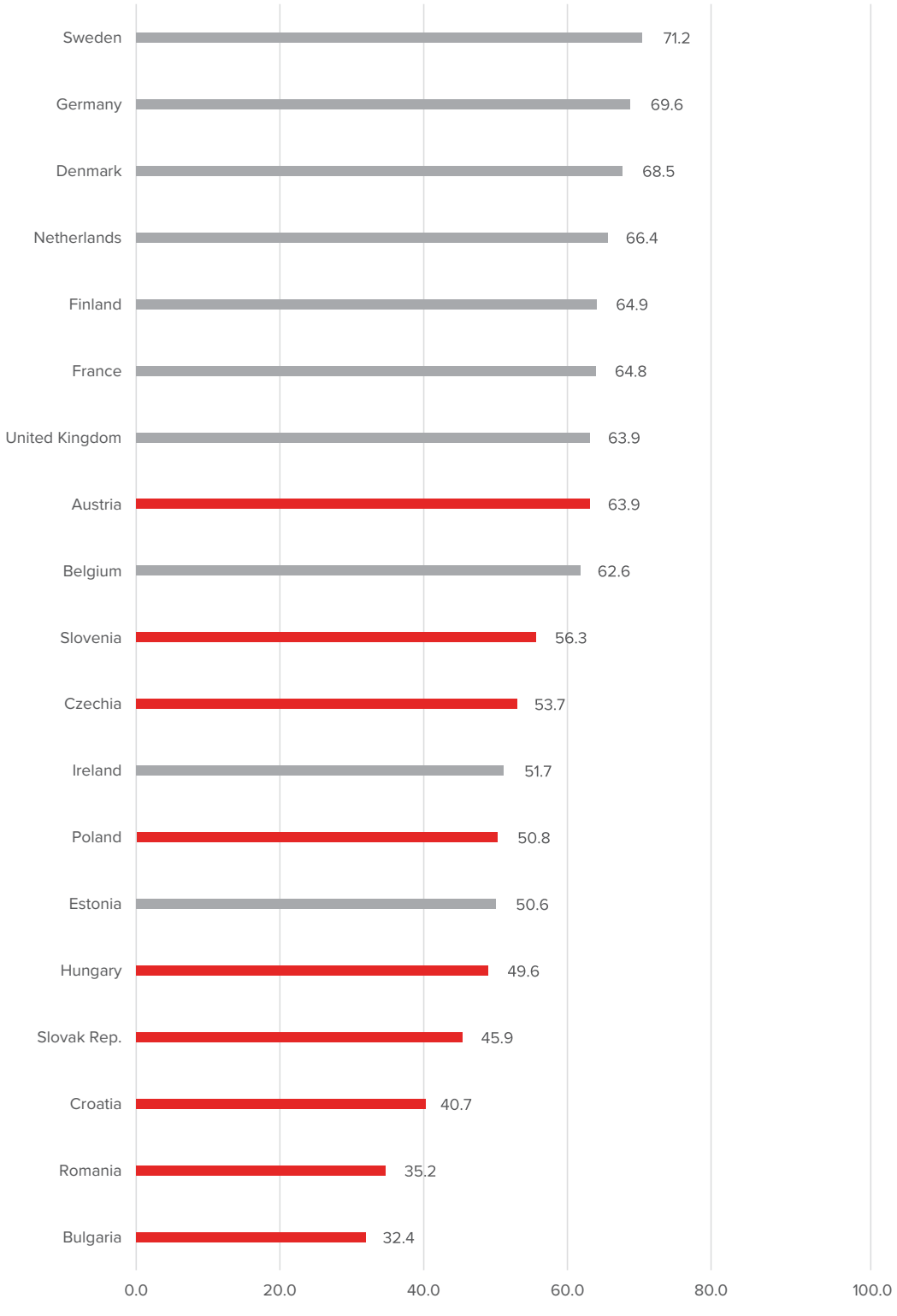
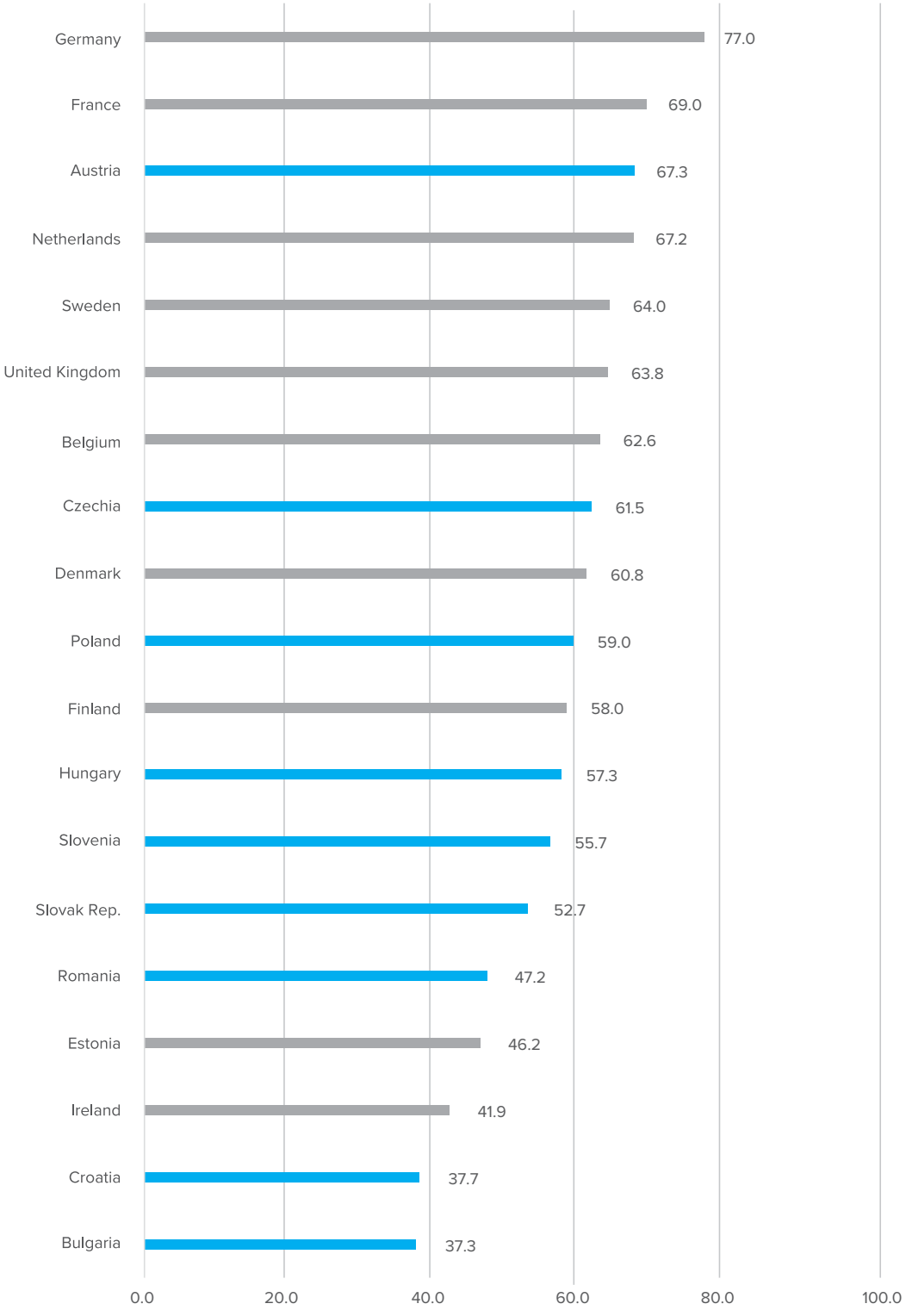


Figure 2. The CEE Strategic Transformation Index 2020:

Pillar 1. Macroeconomic Structure & Resilience



Pillar2. Innovation Economy

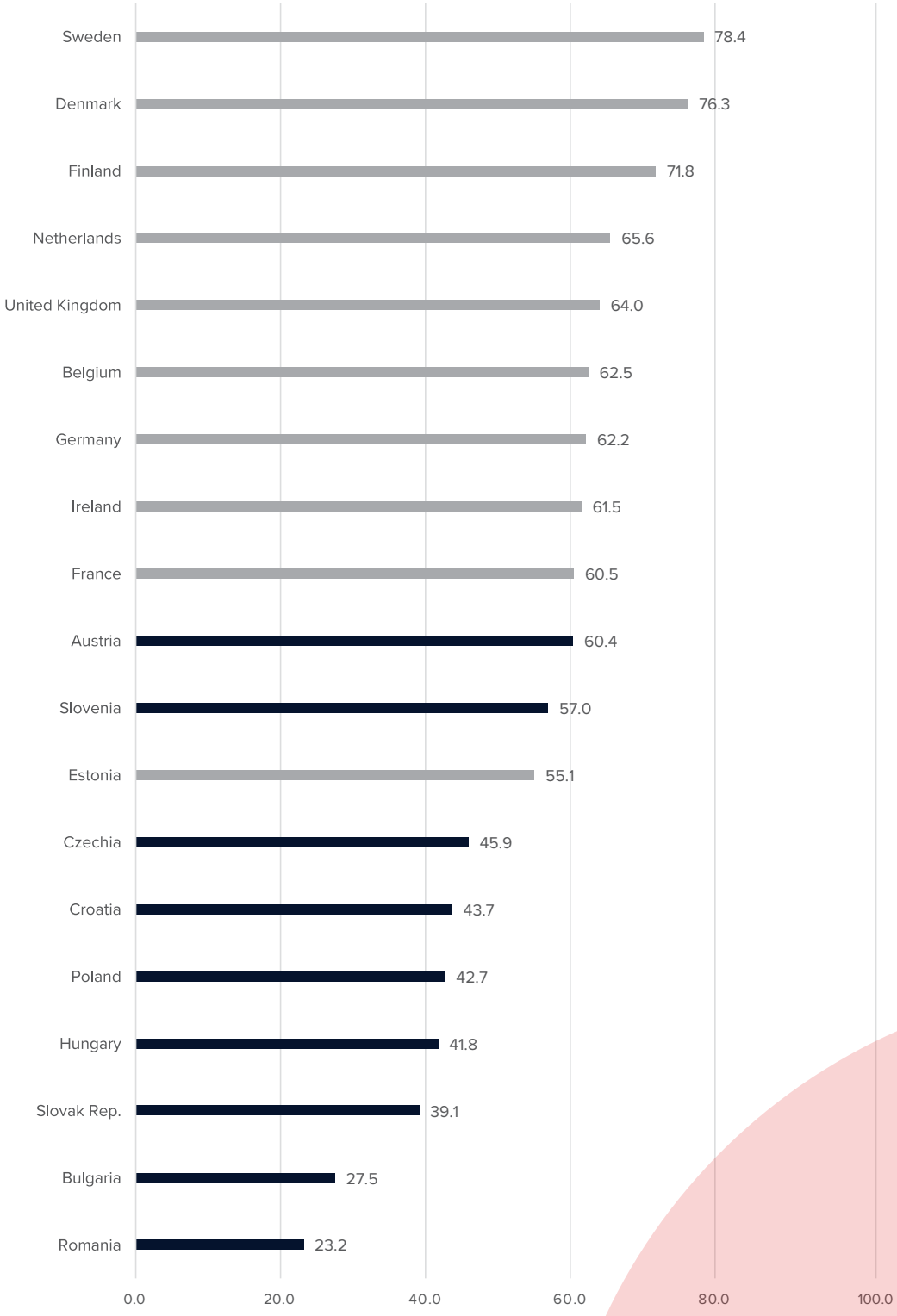
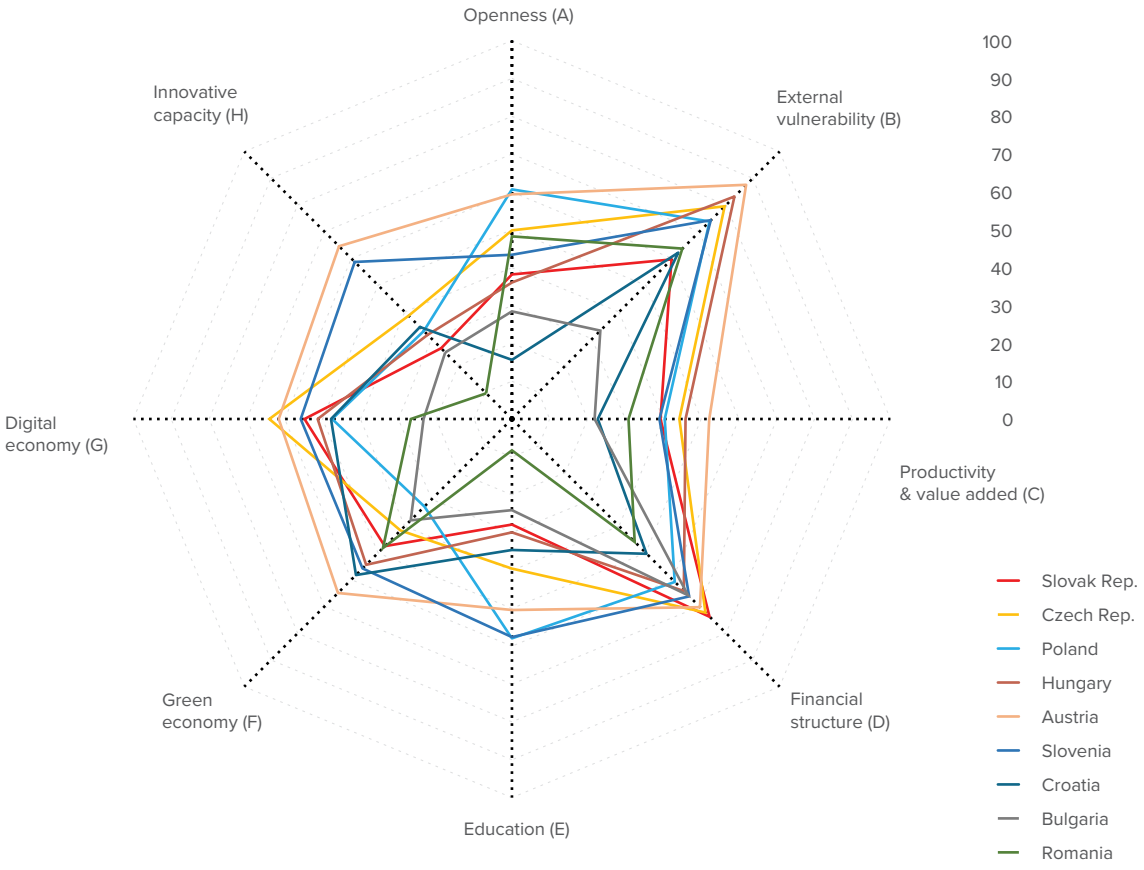


