

ECONOMICS – REGIONAL STUDIES

Innovation investment in Central, Eastern and South-Eastern Europe:

Building future prosperity and setting the ground
for sustainable upward convergence



**European
Investment
Bank**



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EIB Regional study

December 2018

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1. Introduction

Long-term inclusive economic growth and social prosperity relies on the ability of an economy to sustain high levels of productivity growth while ensuring a broad-base distribution of the benefits. As economies become larger, the creation and diffusion of innovation become the main drivers of continued prosperity.

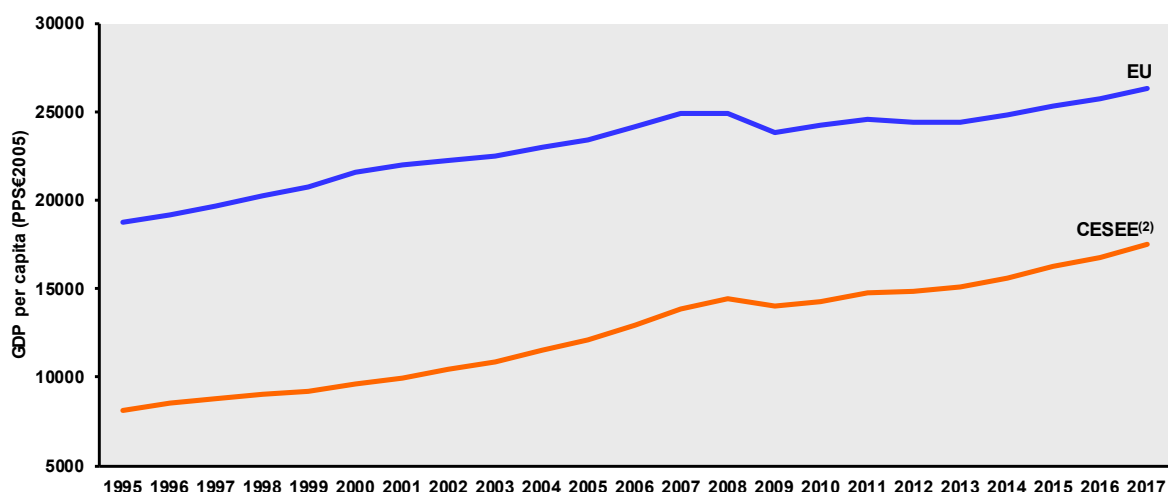
The rise of digital technologies, such as Artificial Intelligence or the Internet of Things, and their increasing convergence with the physical world has brought about rapid and deep changes in the way innovation is created and diffused, redefining entire industries. This process of deep and rapid transformation is expected to accelerate.

This paper investigates the role that innovation plays in Central, East and South East Europe (CESEE), analysing the innovation performance and investment efforts in innovation in different countries of the region, as well as describing their innovation profiles based on the type of innovation activities they predominately carry out. Building on firm-level data of the EIB Investment Survey (EIBIS) and complementing them with other data sources, the paper dives deeper in analysing the financing conditions of investment in innovation as a key driver that may explain differences in investment patterns compared to the rest of the European Union (EU).

2. A new innovation-driven growth model to sustain long-term economic and social prosperity in Central, East and South East Europe

In the past two decades, rapid economic growth in the CESEE region has enabled a process of economic convergence towards the EU average. In 1995, GDP per capita (in PPS at 2005 prices) in CESEE was at EUR 8,150, which represented around 43% of the EU average. In 2017, GDP per capita rose to EUR 17,550 or 66% of the EU average (Figure 1).

Figure 1 Evolution of real GDP per capita⁽¹⁾, 1995-2017



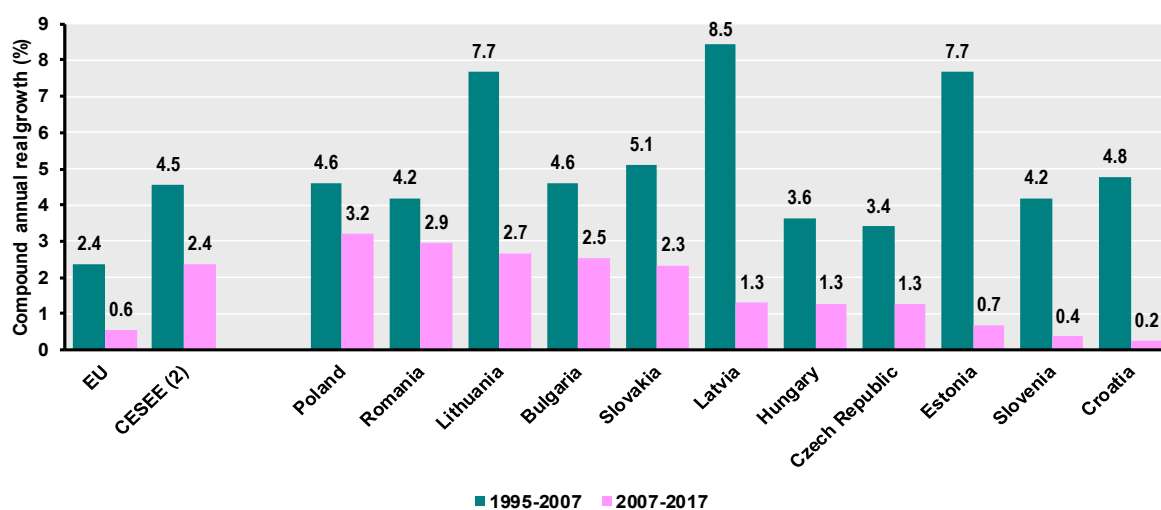
Source: European Commission - DG Research and Innovation

Data: DG Economic and Financial Affairs

Notes: ⁽¹⁾GDP per head of population in PPSE at 2005 prices and exchange rates. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

The convergence process within the EU has been mainly driven by faster economic growth in the CESEE region in the 1990s and early 2000s, although it has slightly slowed down in the past ten years. While convergence towards the EU has been somewhat heterogeneous across the countries of the region, growth in CESEE has outpaced the EU average since the beginning of the 1990s (Figure 2). Nevertheless, the income gap persists as GDP per capita in the region ranges from 49% to 89% of the EU average. The speed of convergence has started to slow down after 2007, notably in countries like Croatia and Slovenia that were severely hit by the global economic and financial crisis. Estonia, the Czech Republic, Hungary and Latvia also experienced sharp decreases in real GDP growth rates in the past decade.

Figure 2 GDP per capita⁽¹⁾ - compound annual real growth (%), 1995-2007 and 2007-2017



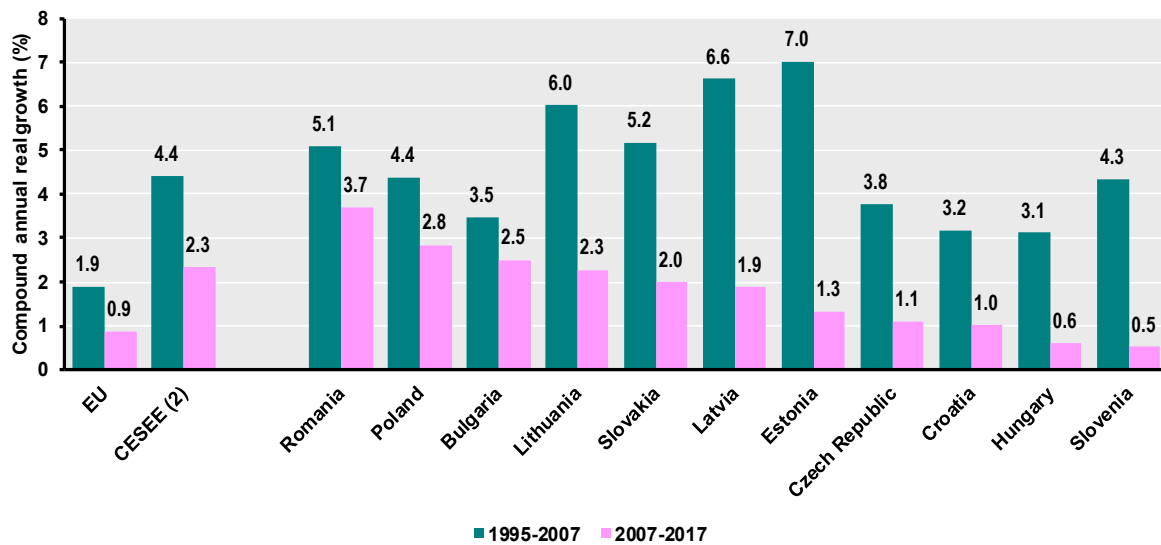
Source: European Commission - DG Research and Innovation

Data: DG Economic and Financial Affairs

Notes: ⁽¹⁾GDP per head of population in PPSE at 2005 prices and exchange rates. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK

Lower productivity growth in the past ten years, notably in some CESEE countries, explains the slowdown in the convergence process. The growth rate of labour productivity was higher in the CESEE region than in the EU over the past two decades (Figure 3). However, since the onset of the global financial and economic crises, several countries in the region have experienced low levels of labour productivity growth – in some cases, such as Slovenia and Hungary, labour productivity growth was even lower than the EU average.

Figure 3 Labour productivity (GDP per hour worked⁽¹⁾) – compound annual real growth (%), 1995-2007 and 2007-2017



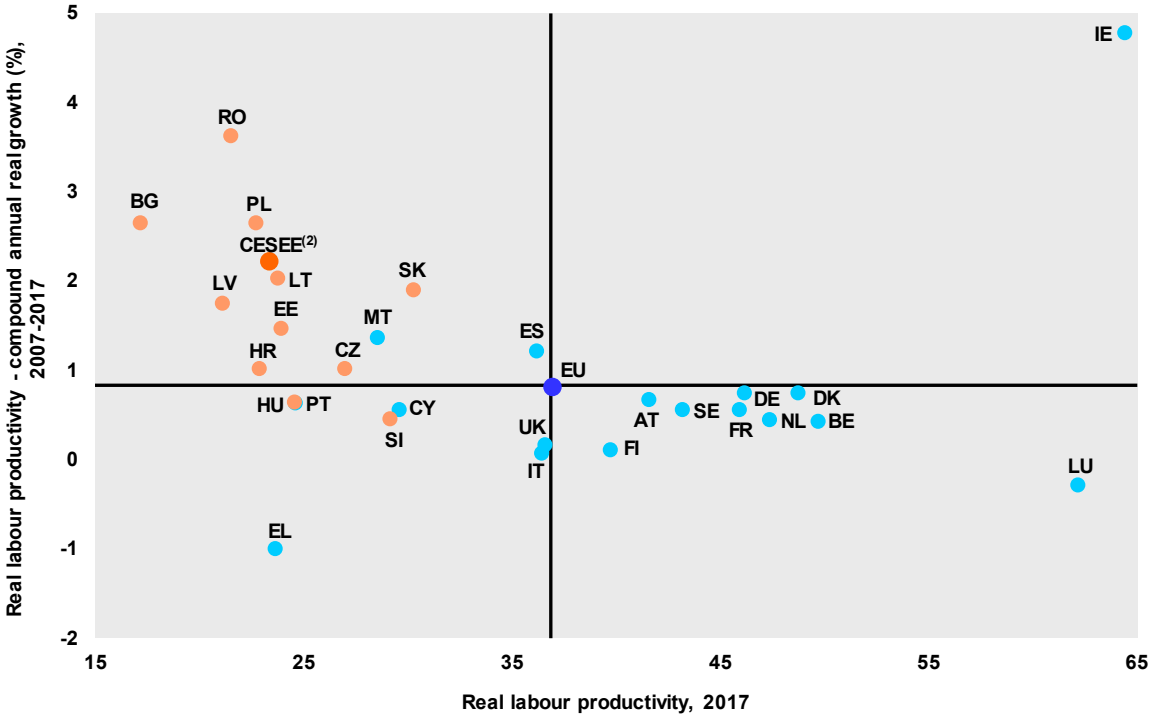
Source: European Commission - DG Research and Innovation

Data: DG Economic and Financial Affairs

Notes: ⁽¹⁾GDP per hour worked in PPS€ at 2010 prices and exchange rates. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Labour productivity growth has been stronger in those countries that have traditionally lagged behind. But all CESEE Member States show levels of labour productivity that remain below the EU average (Figure 4). Within the region, there is a tendency for stronger growth rates in countries that started from lower levels, such as Romania or Bulgaria, reflecting the convergence process. At the same time, the countries with higher levels of labour productivity have experienced stagnation in terms of growth, notably Czech Republic, Slovenia and Hungary.

