BUSINESS RESILIENCE IN THE PANDEMIC AND BEYOND

Adaptation, innovation, financing and climate action from Eastern Europe to Central Asia

Chapter 2

Trade participation, innovation and competitiveness

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European Investment Bank
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Business resilience in the pandemic and beyond: Adaptation, innovation, financing and climate action from Eastern Europe to Central Asia

About this publication

This is a joint publication of the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD), with contributions from the International Monetary Fund (IMF).

Contributors

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The views expressed in this publication are those of the authors and do not necessarily reflect the position of the EIB, EBRD or IMF.

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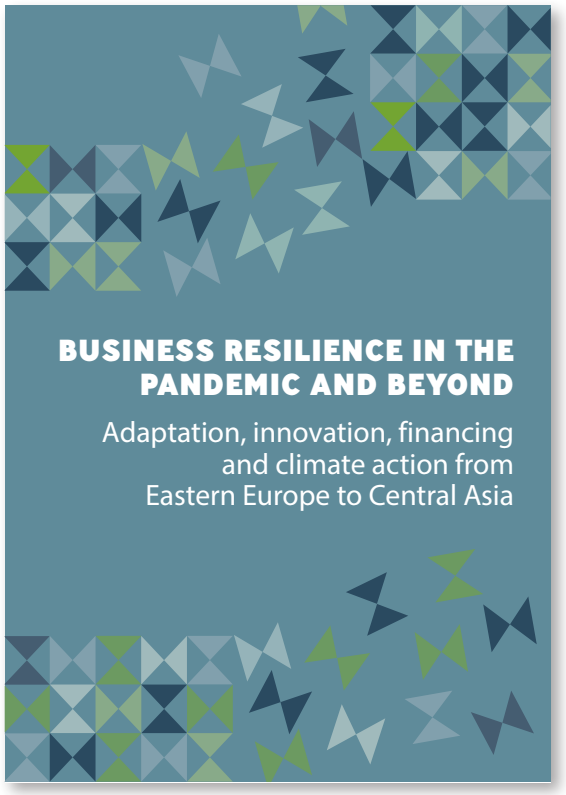

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CHAPTER II

Trade participation, innovation and competitiveness

Summary

The economies of Eastern Europe and Central Asia generally invest more in innovation than comparator economies, although the process is led by adapting new technologies developed elsewhere. Opening up the global economy has been essential for enabling many developing countries to improve their comparative advantages and increase their competitiveness. The industrial composition of more integrated regions in global value chains (GVCs) is clearly focused more on higher value added products, while those that are less integrated are trading mainly manufacturing products with lower value added or raw materials.

The evidence in this chapter indicates that trade integration with developed economies, in particular the European Union, access to information and know-how through participation in GVCs, foreign licensed technology and modern management practices are among the most important ingredients for boosting innovation in Eastern Europe and Central Asia.

Innovation and trade are closely intertwined. On the one hand, there are significant size and productivity premiums for "traders" – firms engaged with foreign customers and suppliers. Moreover, traders tend to grow faster (in terms of sales) when they also invest in innovation, confirming the idea of self-selection of more productive, larger and innovative firms into trading activities. At the same time, participation in trade has a positive impact on the process of innovation, in line with the "learning-by-exporting" effect.

Innovation activities also depend on the places in which firms are located, such as more populated urban centres, where digital infrastructure and skilled labour are available. Consequently, investment in digital infrastructure and improvements in management practices and workers' skills are key elements of innovation-driven development. This could also help to rebalance discrepancies in terms of development across the region as a whole, and improve business resilience and adaptability to shocks, such as the COVID-19 crisis.

2.1. Introduction

Over the past three decades, globalisation has been rapidly intensifying, generating opportunities for firms in many countries to enter new markets. The growth of international trade and the expansion of global value chains (GVCs) have proved to be a powerful means of economic development. Incomes and productivity have increased, while poverty has fallen in many developing countries (World Bank, 2020). Opening up the global economy and the fragmentation of production have been instrumental in enabling these firms to develop comparative advantages in the manufacture of certain products. This has been facilitated by trade liberalisation and declining trade costs, especially after the 1980s.