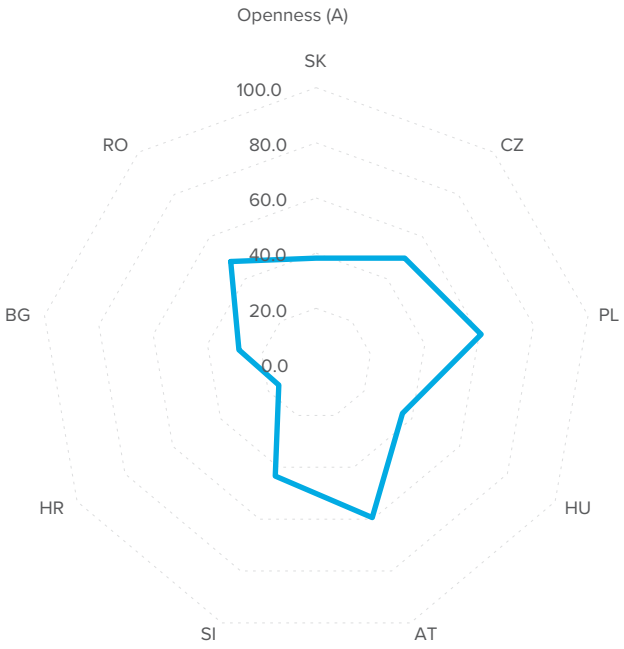
Figure 3. The CEE Strategic Transformation Index 2020 by sub-index

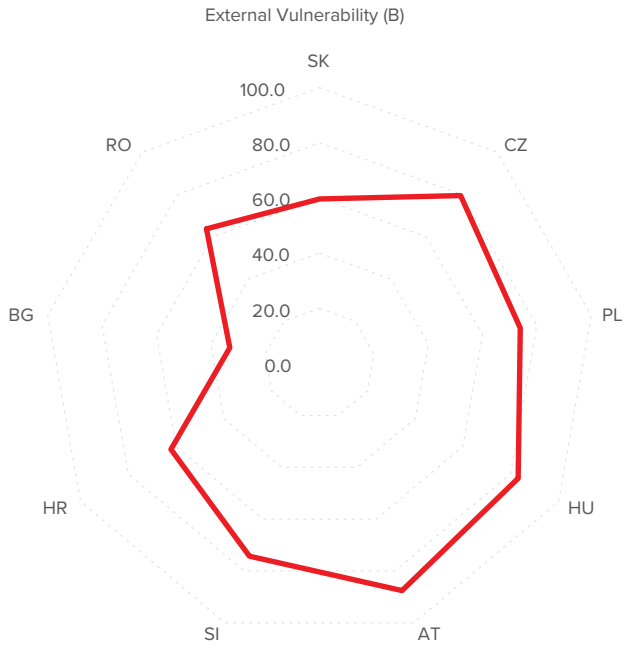


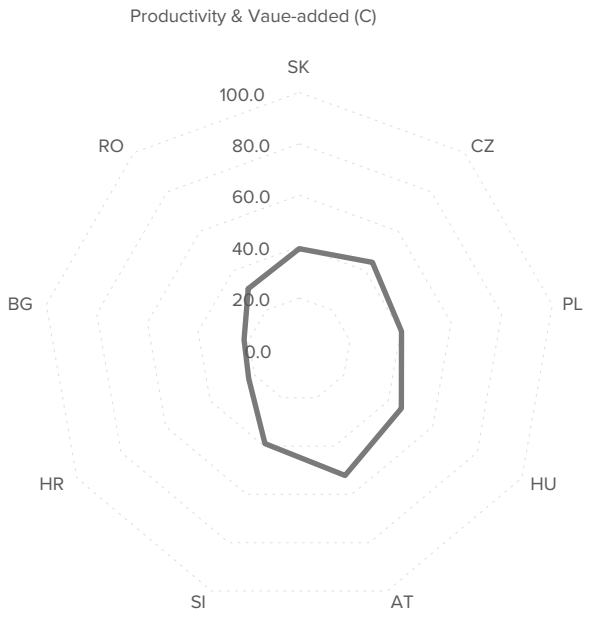
Relative Performance by Sub-index

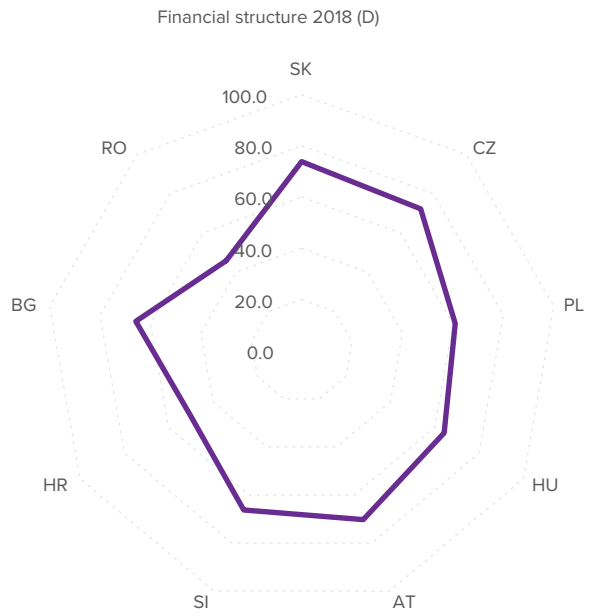
Figure 4. Relative Country Performance by Sub-index

Pillar 1. Economic Structure & Resilience

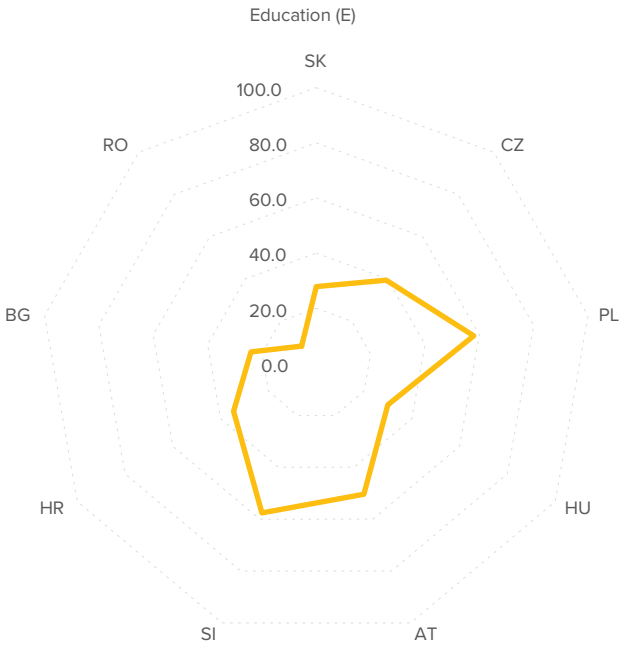


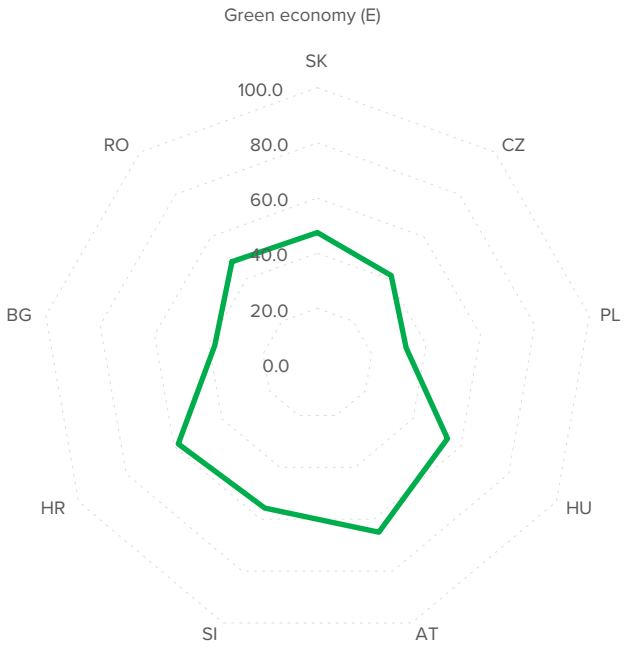


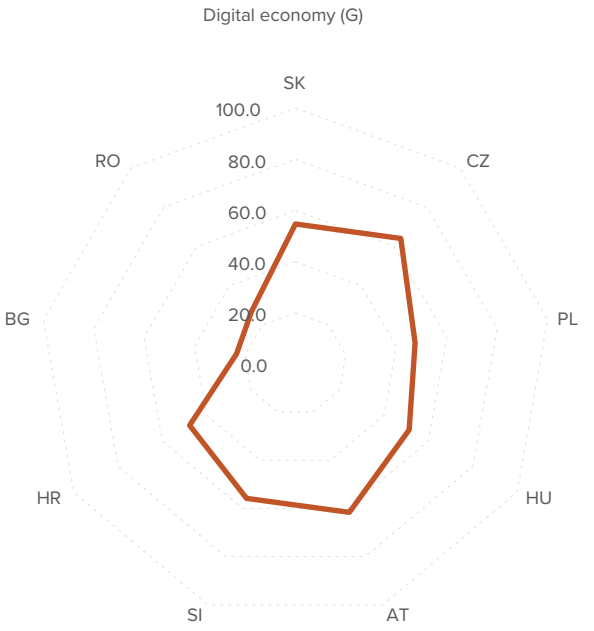




Pillar 2: Innovation Economy







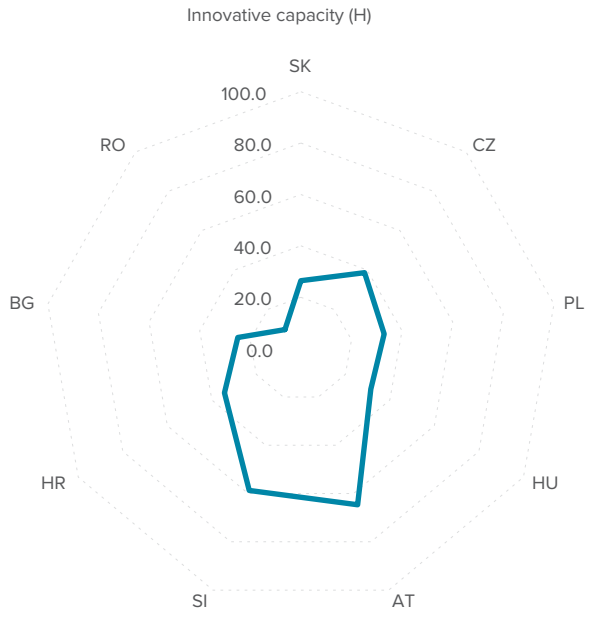
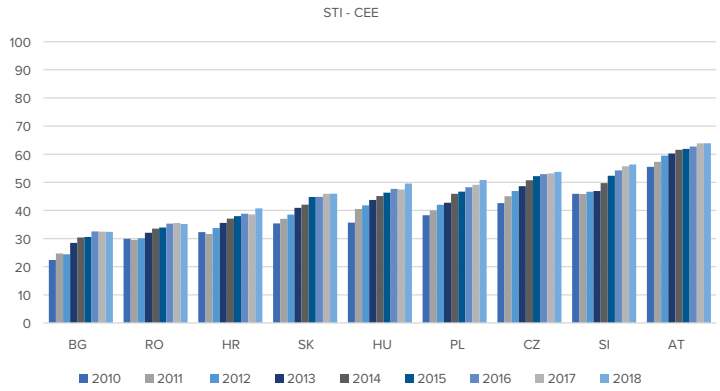


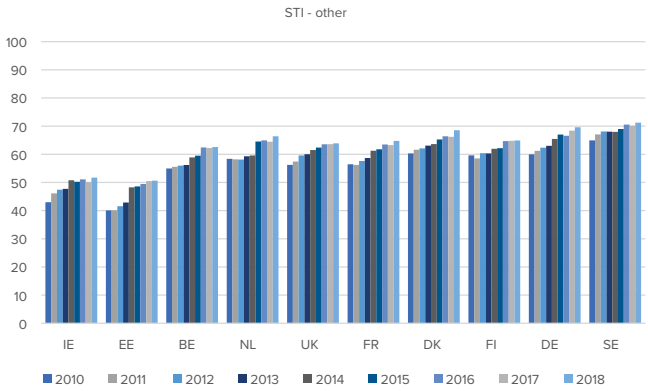
Figure 5. STI 2020 Heatmap: CEE9 vis-à-vis Control Group

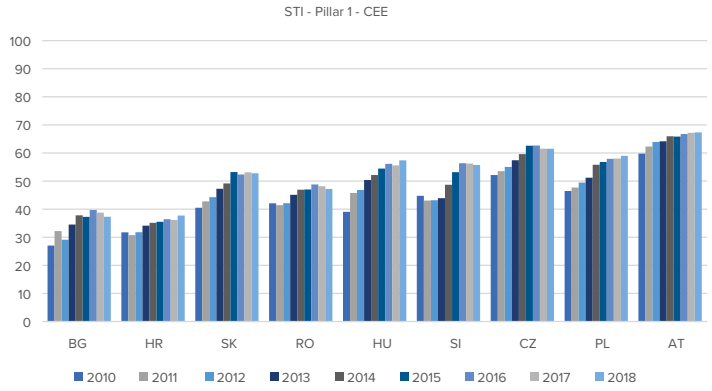
	Openness (A)	External vulnerability (B)	Productivity & value-added (C)	Financial structure (D)	Education (E)	Green economy (F)	Digital economy (G)	Innovative capacity (H)
Slovak Republic	38.2	59.6	39.3	73.9	27.9	47.5	54.8	26.4
Czechia	49.9	79.5	44.3	72.3	39.5	41.6	64.1	38.6
Poland	60.7	73.9	40.4	60.9	57.9	32.7	47.5	32.9
Hungary	36.1	83.2	45.9	64.2	29.9	54.4	51.3	31.5
Austria	59.4	87.5	52.2	70.2	50.4	65.0	61.6	64.6
Slovenia	43.4	74.3	39.0	66.2	57.6	55.8	55.8	58.7
Croatia	15.7	62.2	22.7	50.3	34.6	58.3	47.8	34.4
Bulgaria	28.5	33.0	21.9	65.8	24.0	37.8	23.3	24.9
Romania	48.3	63.7	30.8	45.9	8.2	48.1	26.7	9.6
Germany	83.3	77.4	69.8	77.6	43.8	59.6	77.2	68.1
Belgium	59.6	65.8	59.3	65.8	57.6	57.0	71.5	63.9
Denmark	45.7	73.9	64.0	59.6	73.9	64.2	91.4	75.6
Estonia	29.2	56.9	28.0	70.8	64.8	38.8	64.5	52.1
Finland	49.0	56.1	52.3	74.5	72.2	57.8	77.2	80.2
France	73.8	66.4	71.5	64.4	46.5	65.8	67.3	62.4
Ireland	20.5	21.5	90.9	34.7	66.2	54.5	73.5	52.0
Netherlands	87.9	62.5	62.1	56.5	64.2	60.9	75.7	61.4
Sweden	55.3	78.2	62.2	60.3	69.2	80.8	89.2	74.6
United Kingdom	76.8	59.9	60.0	58.3	47.4	66.3	75.5	66.8