Figure 4 Real labour productivity (GDP per hour worked⁽¹⁾), 2017 and compound annual real growth, 2007-2017



Source: European Commission - DG Research and Innovation

Data: DG Economic and Financial Affairs

Notes: ⁽¹⁾GDP per hour worked in PPS€ at 2010 prices and exchange rates. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Lower labour productivity growth rates reflect the stagnation, or even the fall, in Total Factor Productivity (TFP) growth in the past decade. Economic growth and social prosperity rely on the ability of an economy to mobilise all available resources while boosting productivity growth. Total Factor Productivity is arguably the best predictor for long-term economic growth and reflects the overall efficiency and ability of an economy to work more smartly and produce higher value added products and services. Several CESEE countries have significantly improved their TFP growth over time, including Slovakia, Latvia and Romania, but others, such as Lithuania, Estonia, Croatia and Hungary have had flat or even negative TFP growth rates (Figure 5). As a result, the CESEE region overall has managed to achieve only modest improvements in TFP growth performance over the past decade.

Figure 5 Total factor productivity – compound annual growth (%), 1995-2007 and 2007-2017



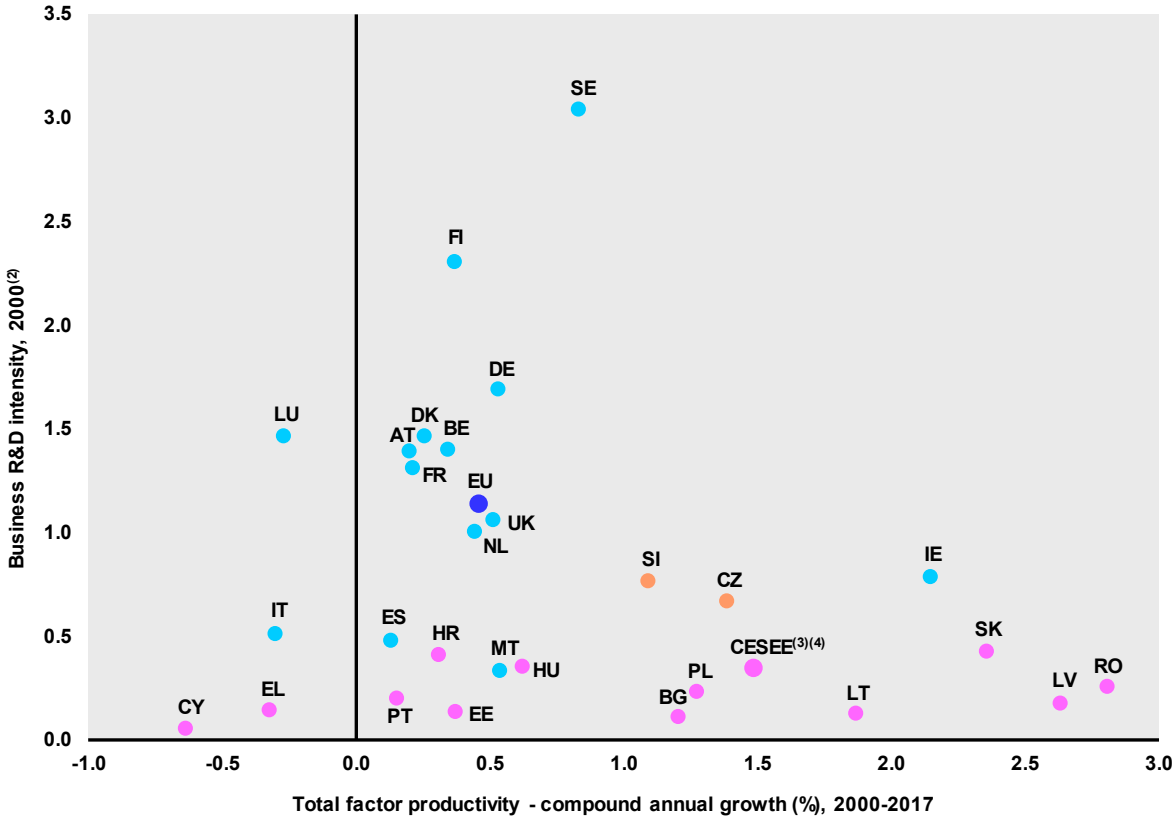
Source: European Commission - DG Research and Innovation

Data: DG Economic and Financial Affairs

Notes: ⁽¹⁾CESEE was estimated by DG Research and Innovation. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

For high-prosperity economies, boosting TFP growth is closely associated with the ability to foster innovation creation and diffusion. There are many factors that can explain TFP growth such as the functioning of institutions, the rule of law, better infrastructure, high levels of education; and it is difficult to map the contribution of all these factors. For high-income countries, however, the main driver for TFP growth is typically the level of technological advancement and innovation. Business enterprise R&D (BERD), as a proxy for innovation capacity, is highly correlated with TFP growth for high-income countries, whose prosperity rely on the ability to innovate (Figure 6). However, there is no direct relationship for lower and middle-income countries, as productivity growth can be mainly driven by other sources, such as improvements in the business environment.

Figure 6 Total factor productivity – compound annual growth, 2000-2017 and business R&D intensity, 2000⁽¹⁾



Source: European Commission - DG Research and Innovation

Data: Eurostat, DG Economic and Financial Affairs

Notes: ⁽¹⁾Countries in pink had a GDP per head of population of less than 25000 PPS€ (current) in 2017. All other countries had a GDP per head of population of more than 25000 PPS€ (current) in 2017. ⁽²⁾SE: 2001; HR, AT: 2002; MT: 2004. ⁽³⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK. ⁽⁴⁾Total factor productivity - compound annual growth (%), 2000-2017 was estimated by DG Research and Innovation.

As many economies in the CESEE approach higher levels of prosperity, avoiding a middle-income trap will require a new growth model based on innovation. This growth model will need to be based on new innovation activities that move beyond the traditional drivers of economic growth in the region since the beginning of the 1990s.

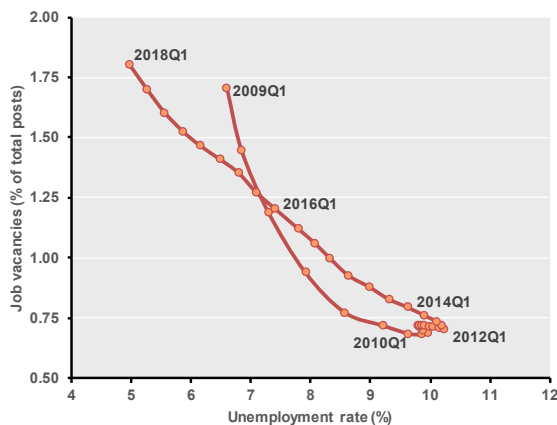
BOX 1: Reflections on the past growth model in the CESEE countries

Having relied mainly on external funding to support investment, the crisis brought a change in the financing environment for the countries in CESEE. Prior to the crisis, countries in CESEE enjoyed significant capital inflows, with FDI being the most important component. Large net capital inflows allowed economies to significantly increase current consumption and sustain investment. After the financial crisis, capital flows to the region collapsed and have remained at a lower level. The largest decline came from inward FDI, but large foreign

banking groups also changed their strategies for the region and reduced cross-border lending.

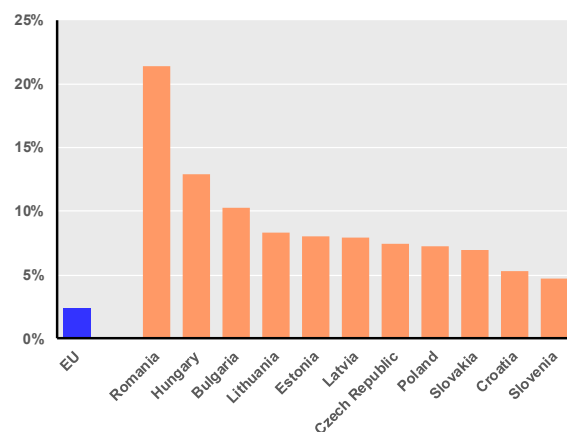
Hitherto a large untapped potential, the labour force has become a key constraint to investment and growth. Before the crisis, the combination of low wages and a skilled labour force attracted foreign investment into the region. This was an important source of growth: new investments supported employment by either channelling those who were inactive back into the labour force, or providing high-productivity jobs to those already employed in outdated production facilities. However, the situation has reversed in recent years due to structural and demographic factors, such as rapid ageing, strong outward migration, and below-average healthy life expectancy. Combining these factors with the effects of the cyclical upturn have made for tight labour markets in CESEE. This is reflected in low unemployment, high job vacancy rate, and wages rising well above the EU average (Figures A and B). There is increasing evidence of labour shortages both in high-skilled and low-skilled categories, acting as a constraint on private investment and economic growth.

Figure A CESEE⁽¹⁾ – unemployment and job vacancies⁽²⁾ - beveridge curve



Source: EIB
 Data: Eurostat and authors' calculations.
 Notes: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK. ⁽²⁾Job vacancy rates and unemployment rates are averages of the preceding 4 quarters.