More recently, the COVID-19 crisis has disrupted economic activity across the globe. In particular, global merchandise trade fell by 7% in 2020. The pandemic forced governments to impose strict containment measures, generating international supply and demand shocks across many countries (Baldwin, 2020). While GVCs have remained quite resilient to date, it is an open question whether COVID-19 will have a long-term impact on international trade and the organisation of GVCs.

International trade is a key determinant of firms' competitiveness and innovation. Trade participation, profitability and survival are driven by different aspects of the business environment in which firms operate. These include the export capacity of domestic firms in an industry, foreign direct investment, trade costs and barriers, the quality of infrastructure and the availability (or migration) of skilled workers. Trade integration also plays a critical role in shaping the incentives for firms to innovate through various channels, including larger market size, increased competition, induced specialisation and the international spread of knowledge (Melitz and Redding, 2021; Buera and Oberfield, 2020; De Loecker, 2013; Gorodnichenko et al, 2010).

This chapter examines trade participation and innovation, and how they are intertwined for firms in Eastern Europe and Central Asia. By analysing cross-sectional and panel data on more than 20 000 private firms in manufacturing and services across more than 30 countries, it explores structural determinants of trade participation and innovation activities. It provides a detailed perspective on firms' competitiveness, labour productivity and management practices, as well as the business environment in which they operate. It also takes a closer look at the importance of innovation hubs close to urban development centres in the context of trading and innovating firms' response to the COVID-19 crisis.

The analysis puts a special emphasis on firms that participate in global value chains. As firms' products mature and become more standardised, production processes can be moved from developed countries at the frontier of innovation to countries at lower levels of development. The lag in technological diffusion gives rise to international trade through GVCs (Vernon, 1966; Krugman, 1979) and, at the same time, facilitates the adaptation of new technologies. This, in turn, can raise firm productivity and an economy's aggregate rate of growth (Perla et al, 2021).

The results show that economies in Eastern Europe and Central Asia generally invest more in innovation activities than comparator economies, even though the innovation process is led by adapting new technologies developed elsewhere. Innovation and trade are closely intertwined. Trade integration with developed economies, in particular the European Union, access to information and know-how through participation in GVCs, foreign licensed technology and modern management practices are among the most important ingredients for boosting innovation in the region. Innovativeness and connectivity to international markets are important for adapting better and being more resilient to economic shocks such as the COVID-19 crisis.

Taken together, the findings suggest several measures that policymakers might implement for accelerate economic development, by improving productivity through deeper trade integration and increasing incentives to invest in innovation. First, improving customs and trade regulations, which will lower entry costs for firms to engage in trade, will increase access to international markets for a larger share of firms, especially smaller ones. But these measures should not only target small firms or give preference to certain groups of firms. Instead, improving the incentives to invest in innovation, in particular for small firms, might be more effective, as small and innovative firms have higher growth prospects and better chances of surviving in international, competitive markets. Second, it will be important to guard against the introduction of restrictions on imports that serve as inputs of production and intermediary goods for domestic firms, in particular for firms participating in GVCs. Third, to increase the participation of local firms in GVCs, reforms to the business environment, through reducing informality and political uncertainty, should be promoted: this will help to create a more stable and predictable operating environment for trading partners and foreign investors, and facilitate the acquisition of foreign licensed technologies by both trading and domestic firms. Finally, policymakers should prioritise investment in digital infrastructure and facilitate improvements in management practices and workers' skills. Governments could encourage intensive training programmes, in particular aimed at improving the management of small and medium-sized enterprises (SMEs) and incentives to reskill the workforce, including in less well connected areas to attract innovative firms. Combined with investment in digital infrastructure, this could help to rebalance discrepancies within the region as a whole, and improve resilience and adaptability to shocks, such as the COVID-19 crisis.