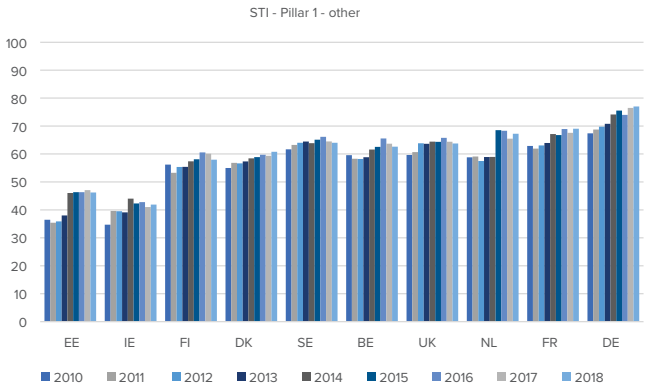
CEE Region: Temporal Perspective

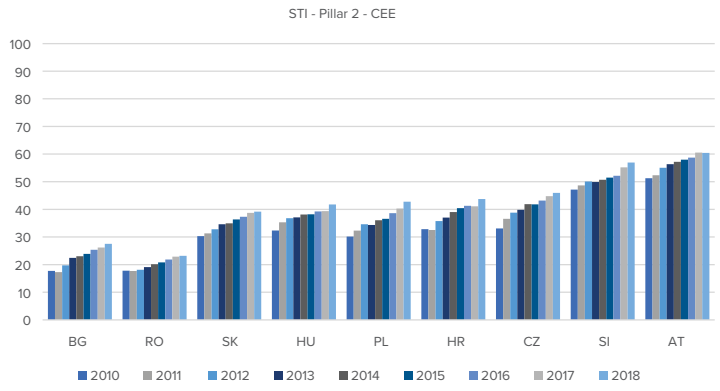
Figure 6. Temporal Performance by CEE9-country vis-à-vis Control Group

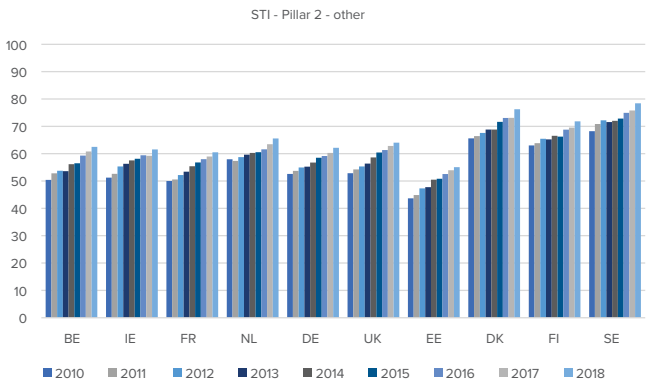












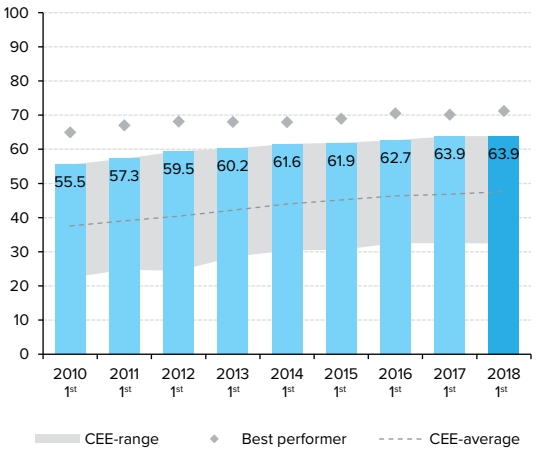
CEE Region: Key Findings

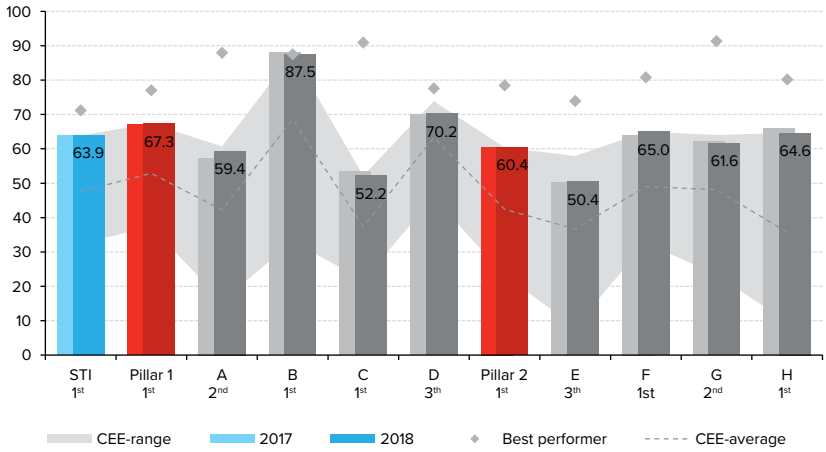
STI results reveal Austria (63.9), followed by Slovenia (56.3) and Czechia (53.7) are the best global index performers among CEE9 (Figure 1). Split into the two main pillars, Austria (67.3), Czechia (61.5), and Poland (59.0) score the highest in terms of Macroeconomic Structure & Resilience (Pillar 1); while Austria (60.4), Slovenia (57.0) and Czechia (45.9) have the strongest Innovation Economy (Pillar 2) among CEE9 (Figure 2). Overall, however, STI results make it clear that the CEE9 economy is fueled more pronouncedly by Pillar 1 than Pillar 2, as evidenced by the relative higher scores of CEE9 countries in the former. The relative rankings are intuitive also in the broader country milieu. European economies proclaimed for their strong macroeconomic fundamentals (Germany, France) are featured at the top of Pillar 1, while Nordic European countries known for their innovation muscle (Sweden, Denmark, Finland) came out at the top of Pillar 2.

The STI 2020 outcomes are driven by underlying developments in the eight thematic sub-indices (Figures 3), which reveal country strengths and weaknesses. Within the first pillar among CEE9, Poland, Austria and Czechia exhibit best relative performance in Openness (A), Austria, Hungary and Czechia show greatest relative External Resilience (B), Austria, Hungary and Czechia showcase strongest performance in Productivity and Value-added (C), and Slovak Republic, Czechia and Austria display the most solid relative financial fundamentals (D). Within the second pillar within CEE9, Poland, Slovenia and Austria demonstrate strongest relative education cluster (E), Austria, Croatia, Slovenia display best relative Green Economy (F), Czechia, Austria, Slovenia score relatively the best in terms of Digital Economy (G), and Slovenia and Austria are relatively most capable to innovate (H).

The relative rank in the reference year (currently 2018) is heralded by historical developments for the period 2010-2017. Overall, CEE9 countries that have been steadily improving their performance over time – primarily, Austria, Slovenia and Czechia – are ranked relatively better than others, where performance levelled off over the time span under review (particularly, Bulgaria and Romania). The side-by-side comparison of CEE9 to the control group of advanced countries shows there is room for improvement even for the CEE9 top performers. Despite outstanding relative performance, they should work towards moving closer to the 'distance to frontier' – the aggregate 'ideal' across all sub-indices of strategic economic transformation. The section that follows offers detailed Country Profiles, with leads as to country-specific strengths and weaknesses, based on STI results, and corresponding key insights for policy action.

STI Country Profile: Austria





Austria sets the mark as the overall regional best performer. The 2020 STI results for Austria (63.9) expose that the economy overperforms the CEE9 2020 average score (47.6) by a significant margin. Nonetheless, Austria still lags behind the advanced economies' best performer (Sweden: 71.2). Moreover, the 2020 index value indicates that the Austrian 'distance to frontier' – the aggregate 'ideal' across all sub-indices of strategic economic transformation – stands at 36.1 points, positioned halfway in between the CEE9-average distance to frontier at 52.4 points, and the global best performer's distance to the ideal at 28.8 points.

Austria has not only outperformed CEE9 in terms of latest STI results, it has been outpacing it also over time. On the macro-resilience side, the positive historical trend has been aided by improvements on the External Resilience (B) front due to reduction in terms of trade volatility and improvements in the FDI openness position in recent years. Exports penetration to new markets has also seen an uptick. On the innovation-side, positive time trends in all components have contributed, except for gains in Education (E) that have been flat, most notably dragged down by PISA science scores, indicating the front-runner could benefit from further policy analysis and action targeting Education (E) outcomes.

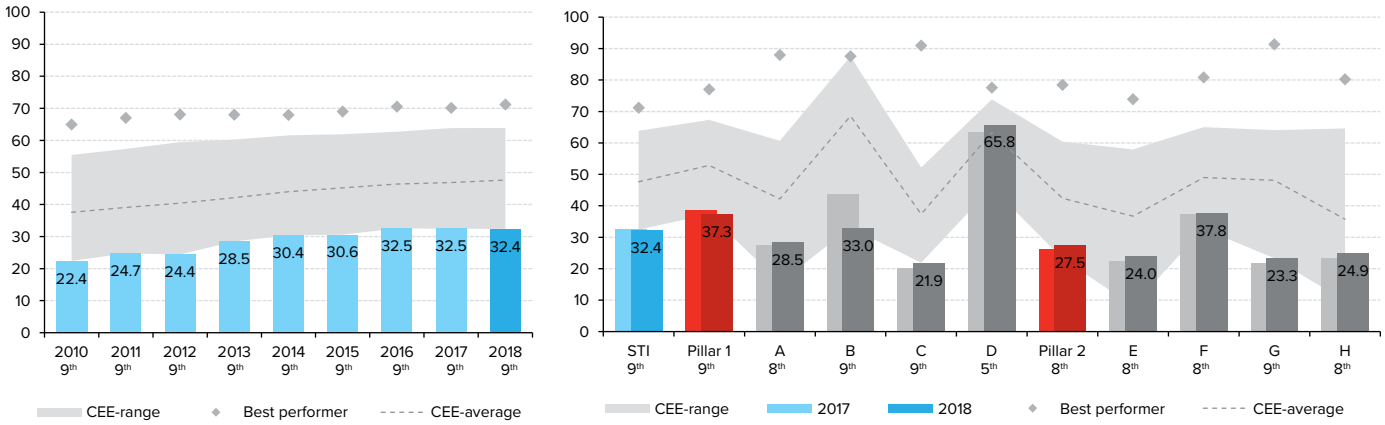
Austrian STI 2020 relative performance benefits marginally more from the first pillar than the second, albeit being greased by components drawn from both pillars relatively evenly. Specifically, External Resilience (B) and Productivity and Value-added (C) drive the above-average relative standing in terms of Pillar 1. External resilience is supported by diversified export profile that enhance resilience to external shocks. The solid relative TFP performance is corroborated by outstanding employment in knowledge-intensive activities and sophistication of exported products. In terms of Pillar 2, Austria remains the relative Green Economy (F) leader, setting the mark in terms of CO2 productivity, clean air, greenhouse gas emissions and resource productivity, and ranking high even by the advanced country group's standards. The economy is the CEE9 regional Innovation Capacity (H) leader, surpassing peers especially in terms of human resource research capacities, personnel, and expenditures on research and development. However, it could improve on innovation outcomes, such as patents.

While STI reveals Austria to be the CEE9 leader, the economy should look to the advanced group of European top performers as yardstick to continue on the path of meaningful and sustainable economic progress. To stay on track of making progress towards the frontier, and continue closing the gap vis-à-vis the global top performer, Austrian key economic actors should work together to address weakness in the following areas:

- **Focus policy efforts on continued analysis and action aimed at improving education outcomes, especially in STEM[109] disciplines**
- **While many necessary pre-conditions for innovation are fulfilled, emphasis should be placed on improved innovation deliverables**
- **While progress has been achieved on the digital agenda, backing e-commerce solutions and further developing e-government services could be exploited, as both operation models of the future and risk-mitigating strategies in disruptive times**

109 Science, technology, engineering, and mathematics

STI Country Profile: Bulgaria



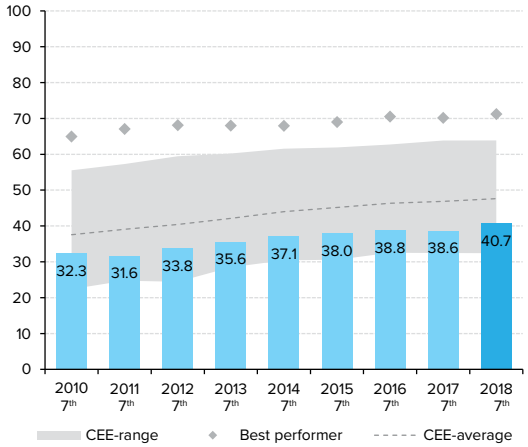
2020 STI results indicate that **Bulgaria ranks ninth within the region**. The Bulgarian aggregate STI score (32.4) underperforms the CEE9-average score (47.6) and stands at about a half of the mark set by the CEE9 regional top performer (Austria: 63.5). Despite the underwhelming relative standing, **Bulgarian performance has improved over time.** In particular, up to 2015, it has posted dynamic aggregate improvements, which have gradually worn off thereafter. Its performance has been broadly stagnating between 2016 and 2018. This over-time development has been propelled by a deterioration in the External Resilience (B), specifically, increased terms of trade volatility, poor economic complexity and high vulnerability of exports to shocks/low diversification of export profile, as indicated by the deteriorated Herfindahl-Hirschman Product/Market Concentration Index. On the innovation-side (Pillar 2), the downward trend in PISA science scores and weak innovation outcomes – as embodied in the number of patent and design applications – has acted as a drag on Education (E) and Capacity to Innovate (H), respectively.