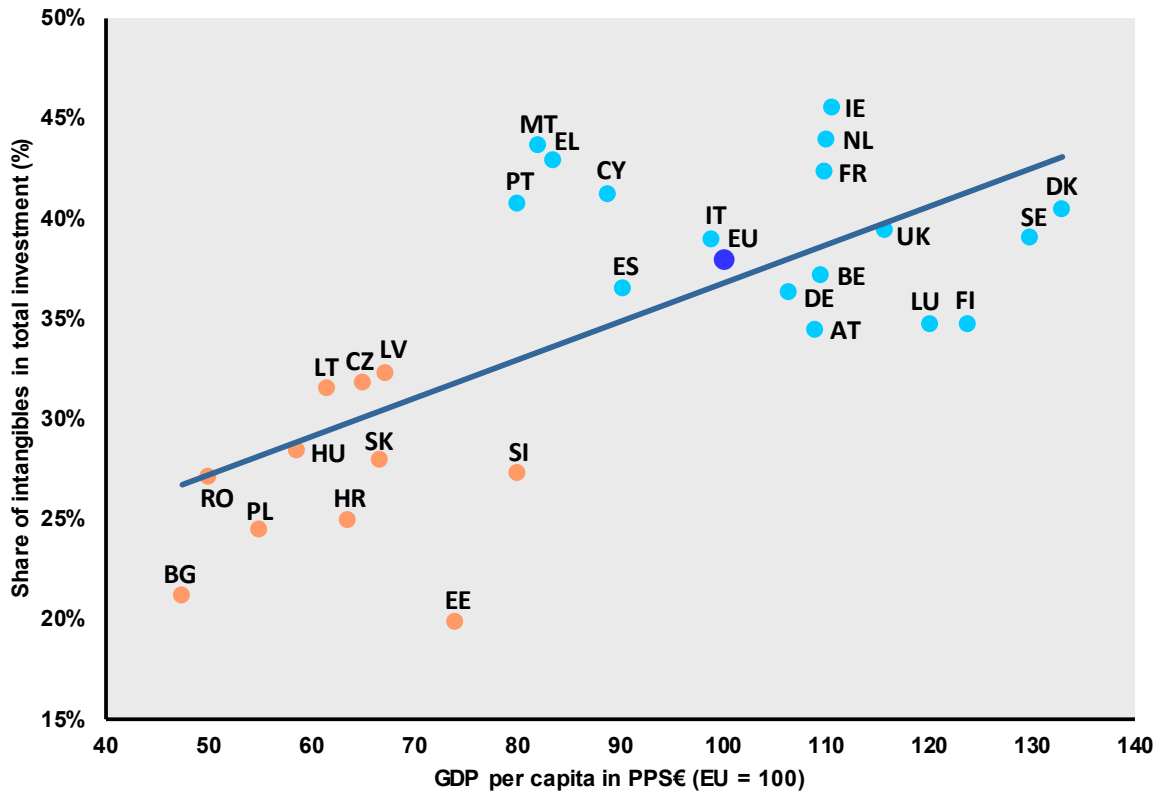
Figure B CESEE⁽¹⁾ – Annual wage growth, 2018 - first quarter⁽²⁾



Source: EIB
 Data: Eurostat
 Notes: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK. ⁽²⁾Average wage growth of the preceding 4 quarters.

Productivity growth has declined, partly due to lower inflows of new FDI, but possibly also because of lower efficiency gains associated with additional FDI. Before the crisis, TFP growth was high, stemming from the combination of a local, skilled labour force with capital and technology imported from abroad. The pace of technological change slowed down after the crisis. One possible reason is the productivity improvement itself, which could lower the extra productivity gains for any additional FDI. The other possible mechanism is the slowdown of FDI due to the crisis or any other exogenous reason. In any case, so far technology importation has not been substituted with home-grown innovation (see Figure C).

Figure C Correlation between GDP per capita and share (%) of intangible investment in total investment, 2017



Source: EIB

Data: EIB Investment Survey, Eurostat

Investment in the CESEE region appears to be below the level necessary for economic convergence towards the most advanced EU economies. Public investment has been maintained at relatively high levels due to the inflows of EU funds. However, in the face of financial and labour market constraints, private investment in CESEE has been sluggish. In the last decade, investment activity has been below the levels experienced in countries that successfully graduated from middle-income to high-income status in the past.

In the light of these developments, a prospective “new growth model” is emerging as a candidate to be the driving force of the region’s economic convergence for the coming years. Such a model has been put forward by various policy analyses and recommendations in the past years.¹ Although the recommendations differ in the details, the common

¹ See for example Piatkowski (2014), Bubbico et al. (2017), and EBRD (2017).

elements generally include an emphasis on home-grown innovation, policies to maintain and strengthen the skilled labour force, stronger reliance on domestic savings, and the development of public infrastructure using EU funds.

A stronger role for home-grown innovation to increase productivity is a key element of the new growth model for the region. CESEE economies already have strong manufacturing bases, well integrated into Western European production chains. This is particularly the case for the automotive industry, where all the major producers have large-scale production facilities in the region. Building on the existing manufacturing base and the surrounding local chain of suppliers is a starting point for CESEE economies to move upwards on the value chain. While technology importation will still have a place in helping to close the productivity gap, a gradually increasing role for local innovation, together with an increase in tradable services (in addition to industrial production) is necessary to maintain economic convergence.

To foster an innovation-based economy, preservation and development of the productive labour force is crucial. A growth model based on skills can only be successful when supported by policies that enable a reversal of the brain drain, and help to preserve and develop a skilled labour force. Education and training plays a key role, and there is much room for improvement in the CESEE economies in this respect.

Economic growth should also be supported by a system of financial intermediation that supports domestic savings. While the region will continue to be a strong potential target for capital inflows, domestic savings should play an increasing role, by providing a stable source of local currency funding that supports investment. In addition, the efficient use of structural funds will help close the gaps in infrastructure. There are several areas where significant gaps exist in infrastructure, including transport, energy, and digital infrastructure. EU funds are a one-off opportunity to lay the foundations for the development of these capacities and necessary enabling factors. Against this background, an understanding of the role of innovation creation and uptake in the CESEE region becomes crucial in determining future sustainability and the direction of economic prosperity.

3. Innovation performance and innovation investment in CESEE

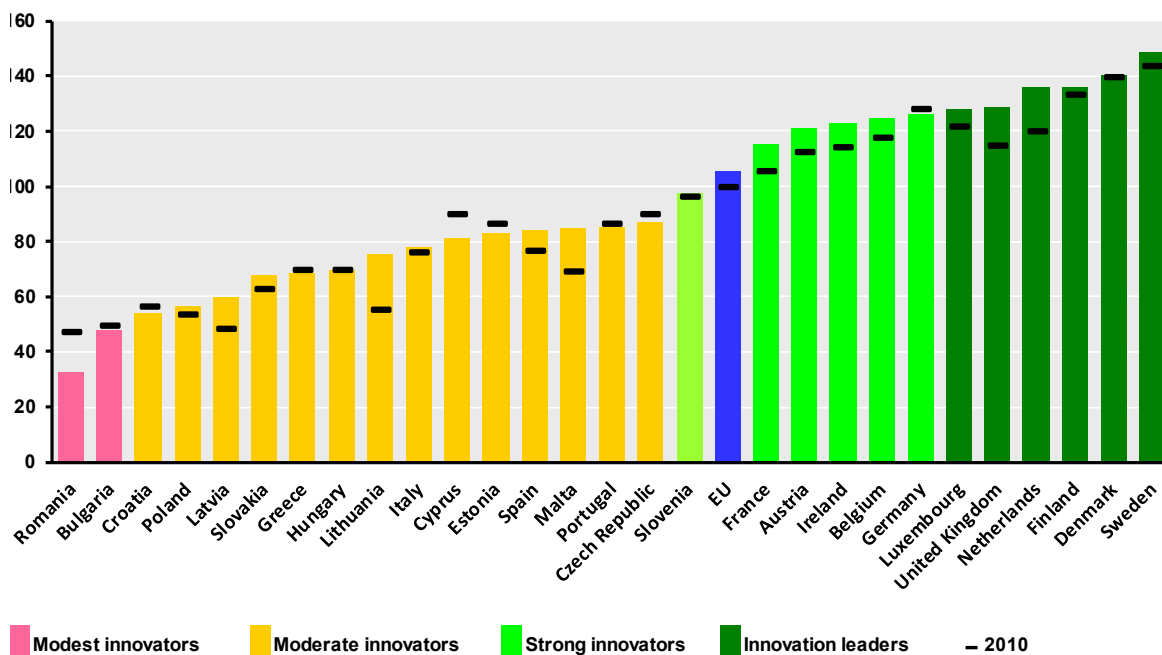
Most countries in the CESEE region are regarded as modest or moderate innovators. The European Innovation Scoreboard² (EIS) is a ranking released on an annual basis which provides a comparative analysis of innovation performance across EU Member States (Figure 7). With

² http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

the exception of Slovenia – a “Strong innovator”-, all of the other CESEE countries fall under the categories of “Moderate innovators” (Czech Republic, Estonia, Lithuania, Slovakia, Hungary, Latvia, Poland, Croatia), or “Modest innovators” (Bulgaria and Romania).

There is substantial heterogeneity in the evolution of innovation performance across CESEE countries. Some countries – such as Lithuania, Slovakia and Latvia – have increased their innovation capacities, while in others – including Slovenia, Poland, Croatia and Bulgaria – innovation performance has stagnated. According to the EIS, innovation performance has decreased between 2010 and 2017 in the Czech Republic, Estonia, Hungary and Romania.

Figure 7 Innovation performance, 2017



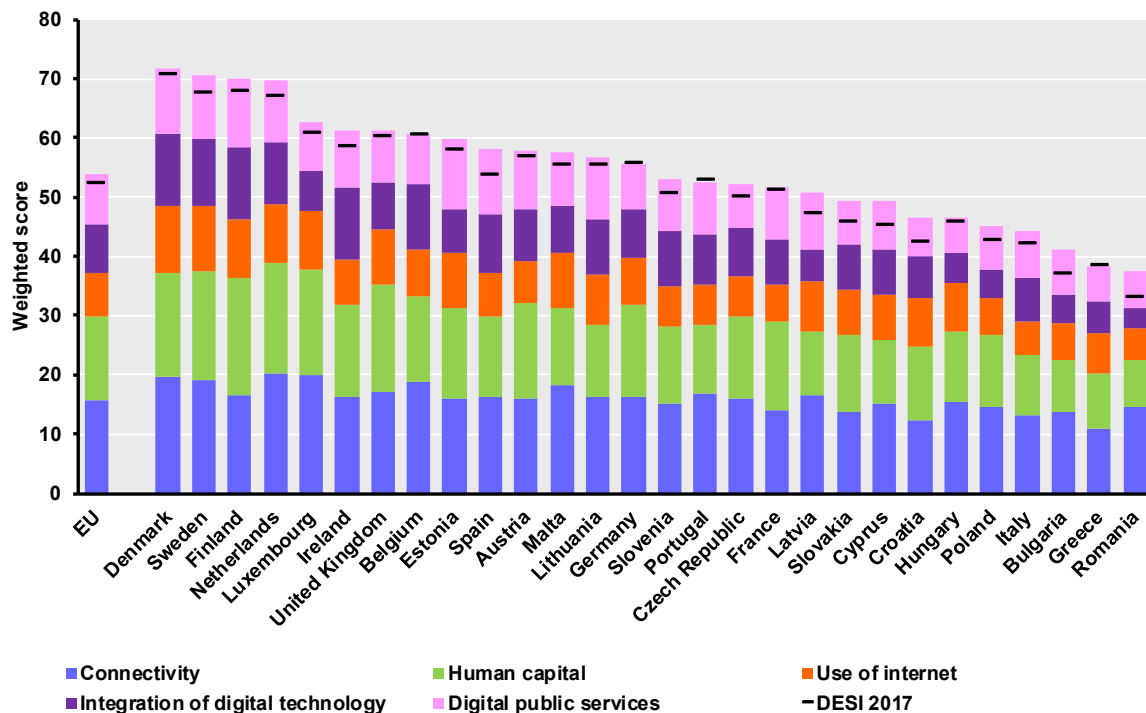
Source: European Commission - DG Research and Innovation
Data: EIS 2018

The level of digital readiness varies across the region, but with only few countries performing above the EU average. Digital technologies are increasingly becoming innovation drivers. The impacts and dynamics of innovation are changing with the rise and convergence of digital technologies with the physical world: understanding the level of technological readiness is thus a prerequisite to understanding the innovation capacity of an economy. Despite cross-country disparities, the CESEE region has made some progress towards increasing digital capacity and performance. When assessing the performance of CESEE in the Digital Economy and Society Index³ (DESI) in 2018, Estonia is the top digital performer of the region and stands out as having a top performance in “digital public services” in the EU context (Figure 8). Lithuania is also a top performer when it comes to the “connectivity” dimension.