The rest of this chapter is organised as follows. Section 2.2 provides an overview of trade integration, economic development and barriers to trade of different sub-regions within Eastern Europe and Central Asia. Section 2.3 discusses innovation activities, management practices and firms' competitiveness, while Section 2.4 explores the interrelationships of trade participation and innovation. Section 2.5 presents evidence on the role of the European Union as a trade facilitator and driver of innovation for the regions, using a gravity model of trade. Section 2.6 concludes with policy implications for fostering private sector development.

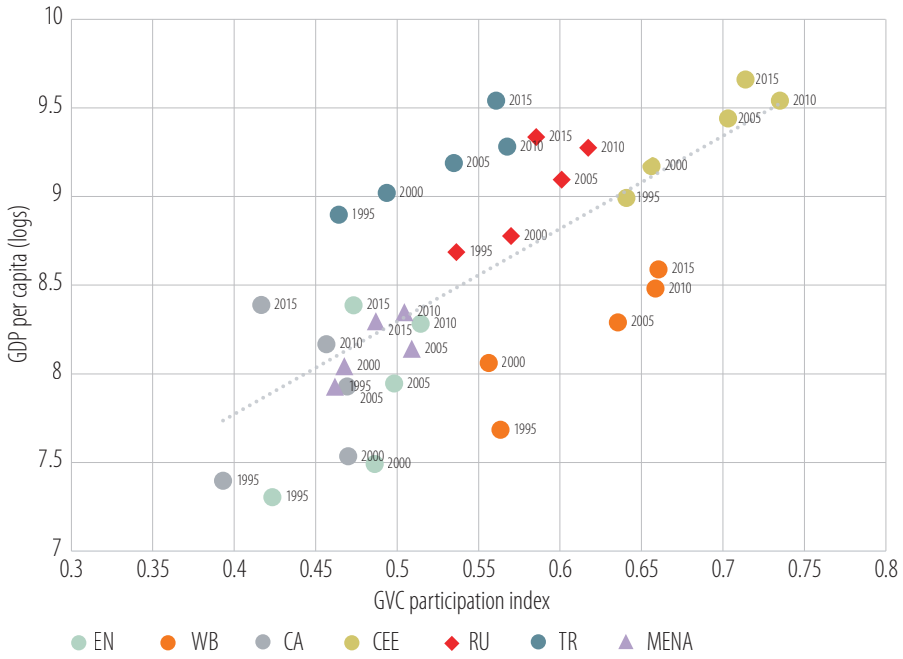
The chapter also includes three boxes. Box 1 shows the analyses on the effects of trade on innovation activity. Box 2 presents a gravity model of trade combining bilateral data on trade flows and the Enterprise Surveys. Box 3 focuses on location-based measures of development that use the intensity of night-time light and population density.

2.2. Trade integration, economic development and barriers to trade

The rapid rise in economic growth for most countries in Eastern Europe and Central Asia over the past three decades has been accompanied by deeper trade integration. In particular, there is a positive dynamic of trade integration for firms in Central and Eastern Europe and the Western Balkans, whereas the Eastern Neighbourhood and Central Asia are lagging (Figures 1 and 2). While international trade has benefited from technological developments and concerted efforts to reduce trade barriers globally, some countries have been further supported by deeper economic and institutional integration with more developed countries through EU integration – either by becoming an EU member or through being a candidate for future EU enlargement with a clear path of future accession. Compared with other sub-regions, Central and Eastern Europe has been able to benefit the most from trade integration, in particular with EU economies, following the transition from socialism to a market economy (IMF, 2014). The process of transition and trade integration in the Western Balkans was delayed by a decade due to the Yugoslav wars and the disruption of previously existing trading routes.