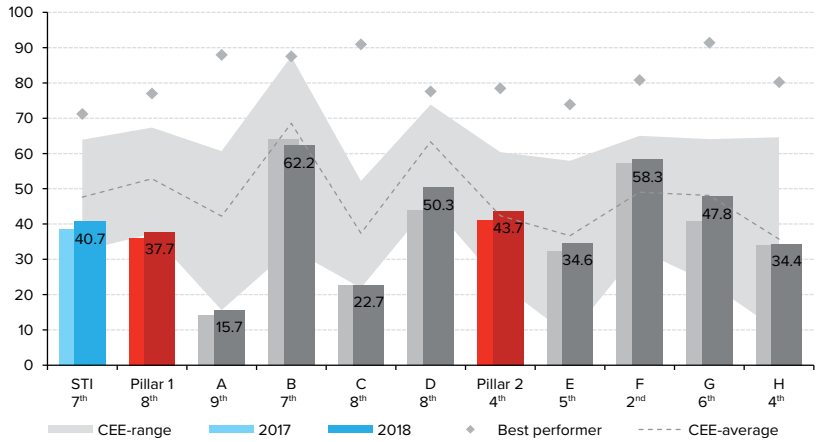
Bulgarian relative STI performance in the reference year has benefitted principally from relative favourable Financial Structure (D) on the macro-resilience side, which ranks 5th in the region. Notwithstanding the sound financial footing, STI outcomes have provided indications of numerous weaknesses in the Bulgarian economy that policy in liaison with the private sector should act upon in order to start closing the gap vis-à-vis CEE9-average. Precisely, **macro-financial fundamentals would benefit from enhanced complexity of exports**, export market penetration, and exported product sophistication to reduce external vulnerabilities, and from sustained efforts to capture greater value-added, and produce and export more knowledge-intensive products. Bulgaria has recently joined the ERM-II, on track to euro adoption, showing a political commitment to stability and reform that will help to improve macroeconomic resilience. Finally, the future participation in the monetary union, the institutions of the Eurosystem and the deepening of the integration in the Single Market should boost macroeconomic resilience even further, increasing the confidence of foreign investors and starting a virtuous circle.

On the innovation front, Bulgarian education outcomes (as embodied by PISA scores in reading, math, science), adult training and lifelong learning, labor market transition, and academic staff noticeably lag behind the regional average. The digitalization dimension has taken a back-seat, with the lowest regional rank overall, underlain by all digital economy factors. The latest results also suggest there is ample room for improvement in terms of the country's Innovative Capacity (H), outcomes, expenditures and human resources. The Green Economy (F) could benefit from policies to improve resource and CO2 productivity. A country's key economic actors should work together to address the principal root causes of Bulgaria's lackluster overall STI position in conjunction with other transition issues beyond the STI framework – such as, for instance, perceptions of corruption, informal economy, or product and financial market development – to produce an integrated growth agenda effective in unlocking sustainable economic growth and social prosperity. To that end, STI provides the following leads:

- **Put forth and implement a well-rounded education strategy to facilitate lasting improvements in education outcomes**
- **Upgrade productivity by finding a balance between human capital investments and technological progress**
- **Identify where the economy can have greatest success in capturing high-value opportunities based on its key strengths, and design policy to enhance them; form collaborative strategic partnerships with industry to ensure appropriate government intervention which delivers desired market outcomes**

STI Country Profile: Croatia





Croatia lands the seventh spot overall within the CEE9 region ranking. The Croatian overall STI score (40.7) underperforms the CEE9-average score (47.6) and is buttressed more by the Innovation Economy (Pillar 2), which ranks 4th overall within CEE9. The macro-resilience pillar (Pillar 1) is dragged down most pronouncedly by Openness[110](A), where Croatia ranks last within CEE9, and by Productivity and value-added (C). Historical improvements in the headline index on the macro-resilience side (Pillar 1) have been driven by the Financial Structure (D) across most components, and to a lesser extent by greater External Resilience (B) thanks to the increased diversification of export trade profile and reduced susceptibility to trade shocks. Digitalization (G) has most visibly fuelled Pillar 2 over time and across most variables.

The 2020 STI overall relative performance of Croatia has been buttressed by its Green Economy (F), as evidenced by the 2nd place overall within CEE9, and documented by individual measures including good relative CO2 productivity, low relative greenhouse gas emissions, and relatively large share of renewable energy in total energy consumption. The country has additionally generated good relative innovation outcomes (patents, trademarks) landing it 4th place within CEE9 in the Capacity to Innovate (H). On the digital front, the economy exhibits a relatively robust use of e-commerce, which should help mitigate impacts of shocks, such as the COVID-19 pandemic, going forward.

As demonstrated by the overall relative rank, however, **the room for improvement is sizeable in the effort to ease the rift vis-à-vis the regional benchmark-setter and to leapfrog ahead**. Croatia's relative education performance is below-average, dragged down by poor PISA in math and science scores, adult education & training, and public expenditures. On the other hand, good relative transition to work outcomes and some indications of teaching quality are encouraging. Croatia should monitor and address financial risks and imbalances, notably in the real estate market, as evidenced by unfavourable relative house price-to-income ratio, and monitor NPLs share in gross bank loans.

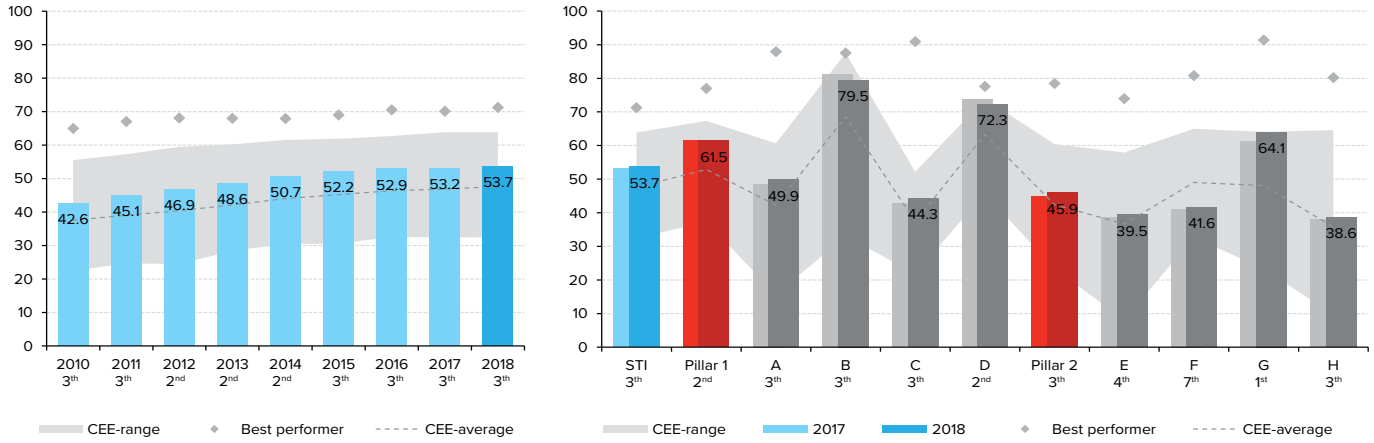
There is ample scope to improve the Productivity and value-added (C) in the Croatian economy. Croatian authorities should formulate an integrated long-term policy strategy focused on tourism and related sectors as a tool for growth and development, given the country's relative important role of services and tourism in the economy, and its pronounced declining path of manufacturing value-added in GDP over time. Openness to foreign capital can help to further develop the tourism sector by enabling key investments. The interdependence of tourism with other sectors of the economy should be taken into account: for example, countries with large domestic agricultural sectors supplying tourist consumption are well positioned to achieve higher levels of value-added in the tourism sector.[111] Higher value-added in services can be achieved through quality staff training & development programs, more efficient service provision achieved through take-up of new systems and technologies and innovation in processes etc. Good relative performance in e-commerce in the digital realm suggests this is an avenue worth exploring/pursuing. Croatia is currently in ERM2, awaiting the adoption of the euro. Euro adoption can further improve the macro-resilience environment, increasing price transparency, and additionally boosting the tourism supply. Against such a background, national authorities and business leaders should undertake efforts in the following priority areas, to address the structural weakness and unleash the country's transformation potential:

- **Formulate an integrated long-term policy strategy focused on tourism and related sectors as tool for growth and development, focused on improving openness to foreign capital and enhancing overall economic productivity and value-added**
- **Productivity in services can be honed by combining human capital upgrades and investments; and advancing digitalization and the take-up of new systems and technologies**
- **Further strengthen macro-resilience through monitoring financial risks and addressing them as needed**

110 The current STI framework to some extent puts Croatia at a disadvantage due to its structural differences vis-à-vis CEE9 peers, namely its economy's relative greater orientation on services, and lesser exports-orientation

111 Roldán, J. (2003). ANNEX 2. TOURISM AS AN ECONOMIC DEVELOPMENT TOOL. The Financing Requirements of Nature and Heritage Tourism in the Caribbean. (pp. 37-47). Organization of American States.

STI Country Profile: Czechia



Czechia places third in the overall STI ranking within CEE9. The 2020 overall Czech score (53.7) outshines the CEE9-average (47.6), while it left behind the regional leader by a 10-point margin (Austria: 63.9).

In the past decade, Czechia has been able to defend its rank in the top three top performers, leveraging its solid macro-economic fundamentals, including large degree of openness, forward international supply chains position, relative external resilience, and supportive financial structure. Its innovation performance – with the exception of a great leap on the digital frontier – has been average. Meanwhile, its underlying Education (E) picture has been mixed. Outcomes have improved only in recent years, and in some areas, particularly education outcomes in science can be further enhanced. Tertiary attainment has visibly risen over time, but adult training lags behind. Quality could be further increased by dedicating more resources into education in a targeted manner.

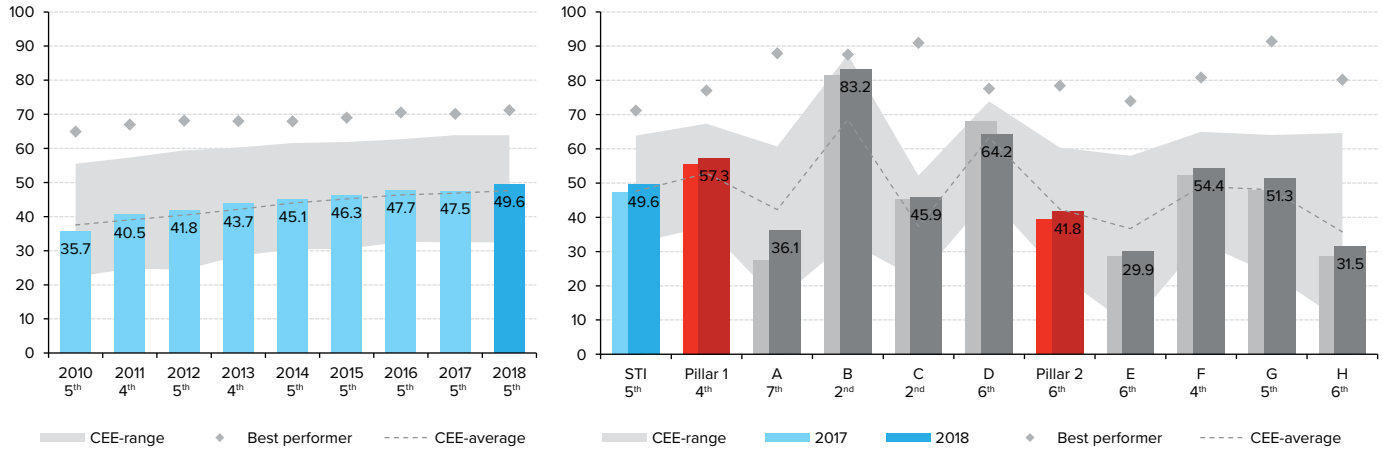
The Czech slightly above-average relative standing is underlain by the macro-resilience pillar more than its innovation economy. Its export-oriented economy continues to benefit from a relatively diversified export profile, and export product sophistication, as further documented by a relatively high share of exports in knowledge-intensive activities in gross exports. The Czech financial structure continues to reinforce its macro-economy. On the innovation side, Czechia posts the highest rank in terms of Digital Economy (G), bolstered by heavy internet use and infrastructure, as indicated by internet purchases, e-commerce and e-government services.

The pain points are evenly distributed across pillars. To continue closing the gap vis-à-vis the regional leader and to advance towards the frontier, a total economy's productivity can be further boosted, and supported by stronger education in terms of both quality and financing. The latter also relates to the need to further expand Czechia's innovative capacity: greater access to/availability of venture capital could enable the dynamism of the local economy. Despite leading a relative Digital Economy (G) position, more can be done to further digital transformation at the local enterprise-level to close the gap of average local SMEs vis-à-vis large export-driven companies, and also at the level of public services. To maintain progress towards the innovation frontier, Czech key economic actors should be working together to make growth greener. Policy priority areas as highlighted by the 2020 STI results include:

- **Put forth a sensible economy greening scheme to make growth cleaner, more resource-efficient and sustainable**
- **Enable lasting productivity increases through targeting greater education quality: realize easy productivity gains though continued take-up and adoption of existing and new digital technologies**
- **The total economy's efficiency can be aided by upgrades towards higher value-added of strategically selected domestic industries, as a part of a conjectured broader industrial strategy**

STI Country Profile: Hungary

#5/9



Hungary places fifth in the overall STI ranking within the CEE9 region, closely behind Poland, with an overall score of 49.6, right above the CEE9-average (47.6). Hungary's gap vis-à-vis the best regional performer (Austria: 63.9) hence stands at about 14 points. Like most other CEE9 regional economies, Hungary's headline relative performance is assisted more by the macro-resilience pillar than innovation.

Hungary has met the CEE9-average benchmark over time, exceeding it visibly in the index reference year. Positive developments in the headline index over time have been driven by stable improvements in External Resilience (B) (improvements in terms of trade, increased diversification of exports), and Financial Structure (D) (most components), on the macro-resilience side (Pillar 1). The innovation pillar (Pillar 2), on the other hand, has been propped up by upgrades in selected measures of the Green (F) and Digital (G) economies.