³ <https://ec.europa.eu/digital-single-market/en/desi>

However, most CESEE countries still lag behind in digital competitiveness – Bulgaria and Romania are at the bottom of the DESI.

Figure 8 Digital Economy and Society Index (DESI)⁽¹⁾ by main dimension, 2018 (and total for 2017)



Source: European Commission - DG Research and Innovation

Data: European Commission, Digital Scoreboard 2017

Note: ⁽¹⁾The Digital Economy and Society Index (DESI) is a composite index that tracks the evolution of digital competitiveness.

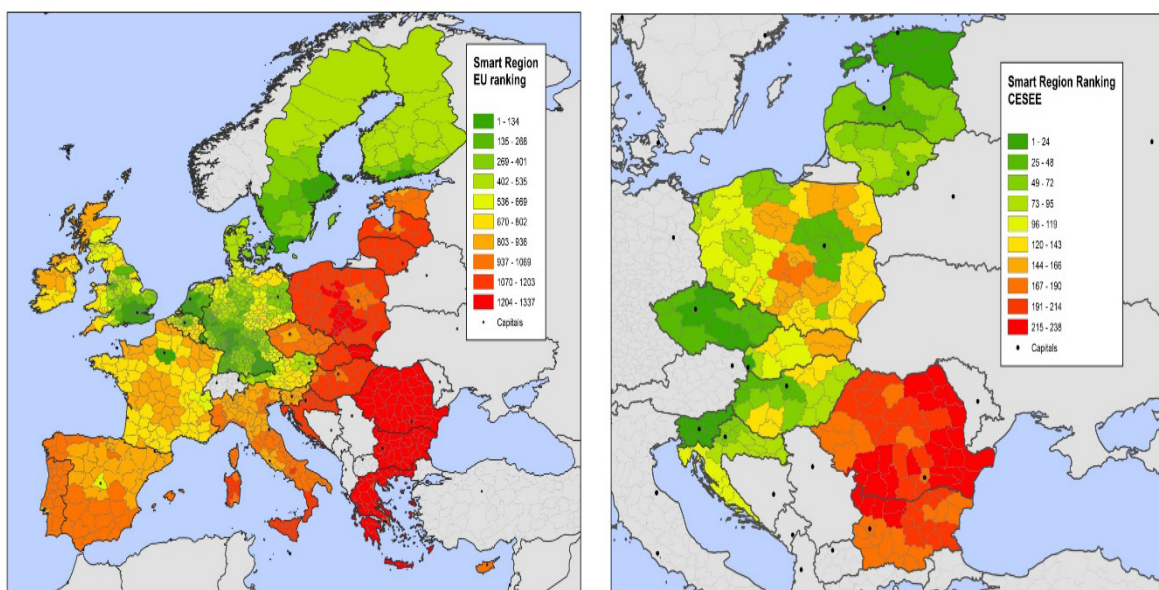
The index is the average of the five main dimensions: connectivity, human capital, uses of internet, integration of digital technology, and digital public services.

At the regional level, the innovation gap is also significant. Based on the Smart Regions Index, the CESEE regions and cities lag behind their EU peers. The index developed by Kollar, Bubbico and Arsalides (2018)⁴ shows a significant divide in the smartness footprint for Europe (see Map 1). In the CESEE, the regions registering the highest smart scores are located in Slovenia, the Czech Republic and Estonia. In most CESEE economies, the capital regions

⁴ Kollar, Bubbico, and Arsalides (2018) divide the concept of “smart” into six pillars : Smart Economy, Smart Governance, Smart Mobility, Smart Society, Smart Living and Smart Environment. Smart Economy comprises variables affecting competitiveness, for instance, innovation performance, degree of entrepreneurship, trademark applications and technological utilisation by firms. Smart Environment is defined by variables explaining clean environmental procedures, the amount of pollution and environmental resource management. The Governance pillar includes indicators explaining the quality of services and the strength of regulations and administration procedures. Smart Living captures the fundamental aspects of quality of life such as Internet use, cultural factors, health conditions and the level of safety in a region. Additionally, when it comes to the variables that define Smart Mobility, both local and international accessibility factors were taken into consideration. Finally, the Society pillar includes variables explaining the citizens’ level of education, creativity and the quality of employment in the region. See the reference for more details.

register the highest smartness score, and a large divide exists between them and the rest of the country. Aggregating the common strengths and weaknesses of the CESEE region, the smartness gap between the CESEE countries and the rest of the EU shows that CESEE regions and cities lag the rest of the EU in all areas. Focusing on the individual components of the index, the gaps are largest in Smart Living, Smart Governance, Smart Economy and Smart Mobility.

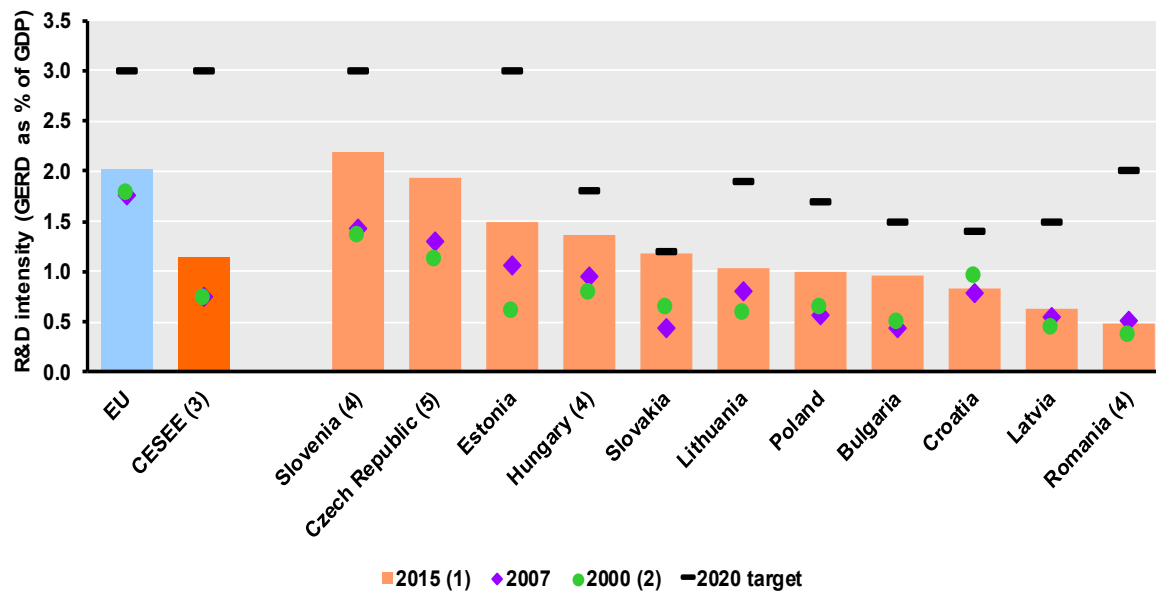
Map 1 – Smart regions (EU rankings and within CESEE rankings, NUTS 3 regions)



Source: Kollar, Bubbico, Arsalides (2018).

One of the crucial reasons for the low innovation performance in the CESEE region is low investment in intangible assets, such as R&D. As the rest of the EU, CESEE countries are not making sufficient strides to improve their R&D investment and continue to lag significantly behind. R&D intensity in the CESEE region remains significantly below the EU average, with the exception of Slovenia (Figure 9). However, with the exception of Romania, Latvia and Croatia, all the other CESEE countries show some signs of progress in increasing their R&D intensities, particularly after 2007.

Figure 9 R&D intensity 2000, 2007, 2015 and 2020 target



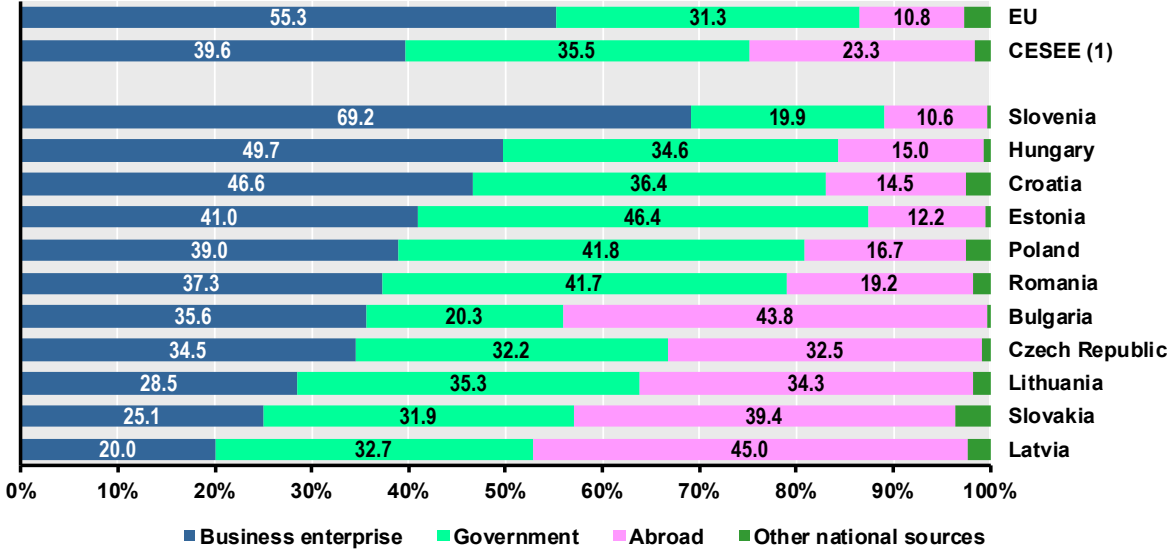
Source: European Commission - DG Research and Innovation

Data: Eurostat, Member States

Notes: ⁽¹⁾EU: 2016. ⁽²⁾HR: 2002. ⁽³⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK. ⁽⁴⁾HR: 2002. ⁽⁴⁾HU, RO, SI: Breaks in series occur between 2000 and 2015. ⁽⁵⁾CZ: An R&D intensity target for 2020 is not available.

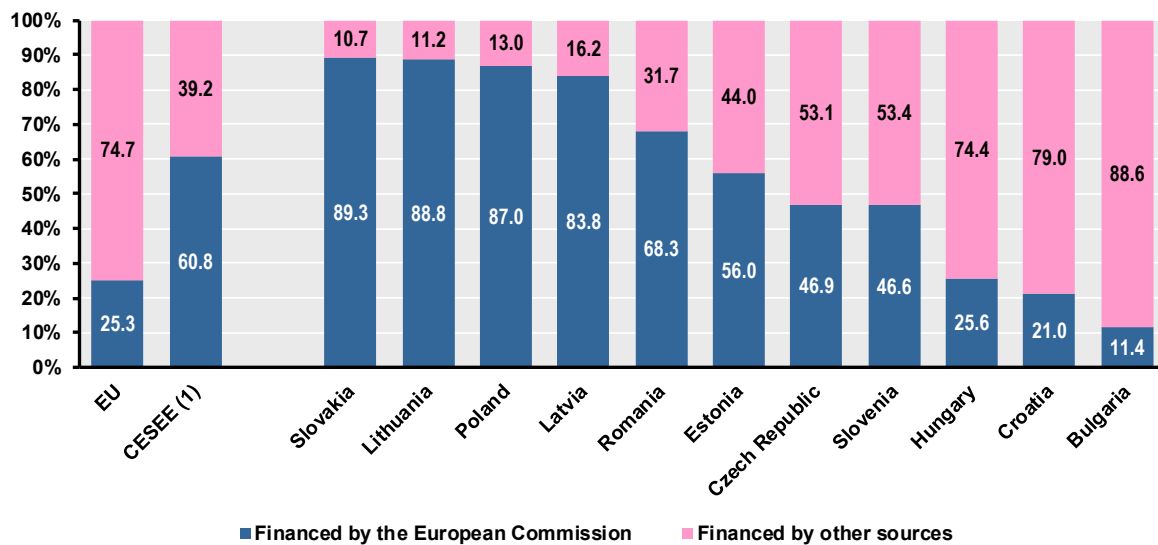
A decomposition of R&D investment by sector shows large differences between the EU and the CESEE region as well as across countries within the region. Private R&D investment plays a lower role in CESEE than on average in the rest of the EU, and foreign financing and public R&D play a much stronger role, notably in certain countries where they account for the vast majority of R&D investment (Figure 10). Compared to the EU average, the CESEE region relies more heavily on government financing and financing from abroad. This reflects, on the one hand, the importance of intra-group financing of R&D due to a large presence of multinationals based in the region, and, on the other hand, the importance of European funding (e.g. the European Structural and Investment Funds) in the financing of much of domestic R&D investment. However, there is substantial heterogeneity within the region. In Slovenia, for instance, almost 70% of R&D is financed by the private sector. At the other extreme, only 20% of R&D is financed by business enterprises in Latvia, and almost half of R&D is financed from abroad.