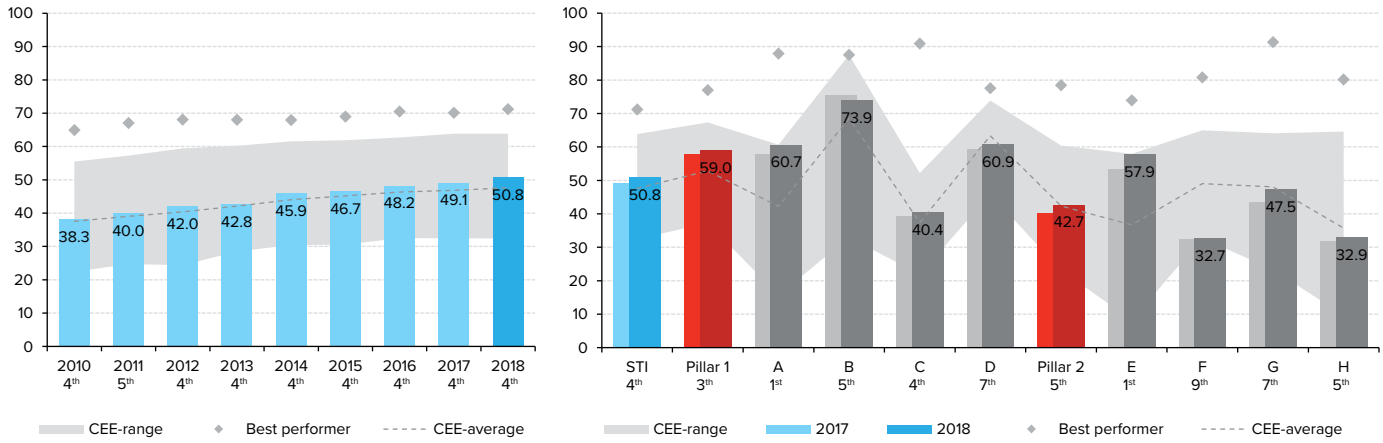
The relative rank is bolstered by visible above-average performance in External Resilience (B), the second-best performance within CEE9 after Austria, documenting a solid economic complexity of exports and a higher relative degree of export sophistication, which helps the economy cushioning shocks. The Hungarian economy furthermore benefits from a large relative degree of FDI openness, a high share of high-/medium-tech value-added share in total manufacturing value-added, and good relative performance in exports of knowledge intense activities. On the financial side, it should monitor financial risks, especially non-performing loans.

The rest of the picture is mixed. On the macro-resilience side, the overall TFP performance of the economy presents a red flag. On the innovation side, Hungary excels in venture capital expenditures, an important ingredient of local entrepreneurship ecosystem. But the country's education performance is lackluster, marked by low tertiary education enrolment and a high share of early leavers. Policy should also address weak relative innovation fundamentals, increase R&D funding and fortify research capacities. The twin digital and green transitions should become firmly anchored in the country's growth strategy.

To close the gap vis-à-vis region's leaders and pick up the pace towards the economic transformation frontier, Hungarian leaders and businessmen should work together to address the underlying weakness in the following strategic areas:

- **Make green and digital transition a greater policy priority for a long-term sustainable growth; especially where digitalization/new technology adoption can facilitate easy productivity gains all-across-the-board**
- **Match digitalization efforts with skills strategy for the 21st century, emphasizing digital skills, STEM subjects, and other skills required to meet labor market needs of tomorrow**
- **A stepped-up capacity to innovate that translates into practical outcomes is a crucial ingredient for moving up towards the frontier of strategic transformation, and should be backed by a tailored policy strategy and public-private liaisons**

STI Country Profile: Poland



Poland takes the fourth spot in the overall STI 2020 ranking within the CEE9 region. The 2020 overall score (50.8) hovers close above the CEE9-average (47.6) and underperforms the regional leader by a 13-point margin (Austria: 63.9). The solid relative ranking benefits from the Macro-resilience (Pillar 1) more than the Innovation Economy (Pillar 2), bolstered by excellent relative performance in Openness (A). Notably, Poland's strength is its Education (E), setting the mark for the CEE9 region, and propping up the Innovation Economy (Pillar 2).

Over time, Poland has wavered around the CEE9-average, visibly outpacing it in the reference year. The historical positive developments have been motivated by a steady performance of the macro-resilience pillar (Pillar 1). In fact, Poland has been one of the fastest converging economies within CEE9 after 1990. Developments on the innovation-side (Pillar 2) have been powered by over-time advancements in digitalization and the capacity to innovate.

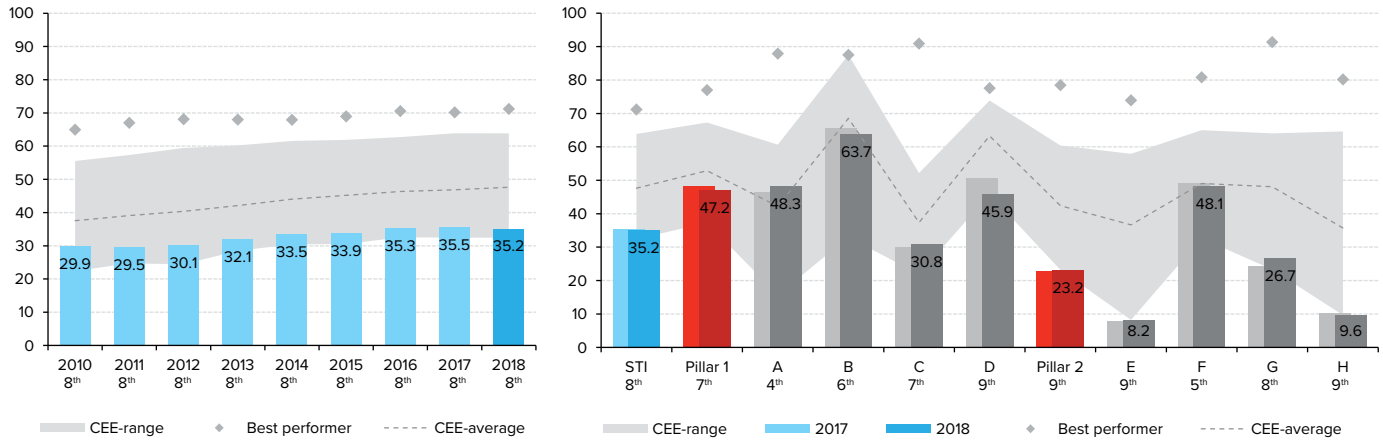
The Polish relative rank is fuelled by favourable position in value chains and high relative export market penetration. Similar to Austria, external resilience is aided by a relatively diversified export profile, which helps cushion against external shocks. Poland also displays solid relative TFP performance.

On the innovation front, the picture remains mixed: Poland fares relatively well across the education cluster of variables (E), but ranks last in terms of the Green Economy (F) dragged down also by most components, including limited resource productivity, low share of renewable energy in total, poor relative air quality, and high greenhouse gas emissions. The digital economy could also benefit from upgrades, notably, in terms of access to internet and its use for commercial ends. Polish ability to innovate is mostly dull, both in terms of outcomes and access to risk capital and constitutes another area that should be underpinned policy strategy.

The insights provided by the STI provides clear pointers where key economy stakeholders should join forces and design practical business and policy solutions, in the quest to accelerate towards the strategic economic transformation frontier:

- **Put forth an actionable economy greening strategy to make growth cleaner, more sustainable and resource-efficient**
- **Create an enabling environment to proceed with economy digitalization across both, private and public domains**
- **Design an innovation strategy to support local R&D, entrepreneurship, and moving up towards higher value-added activities within manufacturing and beyond**

STI Country Profile: Romania



Romania ranks eighth in the overall STI ranking within the CEE9 region. The 2020 overall STI value (35.2) places it well beneath the CEE9-average score (47.6) and about halfway on the strategic transformation path of the best performer (Austria: 63.9). The Macro-resilience (Pillar 1) fundamentals sustain the economy's relative STI more pronouncedly than the Innovation Economy (Pillar 2), although Financial Structure (D) requires attention. Pillar 2 is visibly dragged down by an underwhelming Education (E) cluster and the Capacity to Innovate (H), where Romania ranks at the bottom of CEE9.

Based on historical STI results, **Romania managed to post consistent improvements across time**, except for the previous year where the performance marginally deteriorated due to the aggravation of some financial risks (NPLs), terms of trade, increased exporter vulnerability to shocks, and lowered economic complexity. Over the reference period (2010-2018), steady improvement in Openness (A) and Productivity and Value-added (C) pushed up the headline measure on the macro-resilience side, while Green and Digital (F and G) enhancements have helped on the innovation-side (Pillar 2).

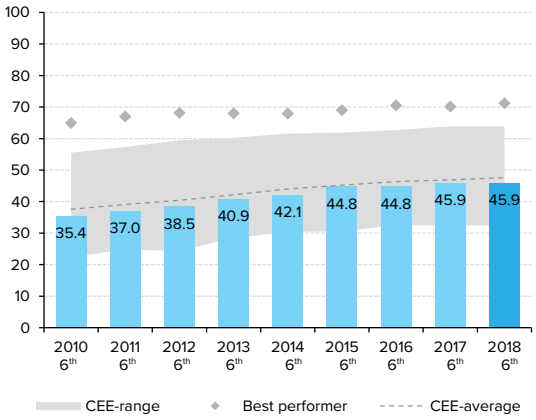
In terms of relative standing, the Romanian economy has profited from strong position in value-chains on the Openness front (A). On the innovation side, it has additionally shown average relative performance in terms of Green Economy (F), ranking fifth overall among CEE9 in 2018.

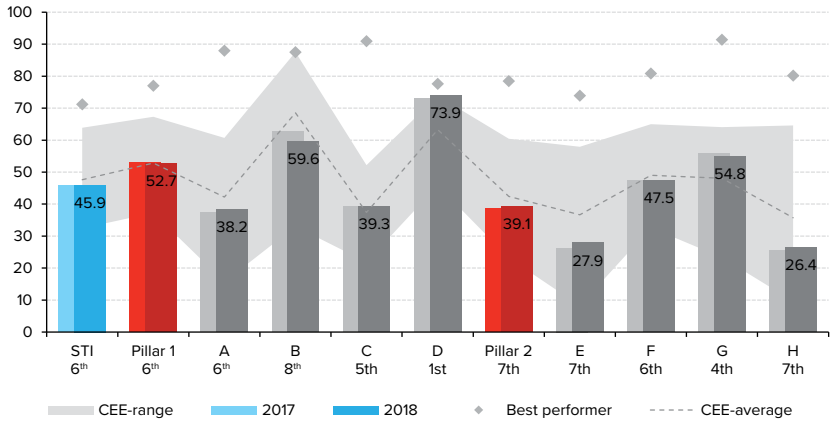
As underscored by the STI findings, however, **the fundamental causes of the idle overall position is lingering weakness in the country's Education (E) outcomes, as well as its capacity to innovate (H)**, where it ranks last within the CEE9 sample. On the macro-resilience side, Financial Structure (D) is dragging down Pillar 1, underlain by most components. Improvements in the Digital Economy (G) – in addition to investments in human capital – could additionally facilitate easy productivity gains.

Based on STI results, key economic actors should work in tandem to underpin most backward areas through sound business strategies and enabling policy action:

- **Take targeted policy action to upgrade the country's education outcomes and labor force productivity**
- **Encourage higher productivity of the economy through targeted upgrades of strategically selected domestic sectors**
- **Match good relative progress in Green Economy with digital advancements that can additionally help facilitate easy productivity gains**

STI Country Profile: Slovak Republic





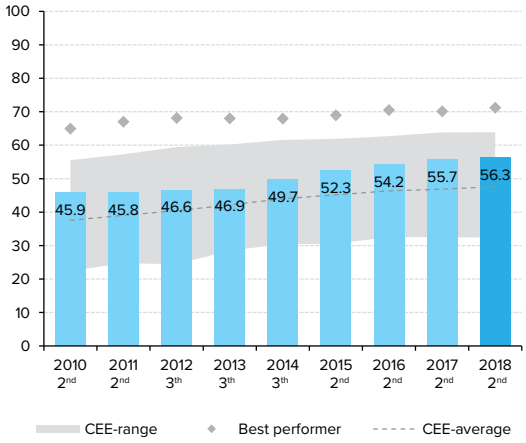
The Slovak Republic ranks sixth overall in STI within CEE9. The 2020 overall STI outcome (45.9) uncovers that the Slovak economy slightly underperforms the CEE9-average score (47.6). The headline STI rank benefits more substantially from the macro-resilience fundamentals than the innovation economy.

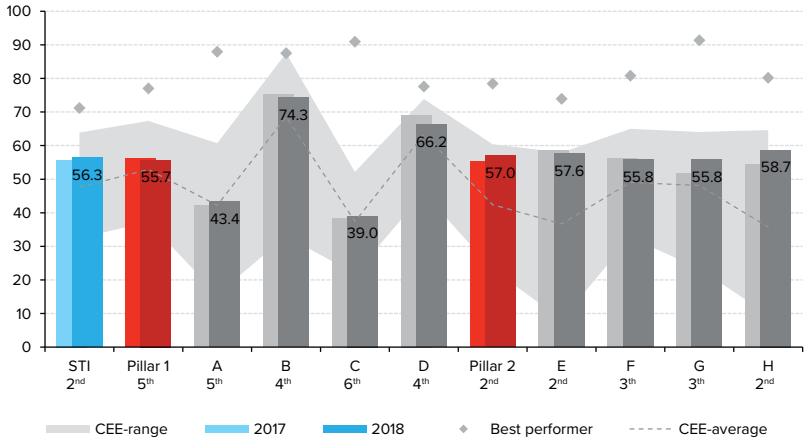
The Slovak economy has posted performance improvements between over the 2010-2018 reference period, fueled by the Financial Structure (D) and some reduction in external vulnerabilities (B), especially stemming from less volatile terms of trade on the macro-resilience front (Pillar 1). Over-time improvements in the Digital Economy (G), and to a lesser extent the Green Economy (F), have propelled the innovation-side (Pillar 2).

In relative terms, the Slovak economy has benefitted from a stable relative financial position, ranking 1st in the CEE9 region, and buttressed by all determinants except household loans-to-disposable income, which should be monitored as an impending financial risk. Productivity and value-added (C) profits from a significant proportion of medium/high-tech industry value-added in the total manufacturing value-added. On the innovation side (Pillar 2), positive developments in internet use, e-commerce and internet purchases and e-government propped up an above-average relative performance in terms of Digital Economy (G), which ranks 4th overall in CEE9.