Figure 10 Decomposition of gross domestic expenditure on R&D (GERD) by sector of funding (%), 2015



Source: European Commission - DG Research and Innovation
 Data: Eurostat
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

The importance of R&D financing from abroad reflects the importance of the European Structural and Investment Funds and the role of foreign investors in boosting R&D investment. Looking specifically into the sources of R&D expenditure financed from abroad, the role of the European Structural and Investment Funds, as the main source of EU R&D funding in the region, becomes evident: 61% of all funding coming from abroad is from the European Commission funds, in comparison to 25% for the EU average (Figure 11). However, in countries with a strong presence of manufacturing Foreign Direct investment such as the Czech Republic, Slovenia and Hungary, foreign investment is the primary source of R&D investment from abroad.

Figure 11 R&D expenditure financed from abroad, 2015


Source: European Commission - DG Research and Innovation

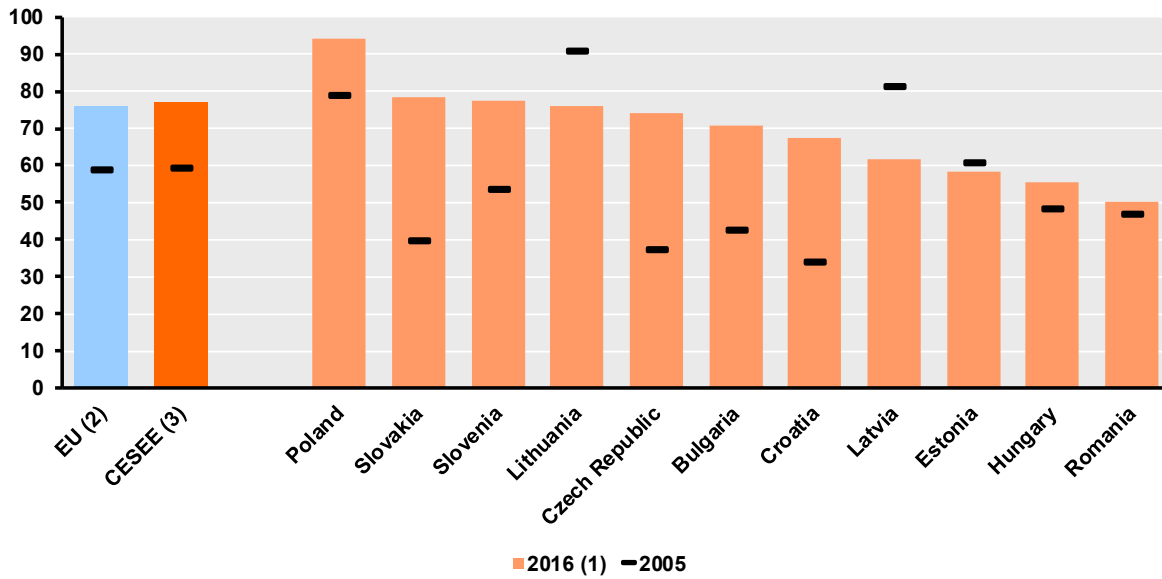
Data: Eurostat

Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Another innovation bottleneck is the availability of workers with the right skills. While the share of new university graduates in the CESEE region has been similar to or above the EU average over the past decade, there has been a sharp decline in the past few years, a decline that accentuates skills gaps and shortages in the region.⁵ The CESEE region has made considerable progress regarding the number of tertiary graduates per 1000 population aged 20-29 (Figure 12). In fact, the CESEE region slightly outperforms the EU average and tertiary attainment has increased considerably between 2005 and 2016. Poland stands out as the country with the highest number of tertiary graduates per thousand population in 2016, above both the EU average and the average for the CESEE region. All CESEE countries registered faster declines in university students between 2013 and 2016 than the EU average due to weak demographics since the 1990s, which have exacerbated the skills challenge in the region (Figure 13). This decrease was most pronounced in Hungary, Lithuania and Poland.

⁵ The importance of the skills gap as a bottleneck for innovation is also analysed in section 3 of this paper using the results of the European Investment Bank Investment Survey (EIBIS).

Figure 12 New graduates from tertiary education per thousand population aged 20-29, 2005 and 2016

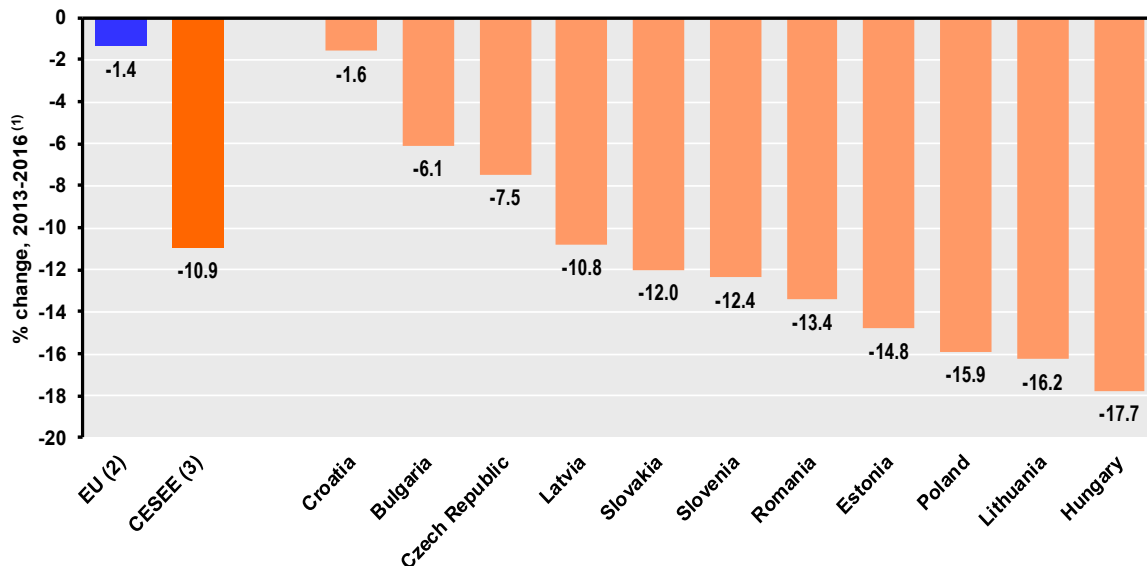


Source: European Commission - DG Research and Innovation

Data: Eurostat

Notes: ⁽¹⁾CZ, EE, SI, SK, CESEE, EU: 2015. ⁽²⁾EU: LU is not included in 2005; EL is not included in 2015. ⁽³⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Figure 13 % change in the number of university students between 2013 and 2016⁽¹⁾



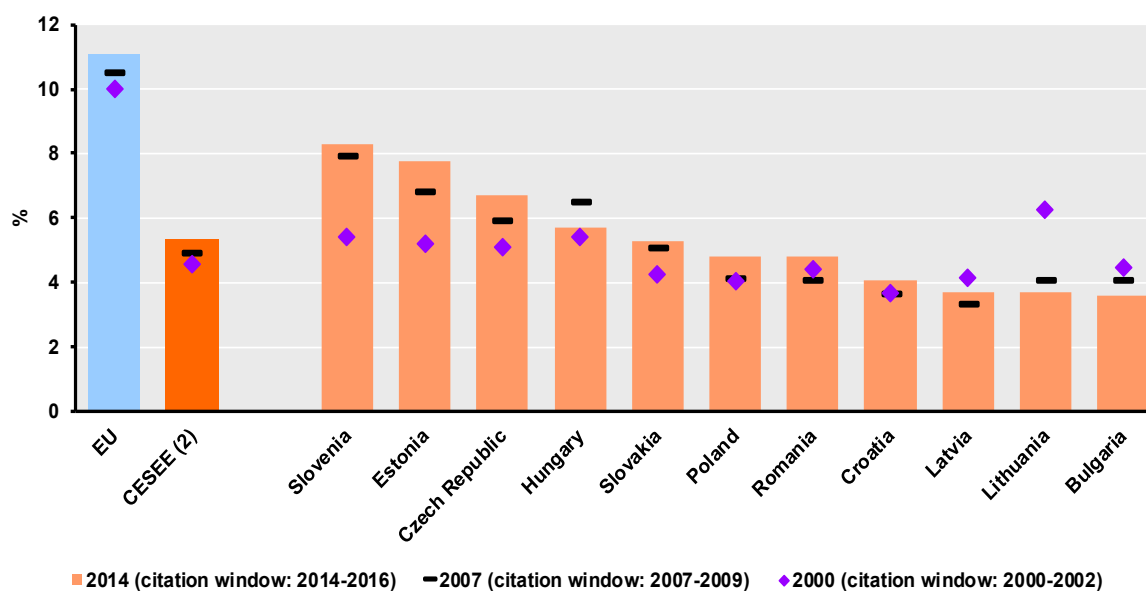
Source: European Commission - DG Research and Innovation

Data: Eurostat

Notes: ⁽¹⁾CZ, SK, SI, EE, CESEE, EU: 2013-2015. ⁽²⁾EU does not include LU and NL. ⁽³⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

The low overall quality of the scientific and technological system also hinders stronger innovation performance. In terms of turning R&D investment into scientific excellence, CESEE countries lag significantly behind the EU average – for instance with regard to the share of national scientific publications within the top 10% most highly cited scientific publications (Figure 14). Although there has been significant progress in recent years in some countries (such as Slovenia and the Czech Republic), there is no general improvement across the region and several countries still show very low levels of scientific excellence. This is also particularly true with regard to transforming scientific production into technological outputs. The region manages to score only a fraction of the EU average in terms of new patent applications, with one notable exception, Slovenia (Figure 15).

Figure 14 % share of national scientific publications within the top 10% most highly cited scientific publications worldwide⁽¹⁾, 2000, 2007 and 2014

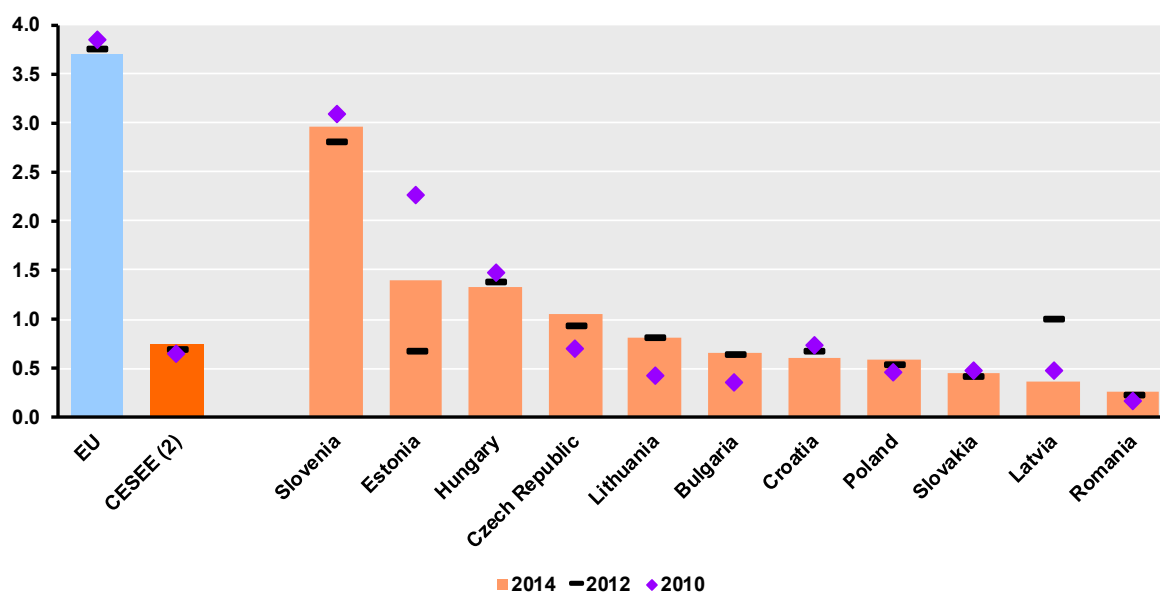


Source: European Commission - DG Research and Innovation

Data: CWTS based on Web of Science database

Notes: ⁽¹⁾Fractional counting method. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Figure 15 PCT patent applications⁽¹⁾ per billion GDP (in PPSE), 2010, 2012 and 2014



Source: European Commission - DG Research and Innovation

Data: Eurostat, OECD

Notes: ⁽¹⁾Patent applications filed under the PCT, at international phase, designating the European Patent Office (EPO).

Patent counts are based on the priority date, the inventor's country of residence and fractional counts. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

There is still substantial room for improvement in the CESEE region when it comes to transforming innovation investment into scientific and technological outputs. In many cases, reforms of their science and innovation system are needed to improve the performance of the scientific and innovation systems.⁶

4. Innovation investment and finance through the lens of the EIB Investment Survey: A microeconomic perspective

What types of firms innovate most in the CESEE countries?

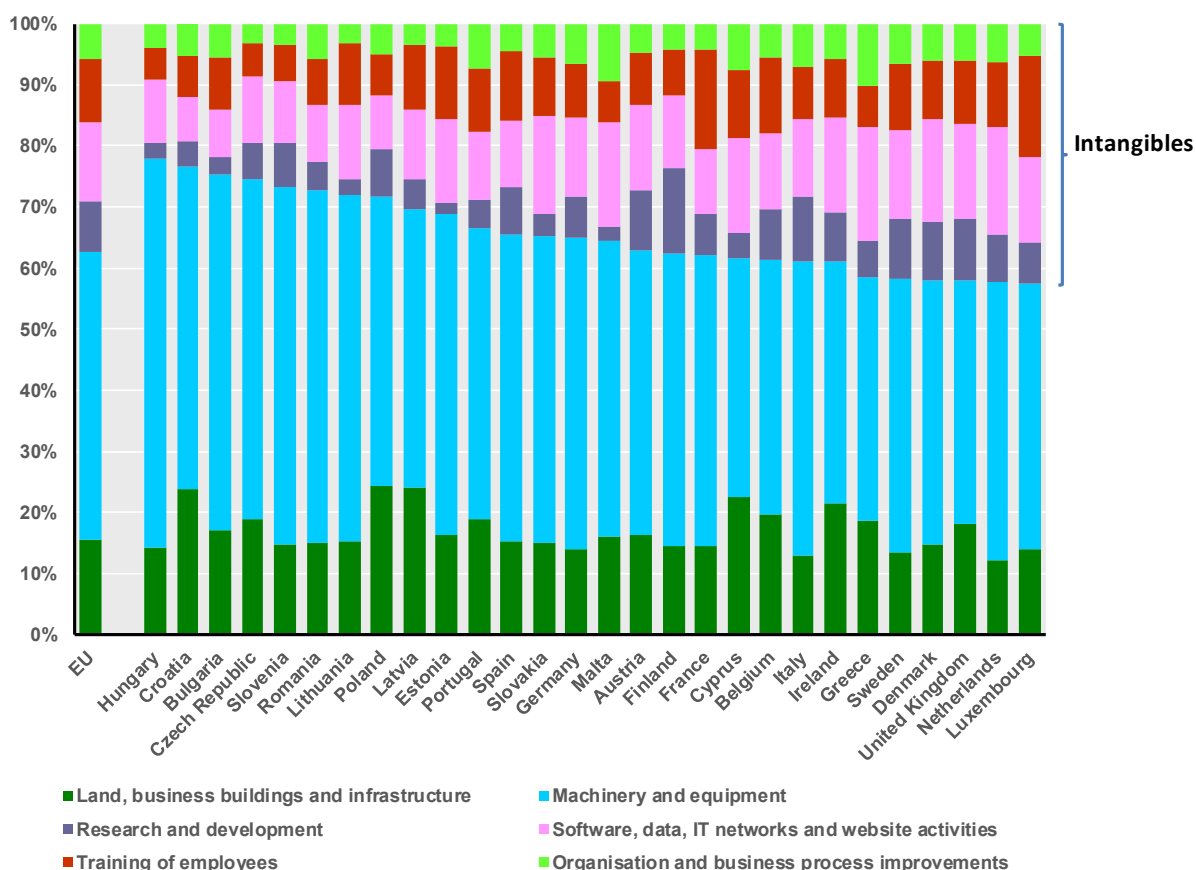
To complement the macro-level view on investment trends and provide analysis more granular view using firm-level data, this paper also uses data of the EIB Group Survey on Investment and Investment Finance (EIBIS). This unique, EU-wide survey conducted collects data on firm characteristics and performance, past investment activities and future plans, sources of investment finance, financing constraints and other challenges that businesses face. EIBIS is representative across all 28 Member States of the EU, as well as for firm size

⁶ For an analysis of specific proposed reforms for specific countries in the region, please see the country reports under the European Semester of Economic Macroeconomic Surveillance of the European Commission (https://ec.europa.eu/info/publications/2018-european-semester-country-reports_en)

classes (micro, small, medium-size and large) and four main sectors (manufacturing, services, construction and infrastructure).⁷ The survey provides a timely micro-level perspective on investment activity as perceived by firms. In 2017, the survey covered 4,881 firms from the 11 CESEE countries (EIB, 2017b).

Looking at corporate investment through the EIBIS lens, CESEE firms report relatively low shares of intangible investment. The share of intangibles – and R&D in particular – is well below the EU average for all CESEE countries (Figure 16).

Figure 16 Investment shares (%) by area, sorted by share of investment in intangibles, 2017



Source: EIB

Data: EIB Investment Survey, 2017

The lower level of investment in intangible assets seems to result in a low number of leading innovators or developing innovators in the CESEE countries. EU firms can be classified in five different innovation profiles based on their R&D investment and innovation activities: basic, adopters, developers, incremental innovators, and leading innovators.⁸ In the CESEE region:

⁷ The data is weighted by value-added to better reflect the contribution of different firms to economic output.

⁸ See EIB (2017a, chapter 9). The development of new products is based on questions 18 and 19 of EIBIS, namely “Q18. What proportion of the total investment was for developing or introducing new products, processes or services?” and “Q19. Were the new products, process or services (A) new to the company, (B) new

- less than 4% of CESEE firms are **leading** innovators (i.e. those that develop products new to the country or to the global market and report substantial R&D expenditures);
- 15% of CESEE firms are **incremental** innovators (i.e. those that develop products new to the company and report substantial R&D expenditures);
- 29% of CESEE firms are **adopting** innovation (i.e. those that report no substantial R&D expenditures and that develop products that are new only to the company);
- 4% of CESEE firms are **developing** innovation (i.e. those that report substantial R&D expenditures, but that do not yet develop products new to the firm, country or global market);
- and 48% of CESEE firms are “**basic**” firms (with no substantial R&D expenditures and no development of new products).

In comparison to the EU average, the results for CESEE countries show that there are fewer leading innovators in CESEE and that most innovation activity is in the form of adoption (Figure 17).

Figure 17 Innovation profiles for firms in the CESEE region and the EU (% of all firms)

Innovation profiles, CESEE

R&D expenditures	Active	4.4% Developers	15.1% Incremental Innovators	3.6% Leading Innovators
	Inactive	48.2% Basic	28.7% Adopting	
		No	New to the company	New to the market or globally new
Developing new products				

Innovation profiles, EU

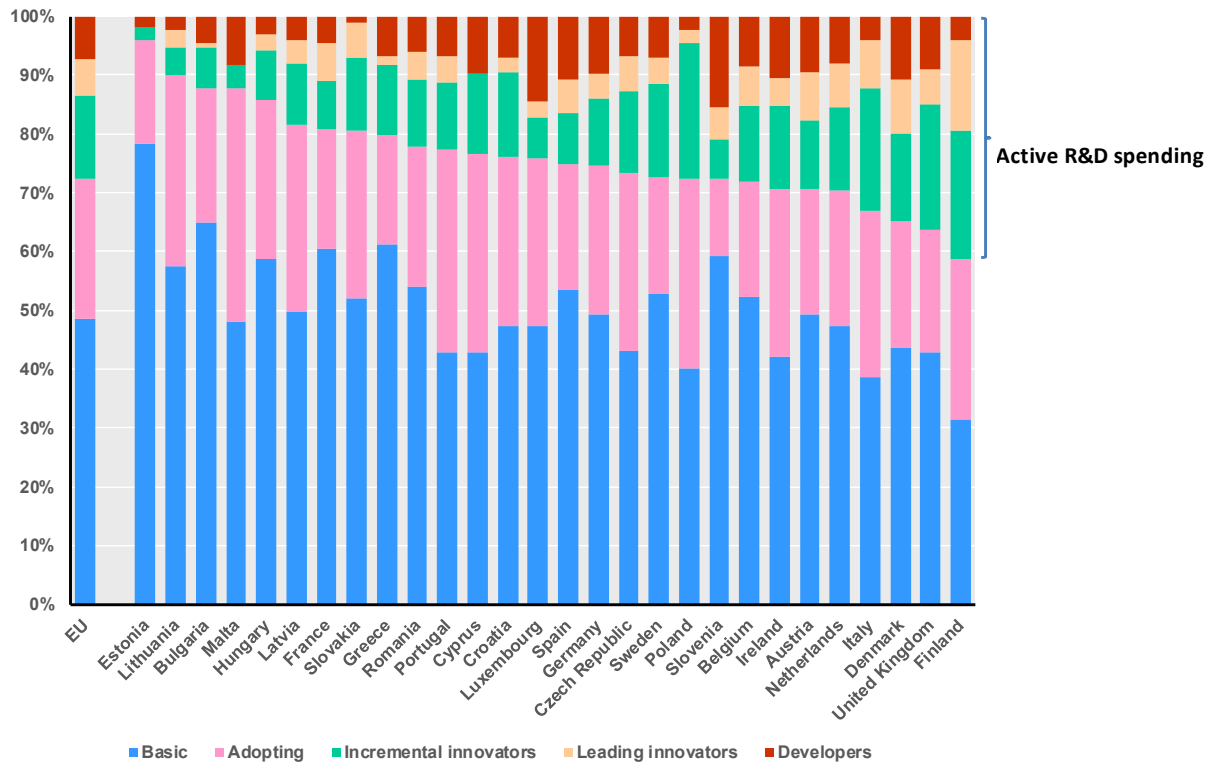
R&D expenditures	Active	7.3% Developers	14.3% Incremental Innovators	6.1% Leading Innovators
	Inactive	48.5% Basic	23.9% Adopting	
		No	New to the company	New to the market or globally new
Developing new products				

Source: EIB Investment Survey, 2017

to the country, (C) new to the global market?” R&D activity is defined as firms reporting substantial R&D (amounting to at least 0.1% of firm turnover).