As highlighted by the STI outcomes, however, **the principal culprit of the lackluster overall relative position within CEE9 is persistent weakness in the country's Education (E) and Innovative Capacity (H)** (Pillar 2). With respect to education, the assessment is underlain by low relative PISA score outcomes (especially in science), weak relative adult training, mediocre transition to work results, low academic staff rank, and soft government expenditures. Tertiary enrolment has been also on the decline, which we partly ascribe to the rising enrolment of nationals abroad. In terms of capability to innovate, besides the count of researchers/professionals engaged in the conception or creation of new knowledge/products that has seen an increase over time, all other aspects require policy attention. This includes funding, innovation outcomes, such as patents, and the availability of capital to translate innovation into commercial outcomes, such as venture capital - especially in the absence of functional capital markets. An integrated policy approach may be required to successfully address the two related sub-domains (E and H). As discussed in Part 1 of the report, the two blocks are critical to moving out of the middle-income rut and to move closer to the strategic transformation frontier. Policymakers and business leaders should work in tandem to address weaknesses in the following policy areas:

- **Deploy a multi-stakeholder approach to conceptualize and execute an education strategy to equip workers with skills and training for the 21st century; public-private partnerships can help with reducing labor market skills mismatches**
- **Create a functional innovation strategy to improve the country's capacity to innovate and move to higher value-added activities; industries and sectors where this should be achieved should be identified strategically where gains are consequential**
- **Target increasing external resilience through the diversification of export profile and product sophistication**





Slovenia ranks second in the overall STI standing within CEE9. The 2020 results of STI for Slovenia (56.3) reveal that the economy overperforms the CEE9 average score (47.6) but still has an ample room to improve vis-a-vis the broad-sample top performer (Sweden: 71.2). The Slovenian overall score is encouraged slightly more by the Innovation Pillar, which ranks 2nd overall in CEE9, than by its macro-economy. In terms of innovation, it benefits from all four pillars quite evenly, while on the macro-resilience side, it is pronouncedly driven by external resilience and financial structure, with the remaining two components hovering at the regional average.

Taking a temporal perspective, Slovenia has been consistently outperforming the CEE9-average over the nine years under review and has posted consistent performance improvements. Driving the upward trend have been increasing External Resilience (B), a visible improvement in the country's Financial Structure (D) on the macro-resilience side (Pillar 1) and improvements in the Green (F) and Digital Economy (G) on the innovation-side (Pillar 2). On the financial front, Slovenia has addressed financial sector risks (reduced NPLs, household loans-to-income ratio) and improved financing conditions; while on the green front it has posted impressive gains on CO2 productivity, air quality and recycling rate; and in almost all individual drivers underlying the digital economy.

Slovenian above-average relative standing in the reference year has been buttressed by economic complexity in terms of both export portfolio and product sophistication, on the macro-resilience side. On the innovation front, it has been supported by a healthy relative Education (E) cluster, including superior relative education outcomes as embodied by PISA results, good participation rates in adult learning, smooth transition to work, solid education finance, high tertiary education attainment, as well as student-teacher ratios. The solid education base demonstrates also in productivity variables, such as employment in knowledge-intense activities and the proportion of medium and high-tech industry value-added in total value-added of manufacturing.

Secondly, **Slovenia has demonstrated a remarkable relative capacity to innovate**, as exemplified by both, outcomes (intellectual assets), spending (research and development expenditures), research staff and personnel, and risk capital expenditures to finance new business ventures. This is set against the backdrop of solid twin transition stance, as indicated by selected measures, particularly, e-commerce, online purchases and municipal recycling rate.

As one of the top three performers within the CEE9 region, the country should strive to benchmark itself to the more advanced control group of countries to maintain momentous and sustainable progress. In particular, economic actors should work together to continue addressing weakness on the following policy fronts:

- **Put forth workable policy strategies to differentiate its export portfolio, reach new markets and further enhance product sophistication towards higher value-added activities (especially knowledge-intense ones)**
- **Empower greater economy efficiency through targeted upgrades of strategically selected domestic production capacities; make use of existing and new technologies to augment productivity…**
- **..while continuing to steer the economy to 'grow better' (i.e. greener and smarter) – with a dual focus on advancing the twin digital and green transition**

6.

Research & Methodology

Country Selection

The CEE Strategic Transformation Index is available at a CEE region aggregate level and at individual country-level. In the current report, CEE is defined as Slovak Rep., Czechia, Poland, Hungary, Austria, Slovenia, Croatia, Romania and Bulgaria. Authors have deliberately targeted a narrower sample of CEE countries, leaving out the Baltic states (Estonia, Lithuania and Latvia) and the Balkan countries (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, Serbia) that are sometimes included in broader CEE compositions. For example, the OECD defines the Central and Eastern European Countries (CEECs) as a group comprising of Albania, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, and the three Baltic States: Estonia, Latvia and Lithuania[112]. Authors duly acknowledge the existence of other definitions/country compositions of the CEE region.

The country choice has been deliberately narrowed to reflect GLOBSEC and partners' areas of regional economic expertise, the common transitional past of most of the included countries, real economic convergence performance to-date, as well as the role advanced economic clubs have played on its transformational path, as detailed in earlier. All included countries are EU members. Austria, Slovak Rep. and Slovenia are additionally euro area members, while Bulgaria and Croatia have been since July 2020 placed in the advanced phase of euro adoption[113]. All but one country (Croatia) are additionally members of the intergovernmental economic club, the OECD. These memberships represent a degree of 'like-mindedness' and basic level of institutional quality, which we leverage as a basis for the index. The memberships also interact with the quality, availability, breadth, coverage and international comparability of the available statistics used for the purpose of the index computation. The quality of the information fed in is important to obtain meaningful index values and policy implications, and thereby deliver an informative diagnostic tool.

Austria has a special standing in the country sample, as it lacks the shared communist past and is pronouncedly more advanced on most macroeconomic counts than the remainder of the countries. Austria has been included on the double-basis of geographical proximity and economic and political ties to the Visegrad economies, and as a benchmark than many of the other countries can aspire to. Authors duly acknowledge the different stage of Austria's development from the rest of the CEE region, as hereby defined. Admittedly, the country choice can be deemed arbitrary. The CEE country composition can change in future vintages of the Index/Report.

To contextualize the rankings within a broader milieu and place them into a perspective vis-à-vis relevant benchmarks we include a broader country sample of richer European economies: Germany, Sweden, Denmark, Finland, Estonia, the Netherlands, Belgium and France[114]. The basic rationale behind the choice of these control countries is two-fold: on a basis of trade ties with CEE in some cases, and as a convergence aspiration for the region. Germany, France, the Netherlands, and Belgium tend to lead the way in terms of Pillar 1, i.e. perform best in terms of macro-resilience, while their Scandinavian counterparts set the mark for Pillar 2 (Innovation Economy). Including a sub-set of the richer European economies also improves the information power of the index. This can be seen in interpreting its values. For example, if the value of the index (sub-index) per a given country in 2018 is equal to 25, it can be interpreted as the country being at a ¼ point between the worst (most often, a CEE country in 2010) and the best performer (most often, an advanced country in 2018) in the sample. Thus, the index benchmarks each country and places it at a scale, passed its historical progress and vis-à-vis future potential advancement, where the mark is set by the advanced economies included.

We considered an inclusion of extra-EU innovation top performers that frequent leading spots in global rankings[115] (South Korea, Singapore, Israel or the United States). Nevertheless, we prefer the selected sample of European advanced nations, as: *one*, the convergence paradigm of CEE makes more sense in the European context; *two*, EU proximity and trading links may play a role; and, *three*, the similar institutional, cultural makeup of the selected countries – under the umbrella of EU like-mindedness, institutions and acquis *communautaire* – matters.

Data, Proxies

All data series deployed in the current analysis are sourced from major international databases (Eurostat, European Commission AMECO, European Central Bank, Penn World Tables, World Bank, OECD, WIPO, etc.) to facilitate cross-country comparability of the information included. The frequency used for all series is annual. Importantly, all deployed series are – as a rule – sourced from active datasets that get regularly updated. A detailed overview of the data used, including definitions, sources, time coverage and country coverage, along with basic data description statistics follows (Table III).

112 OECD. (2001). OECD Glossary of Statistical Terms - Central and Eastern European Countries (CEECs) Definition. https://stats.oecd.org/glossary/detail.asp?ID=303

113 European Commission. (2020, July 10). Commission welcomes Bulgaria and Croatia's entry into the Exchange Rate Mechanism II [Press release]. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1321

114 We deliberately leave out Mediterranean European countries – e.g. Spain, Italy, Greece due to stalled convergence post-Great Recession in some cases, and dissimilarities in economic structure vis-à-vis CEE, as shown in previous sections, (they are less open, less export-oriented, with greater contribution to gross value-added of services, etc.). On the other hand, they grapple with many problems the CEE is facing, including laggard productivity, the need to upgrade human capital, laggard innovation performance, low levels of R&D investments etc.

115 See for example here: Jamrisko, M., & Lu, W. (2020). Germany Breaks Korea's Six-Year Streak as Most Innovative Nation. Bloomberg. https://www.bloomberg.com/news/articles/2020-01-18/germany-breaks-korea-s-six-year-streak-as-most-innovative-nation

PILLAR	SUB-INDEX	SUB-INDEX COUNT	CLUSTER	DATA SERIES	DATA DEFINITION/TRANSFORMATION
1	A	1		Global value chains (GVC) forward participation	domestic value-added in foreign exports as a share of gross exports; includes the value added generated by the exporting industry du domestic suppliers that is embodied in the exports
1	A	2	Openness	Foreign direct investment (FDI) openness	defined as sum of FDI inflows (% of GDP) and FDI outflows (% of GDP); FDI net inflows are the value of inward direct investment made b and intra-company loans, net of repatriation of capital and repayment of loans; FDI net outflows are the value of outward direct investm including reinvested earnings and intracompany loans, net of receipts from the repatriation of capital and repayment of loans
1	A	3		Index of export market penetration	calculated as the number of countries to which the reporter exports a particular product divided by the number of countries that report reach already proven markets: a low export penetration may signal the presence of barriers to trade that are preventing firms from exp
1	B	1		Economic complexity	defined in terms of an eigenvector of a matrix connecting countries to countries, which is a projection of the matrix connecting countrie and the ubiquity of products; measures economic complexity containing information about both the diversity of a country's export and
1	B	2	External vulnerability	Terms of trade volatility	computed as standard deviation of year on year growth rate of net barter terms of trade index (2000 = 100) over 5 years
1	B	3		Herfindahl-Hirschman Product/ Market Concentration Index	measures dispersion of trade value across an exporter's products; country with a preponderance of trade value concentrated in a very vulnerability to trade shocks; measured over time, a fall in the index may be an indication of diversification in the exporter's trade profi
1	C	1		Total factor productivity	TFP in 2015 sourced in current prices from Penn World Tables (variable CTFP; GDP-based measure; 2015=100) - ideal to facilitate coun periods, growth rates from EC AMECO total factor productivity (ZVGDF, index; 2015=100) are used
1	C	2		Medium/high-tech industry value-added	proportion of medium and high-tech industry value-added in total value-added of manufacturing
1	C	3	Productivity & Value-added	Sophistication of exports	is given by summing all the PRODY values for the products exported by the country, each weighted by the product's share in total expo producing that product, with weights derived from revealed comparative advantage
1	C	4		Employment in knowledge-intensive activities	employment in knowledge-intensive activities (manufacturing + services) as a share of total employment; classified as 'knowledge inter employment in that activity; the definition is built based on the average number of employed persons aged 15-64
1	C	5		High-technology exports	products with high R&D intensity (aerospace, computers, pharmaceuticals, scientific instruments, electrical machinery); weighted avera produce low-tech products, product approach used for international trade
1	D	1		Long-term interest rate for convergence purposes	harmonised long-term interest rates refer to government bonds maturing in ten years
1	D	2		Loans to households as a ratio of gross disposable income	loans granted to households as a ratio of gross disposable income (the amount of money that all of the individuals in the household se example, taxes, social contributions and benefits, have taken effect)
1	D	3	Financial structure	MFIs lending margins on loans to non-financial corporations (NFC)	measures difference between Monetary Financial Institutions (MFIs') interest rates on new business loans and a weighted average inte
1	D	4		House price-to-income ratio	ratio of residential prices to disposable income
1	D	5		Bank non-performing loans as a share of gross loans	the value of nonperforming loans divided by the total value of the loan portfolio (incl. NPLs before deduction of specific loan-loss provi the loan as recorded on the balance sheet, not just the amount that is overdue
2	E	1		EDUCATION OUTCOMES: PISA scores: reading	OECD international student assessment of 15-year-olds' ability, knowledge, skills to meet real-life challenges: average PISA score in rea
2	E	2		EDUCATION OUTCOMES: PISA scores: mathematics	OECD international student assessment of 15-year-olds' ability, knowledge, skills to meet real-life challenges: average PISA score in ma
2	E	3		EDUCATION OUTCOMES: PISA scores: science	OECD international student assessment of 15-year-olds' ability, knowledge, skills to meet real-life challenges: average PISA score in sc
2	E	4		ADULT LEARNING: Participation rate in education and training	participation rate in education and training for the last 4 weeks for people aged 25-64 years; survey-based measure: 'Have you partic
2	E	5		TRANSITION TO WORK: Early leavers from education and training	percentage of the population aged 18-24 having attained at most lower secondary education and not being involved in further educati
2	E	6	Education cluster	Public expenditure on education	public expenditure on education, All ISCED 2011 levels excluding early childhood educational development
2	E	7		HIGHER EDUCATION: Tertiary education enrollment	measures tertiary school enrollment; tertiary education requires successful completion of education at the secondary level
2	E	8		HIGHER EDUCATION: Tertiary educational attainment	measures the share of the population aged 30-34 who have successfully completed tertiary studies (e.g. university, higher technical ins
2	E	9		ACADEMIC STAFF: Classroom teachers & academic staff	classroom teachers and academic staff, primary education
2	E	10		ACADEMIC STAFF: Ratio of pupils and students to teachers and academic staff	ratio of pupils and students to teachers and academic staff by education level and programme orientation [pre-primary education]
2	F	1		Production-based CO2-productivity	calculated as real GDP generated per unit of energy-related CO2 emitted (includes CO2 emissions from combustion of coal, oil, natura
2	F	2		Domestic material consumption per capita	amount of material directly used in an economy and equals direct material input (DMI) minus exports. DMI measures the direct input of imports. For the 'per capita' calculation of the indicator the average population is used (the arithmetic mean of the population on 1st Ja
2	F	3		Resource productivity and domestic material consumption (DMC)	gross domestic product (GDP) divided by domestic material consumption (DMC). DMC measures the total amount of materials directly from the domestic territory of the focal economy, plus all physical imports minus all physical exports.
2	F	4	Green economy	Renewable share in final energy consumption	share of renewable energy in final consumption of energy (includes consumption of energy derived from: hydro, solid biofuels,wind, so consumption is calculated from national balances and statistics as total final consumption minus non-energy use
2	F	5		Recycling rate of municipal waste	measures the share of recycled municipal waste in the total municipal waste generation. Recycling includes material recycling, compos measured in tonnes.
2	F	6		Air quality: Mean population exposure to PM2.5	mean population exposure to fine particulate matter, calculated as mean annual outdoor PM2.5 concentration weighted by population
2	F	7		Greenhouse gas emissions	national emissions, including international aviation of the so called 'Kyoto basket' of greenhouse gases, including carbon dioxide (CO2 (hydrofluorocarbons, perfluorocarbons, nitrogen triflouride (NF3) and sulphur hexafluoride (SF6)) from all sectors of the GHG emission i forestry). Using each gas' individual global warming potential (GWP), they are being integrated into a single indicator expressed in units
2	G	1	Digital economy	Households internet access	percentage of householdswith have internet access
2	G	2		Individuals' internet use	percentage of individuals which have used the internet at least once within the last 3 months; survey-based measure
2	G	3		Internet purchases by individuals in 3 months	internet users who bought goods/services for private use in the previous 12 months
2	G	4		E-government activities of individuals via web	percentage of internet users who have interacted with public authorities at least once in the last 12 months
2	G	5		E-commerce sales, Enterprises' total turnover	total turnover from e-commerce sales: defined as the sale/purchase of goods/services, between businesses, households, individuals o computer-mediated networks
2	G	6		E-commerce sales, Enterprises at least 1% turnover	sales coming from e-commerce which includes all enterprises, without financial sector (10 persons employed or more) which have at le
2	H	1		Patents	direct + PCT national phase entries patent applications (a patent is an exclusive right granted for an invention, which is a product or a p technical solution to a problem)
2	H	2		Trademarks	total direct and via the Madrid system trademark applications (trademark is defined as a sign capable of distinguishing the goods/servi
2	H	3	Innovative capacity	Designs	total direct and via the Hague system design applications (an industrial design constitutes the ornamental aspect of an article and may dimensional features, such as patterns, lines or color)
2	H	4		Gross domestic expenditures on R&D	capital + current expenditures in 4 sectors: Business enterprise, Government, Higher education and Private non-profit. R&D covers bas
2	H	5		Venture capital expenditures	sum of early stage (pre-seed, seed, start-up and other early stage) and later stage venture capital
2	H	6		R&D Personnel	include all persons employed directly on R&D, plus persons supplying direct services to R&D (managers, administrative, office staff)
2	H	7		Researchers head count	professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the manag
2	H	8		Human resources in science and technology	active population in the age group 25-64 that is classified as HRST (i.e. having successfully completed an education at the third level o population aged 25-64

	UNIT	SOURCE	START	END	COUNTRY COVERAGE	TURNED SIGN TO 'MORE IS BETTER'
ring its production processes as well as any value added coming from upstream	% of gross exports	OECD	2005	2015	all countries (broad index)	
by non-resident investors in the reporting economy, including reinvested earnings nent made by the residents of the reporting economy to external economies,	% of GDP	World Bank WDI	1990	2018	all	
importing the product that year; measures the extent to which country's exports anding the number of markets to which they export	index	World Bank	2000	2018	all	
es to the products they export; considers information on the diversity of countries their sophistication	index	Harvard Growth Lab	1995	2018	all	
	standard deviation of 5-year growth rate	World Bank WDI	2005	2018	all	x
few products will have an index value close to 1; indicator of the exporter's le	index	World Bank	1990	2019	all	x
try comparison at a point of time. To fill in observations in previous and subsquent	index; 2015=100	Penn World Tables 9.1, European Commission AMECO	1990	2018	all	
	% of total manufacturing value-added	World Bank	1990	2017	all	
orts; PRODY is calculated as a weighted average of per capita GDP of countries	weighted average by product's share in exports	World Bank	1990	2019	all except Romania *	
nsive' if employed tertiary educated persons represent more than 33 % of the total	% of total employment	European Commission AMECO	2008	2019	all	
ge; since industrial sectors specializing in a few high-tech products may also	% of total manufactured exports	World Bank	1990	2018	all	
	% per annum; period averages; secondary market bond yields	ECB	1991	2019	all except Estonia *	x
ctor have available for spending or saving after income distribution measures; for	% of gross desposable income	ECB	1999	2019	all	x
rest rate on new deposits from non-financial corporations	percentage points	ECB	2003	2019	all	x
	number of yearly incomes to purchase 100 square metres	European Commission~'	1990	2017	all	x
sions). The loan amount recorded as nonperforming should be the gross value of	% of gross	World Bank	2009	2019	all	x
ading	scores (available at 3-year basis)	OECD	2000	2018	all	
athematics	scores (available at 3-year basis)	OECD	2003	2018	all	
ience	scores (available at 3-year basis)	OECD	2006	2018	all	
cipated in any training or education in the last 4 weeks?'	% of total respondents	Eurostat	1992	2019	all	
on or training may face difficulties in the labour market	% of total enrolled, 18-24 years old	Eurostat	2010	2019	all	x
	% of GDP	Eurostat	2002	2017	all except Denmark, Croatia*	
	% of gross	World Bank	1990	2017	all	
stitution, etc.)	% of population aged 30 to 34	Eurostat	2000	2019	all	
	count scaled by population	Eurostat	2013	2018	all	
	%	Eurostat	2013	2018	all except Ireland, Denmark, Estonia*	x
l gas and other fuels)	USD per kg	OECD	2010^	2018	all	
materials for the use in the economy. DMI equals domestic extraction (DE) plus nuary of two consecutive years).	tonnes per capita	Eurostat	2000	2019	all	x
used by an economy. It is defined as the annual quantity of raw materials extracted	purchasing power standard (PPS) per kg; 2015 as reference year, data filled in using the EUR per kilogram chainlinked volumes series	Eurostat	2000	2019	all	
olar, liquid biofuels, biogas, geothermal, marine and waste); total final energy	% of final energy consumption	IEA	1990	2016	all	
sting and anaerobic digestion. Expressed in percent (%) as both components	% of total municipal waste	Eurostat	2007	2018	all	
living in the area	concentration level, micrograms per cubic meter (µg/m3) in a year	OECD	2010^	2017	all	x
), methane (CH4), nitrous oxide (N2O), and the so-called F-gases nventories (international aviation, excluding land use, land use change and s of CO2 equivalents.	tonnes per capita	Eurostat	1990	2018	all	x
	% of total households	Eurostat	2002	2019	all	
	% of total respondents	Eurostat	2003	2019	all	
	% of total internet users	Eurostat	2002	2019	all	
	% total internet users	Eurostat	2008	2019	all	
r private organizations, through electronic transactions via the internet or other	% of turnover coming from e-commerce sales	Eurostat	2010	2019	all	
east 1% turnover from e-commerce sales	% of total enterprises	Eurostat	2010	2019	all	
process that provides, in general, a new way of doing something, or offers a new	total count per 1000 population	WIPO	1990	2018	all	
ces of one enterprise from another, protected under intellectual property rights)	total count per 1000 population	WIPO	1990	2018	all except Belgium and Netherlands *	
consist of three dimensional features, such as the shape of an article, or two	total count per 1000 population	WIPO	1990	2018	all except Belgium and Netherlands *	
ic research, applied research, and experimental development	% of GDP	World Bank	1996	2018	all	
	% of GDP	OECD	2007	2019	all except Croatia and Bulgaria *	
	in full time equivalents as % of economic active population	Eurostat	2007	2018	all	
gement of the projects concerned	count scaled by population	Eurostat	2007	2017 (2018)	all	
r being employed in science and technology) as a percentage of total active	% of active population	Eurostat	2007	2018	all	

Table IV. Data descriptive statistics

Raw data (2010-2018)						Data after filling missing, interpolating, extrapolating				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Openness (A)										
a_fdi_openness	171	8.46	22.82	-85.04	146.00	171	8.46	22.82	-85.04	146.00
a_gvc_forward_participation	114	18.97	3.21	12.25	24.41	171	19.05	3.18	12.25	24.41
a_iemp	171	22.50	14.84	5.13	63.39	171	22.50	14.84	5.13	63.39
External resilience (B)										
b_econ-complexity	171	1.37	0.38	0.48	2.26	171	1.37	0.38	0.48	2.26
b_hh_product_mkt_conc	171	0.01	0.01	0.00	0.05	171	0.01	0.01	0.00	0.05
b_tot_volatility	171	1.71	0.79	0.56	3.91	171	1.71	0.79	0.56	3.91
Productivity & value-added (C)										
c_se	162	9.97	0.10	9.72	10.23	171	9.97	0.10	9.72	10.23
c_empkia	171	35.28	6.04	19.50	45.80	171	35.28	6.04	19.50	45.80
c_himva	152	46.11	9.32	24.70	62.45	171	46.06	9.38	24.70	62.45
c_tfp_pwt_ameco	171	82.30	15.84	57.05	136.34	171	82.30	15.84	57.05	136.34
c_xkia	170	15.83	6.48	6.06	32.72	171	15.83	6.46	6.06	32.72
Financial structure (D)										
d_10ybench_i	162	2.64	1.94	0.09	9.61	171	2.61	1.92	0.09	9.61
d_houseprice_income	151	9.91	2.48	6.90	18.50	171	9.96	2.50	6.90	18.50
d_hhdebt_dispincome	170	100.09	65.00	25.07	286.32	171	99.73	64.98	25.07	286.32
d_mfilendingrates	168	1.94	0.87	0.63	4.97	171	1.95	0.87	0.63	4.97
d_npl_totgross	165	6.42	5.39	0.61	25.71	171	6.26	5.36	-0.49	25.71
Education (E)										
e_pisam	57	493.63	23.66	429.92	523.41	171	493.29	23.56	429.92	533.42
e_pisar	57	490.90	26.35	419.84	526.42	171	491.08	25.81	419.84	530.71
e_pisasci	57	495.61	27.15	424.07	545.44	171	497.01	26.95	424.07	551.60
e_train	171	11.84	8.80	0.90	32.70	171	11.84	8.80	0.90	32.70
e_early_leavers	171	9.07	3.49	2.80	19.30	171	9.07	3.49	2.80	19.30
e_tert_edu	171	38.67	9.10	18.30	56.30	171	38.67	9.10	18.30	56.30
e_tert_enrol	147	68.47	11.25	46.63	94.92	171	68.67	11.25	46.63	94.92
e_acad_staff_pop	108	4.45	1.72	1.98	8.67	171	4.42	1.78	1.94	8.67
e_ratio_student	96	13.54	4.95	5.80	40.60	171	12.90	5.06	4.49	40.60
e_edu_gov_expend	130	5.16	1.21	2.58	8.81	171	5.15	1.31	2.58	8.81
Green economy (F)										
f_co2prod	171	5.84	2.35	1.77	14.91	171	5.84	2.35	1.77	14.91
f_pm25	152	14.49	5.03	5.91	27.11	171	14.34	4.98	5.91	27.11
f_renewables	133	19.49	12.05	3.70	53.10	171	19.82	12.12	3.70	53.10
f_greenhouse_emiss	171	9.68	2.74	5.40	16.70	171	9.68	2.74	5.40	16.70
f_recycle_rate	167	36.94	15.58	4.00	67.30	171	37.03	15.42	4.00	67.30
f_resource_prod	171	1.77	0.80	0.62	4.11	171	1.77	0.80	0.62	4.11
f_mat_capita	171.00	17.23	6.42	8.35	37.35	171.00	17.23	6.42	8.35	37.35
Digital economy (G)										
g_ecoms	169	16.98	7.04	3.00	32.00	171	17.06	7.03	3.00	32.00
g_ecomv	163	16.31	6.96	2.00	37.00	171	16.29	6.84	2.00	37.00
g_egov	171	50.67	20.27	5.00	92.00	171	50.67	20.27	5.00	92.00
g_intaccess	171	79.89	11.98	33.00	98.00	171	79.89	11.98	33.00	98.00
g_intbuy	171	38.43	19.71	2.00	78.00	171	38.43	19.71	2.00	78.00
g_intuse	171	80.64	12.01	40.00	98.00	171	80.64	12.01	40.00	98.00
Innovative capacity (H)										
h_patents	165	0.18	0.18	0.02	0.83	171	0.18	0.18	0.02	0.83
h_design	142	0.05	0.03	0.01	0.20	171	0.05	0.03	0.01	0.20
h_trademarks	147	0.95	0.39	0.41	2.21	171	1.00	0.38	0.41	2.21
h_rdexp	161	1.90	0.90	0.38	3.73	171	1.87	0.90	0.38	3.73
h_vc	151	0.03	0.02	0.00	0.10	171	0.03	0.02	-0.01	0.10
h_rd_personnel	171	1.22	0.50	0.29	2.23	171	1.22	0.50	0.29	2.23
h_hr_sci_tech	171	45.88	9.16	25.10	60.70	171	45.88	9.16	25.10	60.70
h_researchers	136	0.57	0.26	0.13	1.12	171	0.60	0.26	0.13	1.12

Method

Drawing on the conceptual framework and data, an empirical method – principal components analysis (PCA) – is deployed to get a sense of the internal structure of the data, as embodied by the total of 47 variables per each country, and its variance. PCA is a dimensionality-reduction technique often used to decrease the dimensionality of large datasets in an interpretable way. It does so by transforming a large set of variables into a smaller one by creating new uncorrelated linear combinations of the existing variables, the principal components (PCs)[116]. Principal components are the most important features of the dataset: they successively maximize variance (i.e. capture most of the original statistical information), while minimizing interpretation loss, and in such a way facilitate greater interpretability.

As a statistical method it is suitable for our purposes, as it adapts to the dataset at hand, rather than relying on a narrow choice of variables a priori. PCA is a standard statistical technique for pattern recognition and feature identification in a broad pool of information[117], and presents some additional advantages, including efficiently removing correlations between data series (since PCs are independent of one another). This fits well with our aim to distil the key drivers of CEE strategic economic transformation, while getting rid of information duplicities and correlations between variables. By reducing the number of features, it also helps in overcoming overfitting caused by too many variables in a dataset. PCA is applied at the normalized dataset to be able to obtain the resultant principal component loadings.

PCA can be ran on a pooled full country sample (per thematic cluster/sub-index), or at individual country-level (per thematic cluster-sub-index). The advantage of the former approach is that it exploits both within-country and cross-country correlations between variables. However, like pooled Ordinary Least Squares (OLS) estimation, it requires that relationship between variables to be the same in all countries. Otherwise, loadings of variables tend to be distributed across components more broadly. Conversely, the advantage of running PCA on individual country-level (by thematic cluster/sub-index) is the freedom of assumptions, i.e. that it is not required that there be the same linear relationship between variables in all countries. Hence, the latter approach allows for a *priori* country heterogeneity but at the expense of losing some cross-country information content.