CESEE firms are lagging behind the EU average in terms of innovation activity. Considering the share of firms with active R&D expenditures (i.e. those belonging to the groups of leading, incremental, and developing innovators), all CESEE countries rank below the EU average (Figure 18). About 77% of CESEE firms are either basic firms or are adopting innovation (i.e. no active R&D expenditures), compared to an EU average of 72%.

Figure 18 Innovation profiles across EU Member States, sorted by % of firms which invest in R&D, 2017



Source: EIB

Data: EIB Investment Survey, 2017

Innovation activity in the CESEE countries is driven by manufacturing firms, large companies, or young firms. Looking at firms with active R&D spending (i.e. leading, incremental and developing innovators), about 68% of active innovators are large firms, almost 18% are medium-size firms and less than 10% are among small firms (Figure 19).⁹ About 62% of active innovators are manufacturers, 20% are in the infrastructure sectors and 14% in services (Figure 20). Looking at firm age, in the CESEE countries, in relative terms, young firms tend to innovate more than old firms, whereas old firms tend to adopt innovation more than young firms (Figure 21).¹⁰

⁹ Large companies are those with more than 250 employees, medium-sized companies have 50-249 employees, small companies have 10-49 employees, and micro companies have 5-9 employees.

¹⁰ For the purposes of this paper, adopting innovation is treated as a form of innovation activity.

Figure 19 CESEE⁽¹⁾ - Active innovators⁽²⁾ by firm size, 2017

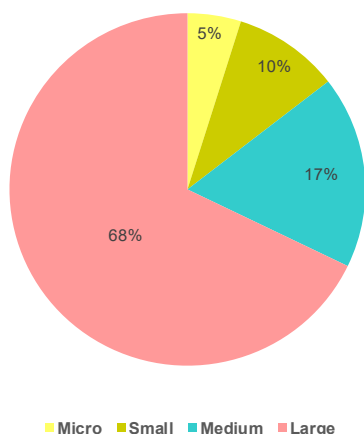
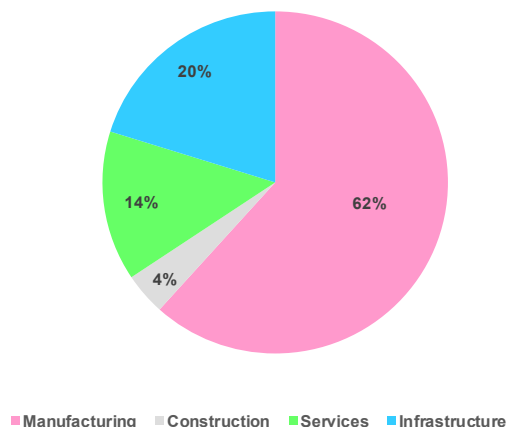


Figure 20 CESEE⁽¹⁾ – Active innovators⁽²⁾ by sector, 2017

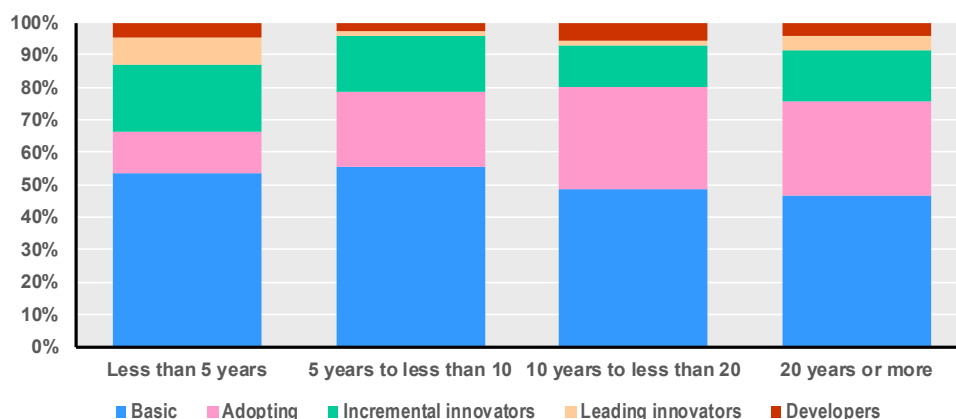


Source: EIB

Data: EIB Investment Survey, 2017

Notes: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK. ⁽²⁾Active innovators refer to those that spend actively on R&D and fall into the categories of leading innovators, incremental innovators and developers.

Figure 21 CESEE⁽¹⁾ - Innovation profiles by age of firm (weighted percentages), 2017



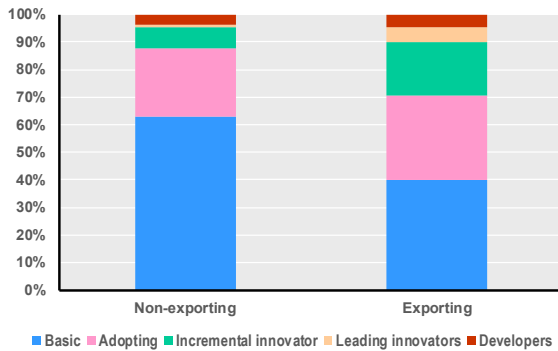
Source: EIB

Data: EIB Investment Survey, 2017

Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

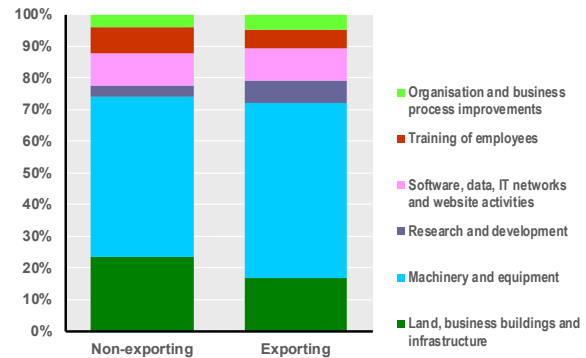
Exposure to foreign markets is also associated with stronger innovation. Exporting firms have on balance a larger share of innovators than non-exporting companies, which can be linked to their foreign ownership or participation in global value chains (Figure 22). This is also reflected in the fact that CESEE exporters tend to have higher R&D spending compared to non-exporters (Figure 23).

Figure 22 CESEE⁽¹⁾ - Non-exporting and exporting firms - % distribution by innovation profile, 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

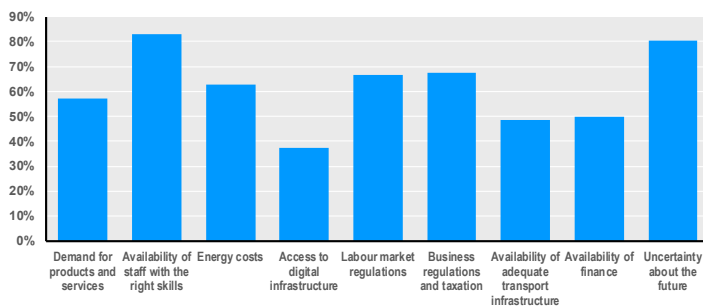
Figure 23 CESEE⁽¹⁾ - Investment areas by exporter status (% of total investment), 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

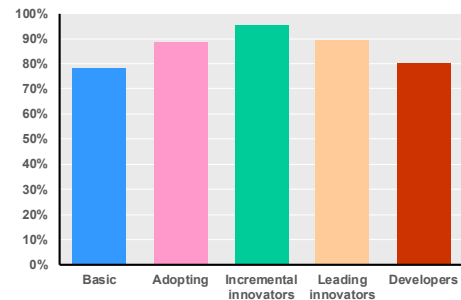
Firms’ readiness to innovate is closely linked to the availability of staff with the right skill sets. Besides uncertainty about the future, an overwhelming majority of CESEE firms report availability of skilled staff as the key impediment for investment (Figure 24). Labour market regulations and business regulations are also obstacles that are mentioned by a vast majority of firms. The lack of skilled staff is even more burdensome for more innovative firms. More than 90% of leading and incremental innovators in the CESEE countries are constrained in their investment decisions by the lack of staff with the right skills (Figure 25). This can negatively affect the potential of CESEE firms when it comes to boosting their innovation activity.

Figure 24 CESEE⁽¹⁾ - Long term obstacles to investment, 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Figure 25 CESEE⁽¹⁾ – Availability of staff with the right skills as an obstacle to investment, by innovation profile of firms, 2017

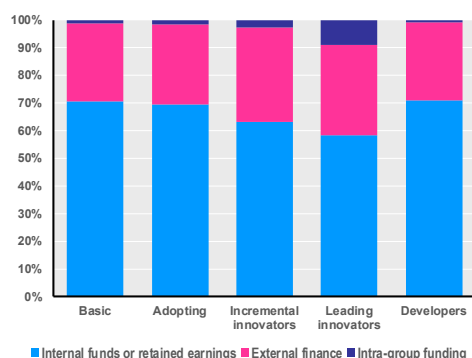


Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

How is firm-level innovation financed in the CESEE countries?

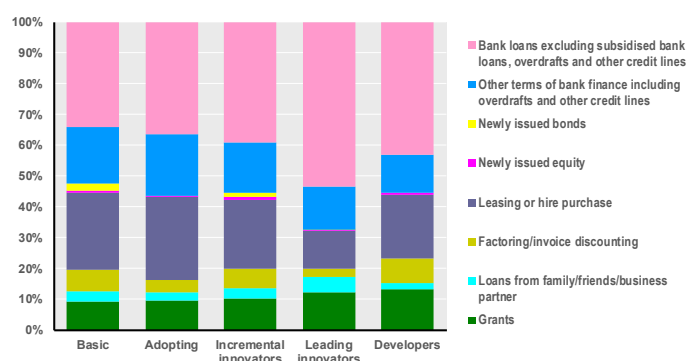
CESEE innovators rely on bank finance, but also tap intra-group funding. In terms of overall sources of finance, CESEE innovators use relatively more external finance than basic firms, and they also have access to intra-group funding (Figure 26). As to the sources of external finance, CESEE leading innovators stand out as being predominantly funded by banks, either in the form of direct bank loans or other forms of bank finance. Capital markets funding – i.e. newly issued bonds and equity – also play a relatively stronger role in financing incremental innovators, in comparison to other firms (Figure 27).

Figure 26 CESEE⁽¹⁾ - Source of finance by innovation profile (weighted percentages), 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Figure 27 CESEE⁽¹⁾ - Source of external finance by innovation profile (weighted percentages), 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

As the financing of CESEE firms remains largely bank-centric, private equity and venture capital markets still lag behind the EU average. While private equity activity in the CESEE is recovering from its post-crisis decline, volumes are still only one-third of the EU average (Figure 28). Consumer goods and services is the most targeted area of private equity in the region, the ICT sector ranks second. Buyout transactions account for 75% of total private equity investments. Funding for private equity is coming mainly from outside CESEE and from public sources. Venture capital volumes in the CESEE have been stagnating in the last few years (Figure 29). Venture capital accounts only for 6% of total private equity volume, with 70% of the recipients being start-ups. And the ICT sector accounts for almost half of the venture capital volume in the CESEE.