Index Computation

As a main approach, **PCA is estimated at individual country-level per thematic cluster/sub-index**. Since in individual countries there is a strong correlation between variables within clusters, most of the variation of the data can be explained by the first component loadings, which are then used to produce weights.

Where entire time series are unavailable for a country (in several cases as reported in Column 10 of Table III, marked with an asterisk), the missing time series are estimated using (1) other available series within the thematic cluster/subindex (if these contain missing values, we firstly interpolate observations using cubic splines); and, (2) a time dummy on a full sample; fitted values are then used to populate the missing time series. A similar method is used to fill in sparsely populated series (for example, government spending on education) and to fill in several series during early years (for example student-to-teacher ratio and academic stuff until 2012).

Reference years, missing data: Once the missing times series are filled in using this method, the index can be calculated across all countries from 2010 to 2018. A nine-year cross-country overlap is sufficient to obtain the index values. Data prior to 2010 are utilized only for data imputations. Missing data are interpolated using cubic splines (for example, for PISA data). Where a data series ends prior to 2018, the last available value is extrapolated to populate the series up to 2018. Once the missing times series/observations are populated using the method as described in the previous paragraph and through interpolation/extrapolation respectively, the index can be calculated across all countries from 2010 to 2018.

Outliers: Before the calculation of the index, standard data cleaning and outlier identification/treatment is performed. Specifically, outliers are identified based on standard deviations of residuals obtained from regressions of each variable on (1) time dummies; and (2) country dummies. If the residual is smaller/greater than 2*stdev, it is identified as an outlier and replaced with fitted value +/- 2*stdev. This method of outlier identification/treatment[118] takes into account deviation from mean conditional on year and country.

116 Jolliffe, I. T., & Cadima, J. (2016). Principal component analysis: a review and recent developments. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 374(2065), 20150202. https://doi.org/10.1098/rsta.2015.0202
117 Lin, T. K. (2019). Adaptive Principal Component Analysis Combined with Feature Extraction-Based Method for Feature Identification in Manufacturing. Journal of Sensors, 2019. https://doi.org/10.1155/2019/5736104
118 Using this method, about 5% of observations per variable are identified as outliers (9 observations per variable on average)

Normalization: Before the application of PCA data is normalized using the full sample. All data variables are treated, so their increase means getting closer to the desired outcome. This results in the following two normalization formulas:

- For the group where 'more is better' (most variables, except group that follows):

  x_norm = (x-min)/(max-min),

  where x is the raw value at a point of time, 'min' is the minimum within the variable series, max is the maximum within variable series.

- For the group where 'less is better'[119]:

  x_norm = (max-x)/(max-min)

  where x is the raw value at a point of time, 'min' is the minimum within the variable series, max is the maximum within variable series

Skewness: Furthermore, variables where skewness is greater than 1 are squared to the power of ½; variables, where skewness is less than -1; are squared to the power of 2.

Weights: PCA is run at a country-level, cluster by cluster. Since in individual countries there is a strong correlation between variables within clusters, most of the variation of the data can be explained by the first component (PC1). To obtain weights for each cluster at country-level, PC1 loading is squared to the power of 2. For example, PCA is ran for Slovak Rep. for cluster 'a' (Openness), calculating weights w_a_SK, for cluster 'b' (External Resilience), calculating weights w_b_SK, for cluster 'c' (Productivity & Value-added), calculating weights w_c_SK etc. The squared loading is the percentage of variance in the variable explained by the principal component.

Index aggregation: Final weights for cluster 'a' are calculated as an arithmetic average of w_a_SK, w_a_CZ, w_a_HU, w_a_PL etc., attaining sti_a. This is done for each of the eight clusters. Final index sti_final is an unweighted average of the 8 thematic sub-indices/clusters.

Final index can be further split into 2 main pillars: *(1) Macroeconomic Structure & Resilience (sti_p1)*; and, *(2) Innovation Economy (sti_p2)*. Sti_p1 is an unweighted average of the first four clusters/sub-indices ('A', 'B', 'C', 'D') and sti_p2 is an unweighted average of the latter four clusters/sub-indices ('E', 'F', 'G', 'H').

Robustness, Sensitivity

We verify the stability of our methodology in three ways. One, by calculating a narrow version of the index only with CEE countries and seeing whether the country rank changes. Two, by calculating the broad index on a pooled sample of all countries, cluster-by-cluster (as opposed to our main approach: running PCA on a country-basis). Three, by estimating PCA on a narrow, pooled sample of CEE countries, cluster-by-cluster.

All alternative approaches produce broadly the same results for CEE, both in terms of relative rankings of CEE countries in 2018 and over time. As shown in Table V, the first principal component (PC1) explains on average 2/3 of data variability at country-level. This is more information content than when PCA is run on a pooled data sample, further substantiating our primary method choice.

Table IV. Data descriptive statistics

	Pooled	Average	SK	CZ	PL	HU	AT	SI	HR	BG	RO	DE	BE	DK	EE	FI	FR	IE	NL	SE	UK
A	0,56	0,61	0,64	0,64	0,60	0,51	0,53	0,79	0,69	0,75	0,85	0,54	0,65	0,66	0,52	0,60	0,62	0,53	0,63	0,43	0,44
B	0,48	0,59	0,42	0,74	0,64	0,70	0,42	0,63	0,60	0,49	0,51	0,72	0,67	0,66	0,70	0,53	0,47	0,58	0,71	0,54	0,54
C	0,64	0,57	0,74	0,63	0,80	0,55	0,51	0,63	0,62	0,56	0,73	0,46	0,52	0,54	0,54	0,42	0,47	0,45	0,54	0,55	0,57
D	0,54	0,64	0,52	0,54	0,70	0,57	0,52	0,62	0,70	0,54	0,45	0,93	0,62	0,60	0,92	0,64	0,69	0,40	0,62	0,80	0,79
E	0,56	0,60	0,53	0,59	0,53	0,65	0,69	0,58	0,58	0,52	0,46	0,64	0,66	0,66	0,54	0,69	0,73	0,55	0,69	0,52	0,50
F	0,33	0,68	0,69	0,81	0,60	0,53	0,74	0,63	0,71	0,61	0,55	0,80	0,76	0,65	0,53	0,60	0,88	0,63	0,78	0,55	0,86
G	0,73	0,78	0,59	0,66	0,84	0,82	0,74	0,82	0,74	0,84	0,69	0,79	0,78	0,86	0,91	0,75	0,90	0,80	0,70	0,75	0,79
H	0,58	0,62	0,49	0,72	0,70	0,62	0,78	0,46	0,69	0,60	0,45	0,62	0,78	0,61	0,45	0,57	0,59	0,51	0,76	0,63	0,73
Average	***0,55***	***0,64***	***0,58***	***0,67***	***0,68***	***0,62***	***0,62***	***0,65***	***0,67***	***0,61***	***0,59***	***0,69***	***0,68***	***0,65***	***0,64***	***0,60***	***0,67***	***0,56***	***0,68***	***0,60***	***0,65***

119 Includes: Terms of trade volatility (B), Herfindahl-Hirschman Product/Market Concentration Index (B), House price-to-income ratio (D), Non-performing loans (D), Long-term interest rate for convergence purposes - 10 years maturity (D), Household debt as a ratio to gross disposable income (D), MFI lending margins to non-financial corporations (D), Adult education: Early leavers (E), Pupil/student-to-teacher ratio (E), Domestic material consumption per capita (F), Air quality: Mean population exposure to PM2.5 (F), and Greenhouse gas emissions (F).

Availability, Comparability & Further Work

The CEE Strategic Transformation Index is updated annually in the run-up to the yearly Tatra Summit, which takes place in the first half of October every year. The cut-off date for the incoming information included in the index is August 30 every year.

Tatra Summit 2020 marks the introduction of the CEE Strategic Transformation Index, and its first vintage. Looking ahead, each vintage will be obtained through the methodology described, by updating the data inputs, including new observations and historical data revisions. Loadings calculated on the current sample will be retained, in order to make the index comparable not only across countries at a given point of time but also to have a meaningful year-on-year comparison. To that end, the same estimations to fill in missing series will be computed on the 2010-2018 sample. Minima, maxima and skewness used to normalize the data will be also calculated using the 2010-2018 sample. Loadings, minima, maxima and skewness are scheduled to be updated in the 2025 release.

Admittedly, the CEE Strategic Transformation Index framework would benefit from a more comprehensive measurement of local entrepreneurship. Here, the concept was limited by international data availability and historical coverage for CEE countries. Authors will monitor the availability of relevant data series going forward and potentially revise the conceptual framework in the future, as relevant data series become available in an adequate coverage across countries and time.

The current CEE Strategic Transformation Index does not replace the usefulness and merit of individual indicators for economic analysis and policy. Individual indicators should continue to be monitored on a perpetual basis, as they provide a more detailed, granular, disaggregated insight into drivers of broader developments across the sub-themes as hereby identified (openness, external resilience, productivity & value-added position, financial structure, education, green and digital transitions and innovative capacity).

7. Conclusions

The Road Ahead for Government

- CEE9, set against the milieu of the European and global economy, is experiencing extraordinary economic developments. The challenges posed by the COVID-19 crisis on trade, value chains, jobs, commerce, and public finances depress confidence and act as a brake on exports, investment, and growth. Developments in CEE9 and elsewhere call for novel initiatives and enhanced coordination to soften the landing for its economies and societies. In these unprecedented times, moreover, **it is important to take stock of where future growth is likely to come from, and how this may be best achieved.**
- STI caters to the plea identified, as a part of the broader quest for sustainable growth paradigm. **The leads provided by the index highlight the recurring themes** and corresponding implications for government action, both, in terms of scope and means. The report specifically highlights that progress is overdue in the following areas:
  - **Continued progress on the education dossier:** STI shows that all CEE9 countries can benefit from upskilling, lifelong learning and education upgrades to align outcomes with the needs of labour markets of tomorrow, supporting economy's productivity, the move towards higher value-added, and propping up the digital transformation. The report indicates that numerous education and upskilling aspects – including access, quality, and funding – can be improved
  - **Progress towards higher value-added activities:** requires pinpointing strategic industries based on economy-specific strengths and existing productive capacities, where headway can be feasibly achieved. For many CEE9 economies, this will mean move to advanced/knowledge-intensive manufacturing, for others, upgrading services (such as tourism), or moving towards more advanced services (professional and business services)
  - **Addressing vulnerabilities in a turbulent world:** in the mostly open, export-oriented CEE9 economies, export profile diversification, recipient markets and export product sophistication can be further improved and act as a valuable coping strategy against external disruptions. On the financial front, monitoring and addressing risks (such as household debt, non-performing loans in the banking sector, and housing

market bubbles) will safeguard the relatively sound financial structure and resilience

- **Tackling the laggard innovation performance:** in addition to education, the capability to innovate, including outcomes, access to funding for new business ventures, and R&D capabilities and staff, can be improved by a large margin. Country-tailored innovation strategy formulation drawing of country strengths in liaison with the private sector and other key stakeholders is key to escape the middle-income trap
- **Making green and digital transitions a necessary part of the CEE9 growth paradigm, and the means to an end:** easy productivity gains can be reaped from adopting existing and new digital technologies across private and public domains. Transition to the green economy cannot be postponed indefinitely and the time to act is now. The intense rescue efforts in response to the coronavirus pandemic and policy impetus created should be harnessed to make green growth a part of CEE9's growth narrative. Swift action on the green agenda and towards the low-carbon economy in conjunction with innovation can lift the regional economies to the forefront of emerging green enterprises, industries, and green industry clusters responding to climate change

- In addition, while the time to act is now, **kickstarting a transformation requires time.** Allowing adequate time for policies to work and creating long-lasting structures to support stable delivery is key. Trade-offs/short-term sacrifices may be inevitable in catalysing an enduring change. Many policy decisions in the right direction will not immediately show up in traditional measures of economic success, such as GDP growth and employment . To jump on the transition bandwagon for all key actors and win the broad support necessary for a successful transition, raising awareness, with a full understanding of the long-term strategy and benefits for well-being and prosperity is key. The narrative should be packaged 'right': understandably, transparently, and attractively.
- **Igniting a transformation requires concerted action.** The policy solutions should benefit from collaborative, strategic partnerships with the private sector and other key actors to deliver anticipated market outcomes. Governments must think beyond the traditional top-down policymaking, in favour of mission-oriented policymaking, capitalizing on the cross-overs of the public and private domains to design solutions that work under real-life conditions in an ever-complex, and still new post-COVID-19 terrain.
- It is becoming increasingly obvious that **policy ends cannot be pursued in isolation**, as a part of secluded portfolios. Rather, to be successful, economic, environmental, and social goals must be pursued together, as a part of integrated, wholesome strategic policy agenda that is inter-disciplinary, sustainable, inclusive, and targeting incentives and motivations of key economic actors.
- **Kickstarting a deep transformation requires long-term leadership and commitment.** Governments should play a balancing role, levelling the playing field in terms of access to opportunity, harmonizing policy formulation in terms risks and opportunities, and making sure incentives of all key involved actors are aligned. This also involves facing spillover effects and policy externalities, both, deliberate and unintentional, of economic policies beyond the direct goals they pursue.

The Road Ahead for Business

- Businesses are counting on greater clarity from the government on its long-term approach to supporting business in difficult economic times. But **the ambitious policy agenda must be propelled from the ground-up**, through both, proactive role in formulating policy solutions, and strategic business action. A lasting change can be achieved but an upgrade of business practices is essential to this end
- **It is necessary to take the lead** in actively **shaping prevailing model of capitalism in the region**. While governments are to create enabling policy context, businesses must drive the underlying change. Commitment to sustainability, modernization, greater productivity through existing and new digital technologies, and resilient business models must be demonstrated in daily economic transactions and interactions of key actors
- **To work to balance profits with purpose**, promote equality practices in organizational structures, entrench sustainability as a part of a business strategy, instil trust and help positively shape and grow consumer bases.
- **Joining forces on new approaches to improving** (traditionally) **public ends is needed,** such as enhanced education outcomes, articulating a new approach to jointly financing such efforts between the public and private sector. There is a business case as companies today face sizeable risks from system challenges
- **Collaborative approaches are important also in the competitive marketplace**. A strategic change can be better facilitated through liaisons and collaborations at sectoral-industry-/levels of the economy
- **Enduring alliances created by key economic actors around same goals may be key** to carrying the momentum of a strategic economic transformation, where political commitment/leadership is diluted

How to Get Involved

To learn more about the CEE Strategic Transformation Index and engage with the Tatra Summit Platform work please refer to the following website:

https://www.globsec.org/publications/tatra-summit-report-2020/

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