Figure 28 Private equity investment (market statistics) as % of GDP, 2017

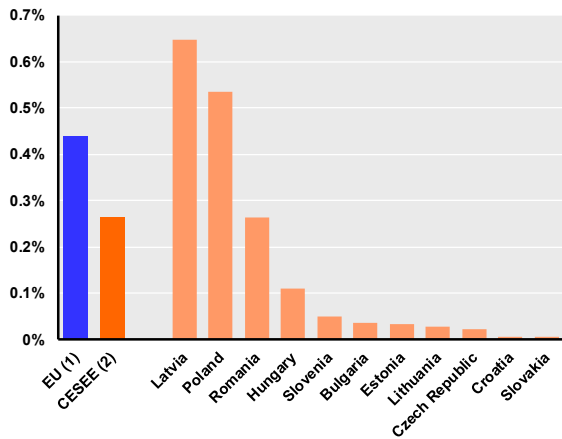
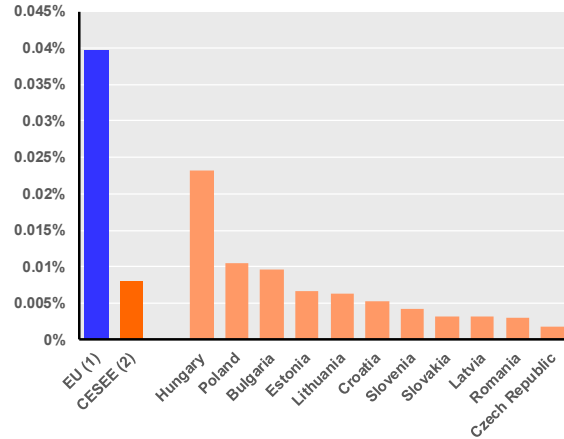


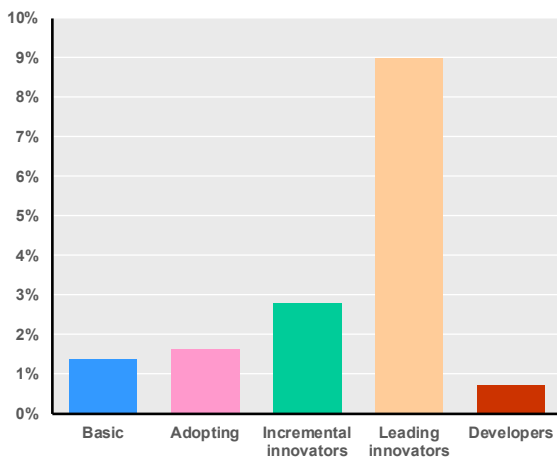
Figure 29 Venture capital (market statistics) as % of GDP, 2017



Source: European Commission - DG Research and Innovation
 Data: Invest Europe, Eurostat
 Notes: ⁽¹⁾EU does not include CY and MT. ⁽²⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

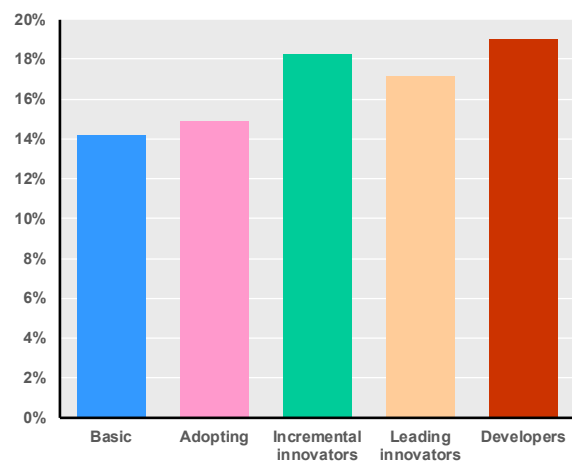
While leading innovators in the CESEE make the most use of intra-group financing, grant financing – mainly EU funds – is tapped by all innovation profiles. About 9% of investment by leading innovators is financed by intra-group sources (Figure 30). Active R&D spenders in the CESEE, i.e. incremental, leading and developing innovators, use marginally more grant financing than firms who are adopting innovation and basic firms (Figure 31).

Figure 30 CESEE⁽¹⁾ - Use of intra-group by innovation profile, 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

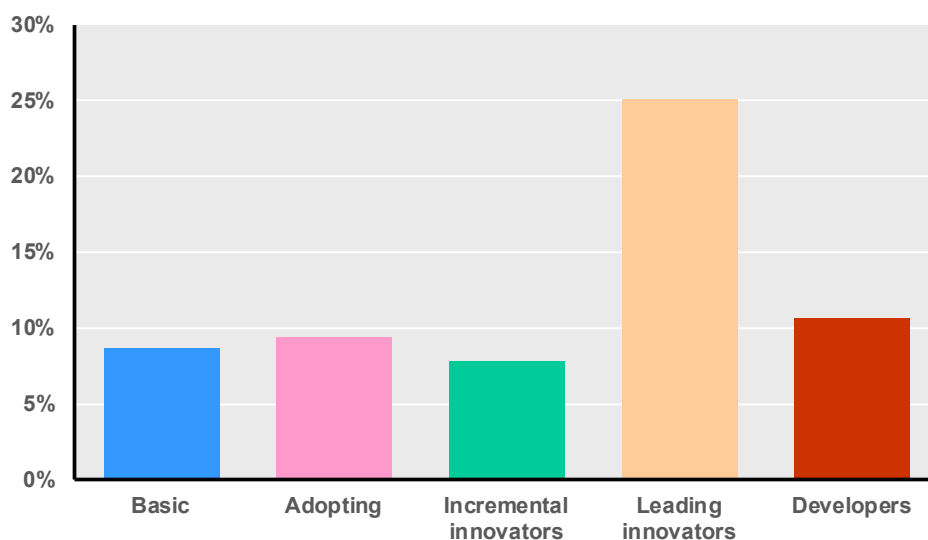
Figure 31 CESEE⁽¹⁾ - Grant use by financing innovation profile (weighted percentages), 2017



Source: EIB
 Data: EIB Investment Survey, 2017
 Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Leading innovators face somewhat tighter credit constraints than other firms. In particular, about 25% of CESEE leading innovators are financially constrained in one way or another (Figure 32). In addition, firms that have high shares of intangible investment are relatively more constrained by price and quantity of credit, which opens a role for the products offered by IFIs that target price and/or quantity of credit for innovative companies.

Figure 32 CESEE⁽¹⁾ - Shares (%) of financially constrained firms by innovation profile (weighted percentages), 2017



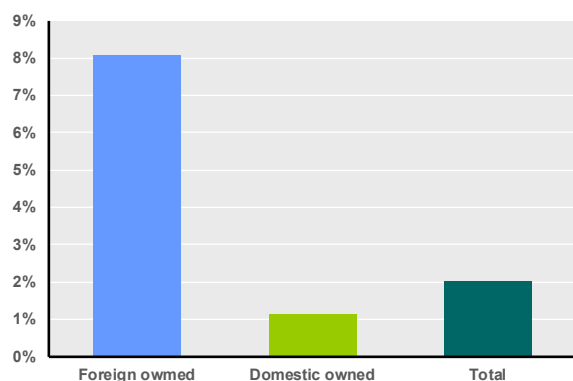
Source: EIB

Data: EIB Investment Survey, 2017

Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Most innovation activity in CESEE originates within the large manufacturing firms that are often foreign-owned. Foreign-owned firms have the means to access an additional source of funding for their investment activities in the form of intra-group sources. This can serve both as a buffer in times when credit conditions get tighter (e.g. during a crisis) or as an internal “within-firm” pool of funding available for expansion and innovation. Currently, financing conditions in most of the CESEE countries are accommodative and there is not much difference in the share of credit-constrained firms when distinguished by ownership. Nevertheless, as in the rest of the EU, foreign-owned firms tend to be less financially constrained than domestically-owned firms, especially in times of financial turbulences.

Figure 33 CESEE⁽¹⁾ – Average share (%) of investment financed by intra-group funding, 2017

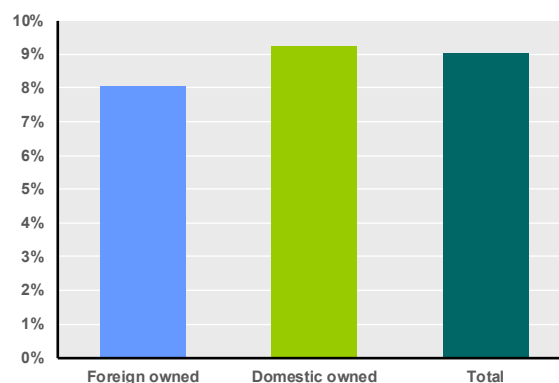


Source: EIB

Data: EIB Investment Survey, 2017

Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

Figure 34 CESEE⁽¹⁾ - % share of firms which are financially constrained, 2017



Source: EIB

Data: EIB Investment Survey, 2017

Note: ⁽¹⁾CESEE: BG+CZ+EE+HR+LV+LT+HU+PL+RO+SI+SK.

5. Conclusions

The rapid economic growth and fast convergence process that many countries in the CESEE region experienced during the 1990s and early 2000s has slowed down in the aftermath of the global economic and financial crisis. Productivity growth has declined sharply during the past decade. This suggests a certain exhaustion of the model that fuelled much of the previous growth and was characterised by a combination of various factors, such as the rapid expansion of global supply chains that drove much foreign direct investment, thriving trade and high commodity prices.

Sustaining high levels of economic growth going forward will require a shift in the growth model in the CESEE region to a new model that will need to be increasingly based on innovation. This innovation imperative will be crucial if rising prosperity is to be sustained and a fall into the middle-income trap is to be avoided. This is particularly important against the backdrop of rapid technological change driven by the rise of digital technologies and their convergence with the physical world that are posed to deeply transform our economies. Currently, the regions continues to lag behind in terms of its digital transformation.

The situation across the region is diverse as many countries find themselves at different stages of development. However, most countries in the region seem to face a development ceiling that can only be broken through innovation driven productivity growth.

Almost all countries in the CESEE region can be considered only as moderate or modest innovators and with some notable exceptions, their digital capacities that will form the basis of many future innovations, are low. Bottlenecks such as low investment in innovation, e.g.

R&D, coupled with some skills gaps and low performing scientific and innovation systems that hinder the ability to transform innovation investment into scientific and technological capacity, are holding back the region's potential to boost its innovation performance. This calls for increased investment in innovation as well as reforms in many of these systems if overall innovation performance is to be improved.

On the firm level, there are relatively fewer leading innovators in CESEE countries than in the rest of the EU. More firms in CESEE, in comparison to the EU average, are focused on adopting new technologies. Large and manufacturing firms are responsible for most active innovation activity in the CESEE region. CESEE innovators rely more on external finance than basic firms, but they are also more financially constrained. Bank loans are the main source of external finance for innovators in CESEE. In order to further boost innovation activity, private equity and venture capital remain crucial, but they are currently underdeveloped in the CESEE region at large.

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eBook: QH-04-18-810-EN-E ISBN 978-92-861-3841-6 DOI 10.2867/54212
PDF: QH-04-18-810-EN-N ISBN 978-92-861-3842-3 DOI 10.2867/94719