Figure 1

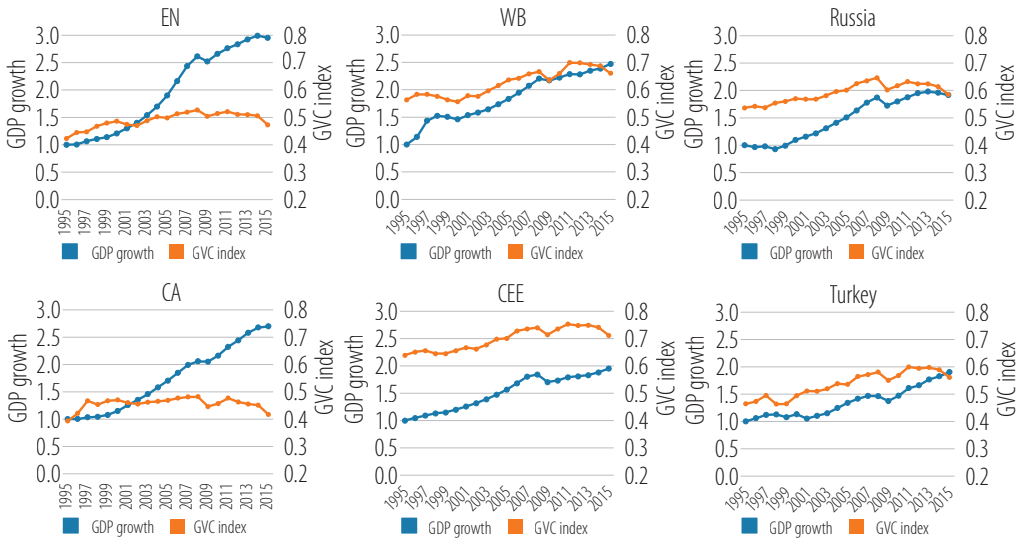
Levels of real GDP per capita and participation in GVCs, 1995-2015



Source: *Authors' calculations based on UNCTAD-Eora and World Bank World Development Indicators.*
Note: *The figure shows the GVC participation indices and GDP per capita in 2010 US dollar terms (in logs) for five selected years from 1995 to 2015. The regional statistics are calculated as unweighted averages from country level figures.*

Figure 2

Growth of real GDP per capita and level of participation in GVCs, 1995-2015



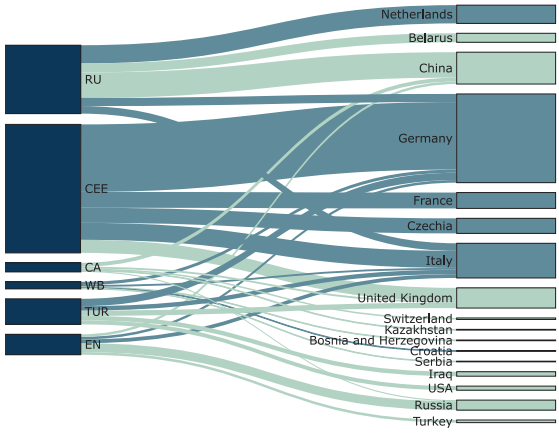
Source: *Authors' calculations based on UNCTAD-Eora and World Bank World Development Indicators.*
Note: *The figure shows the average GVC participation index[1] (in orange, right axis) and the growth in the average GDP per capita of the region compared to 1995 (in blue, left axis). The regional statistics are calculated as unweighted averages from country level figures.*

1 The GVC participation index is calculated as the sum of forward and backward participation rates. The backward participation rate is the share of exported value added that is imported for further processing from another country. The forward participation rate is the share of exported value added that will be used for further processing by another importing country. The calculations are based on the UNCTAD-Eora dataset (Casella et al, 2019).

EU countries are key export markets for firms in Eastern Europe and Central Asia. Germany, Italy and France are among the top five export destinations of both Central and Eastern Europe and the Western Balkans, while the Western Balkans also include some neighbouring countries in Central and Eastern Europe among its top destination countries (Figure 3). The Eastern Neighbourhood and Central Asia are more exposed to neighbouring countries that are outside the European Union: Russia is the top export destination for the Eastern Neighbourhood and China for Central Asia. Russia's top export destination country is China, but other key trading partners include Germany and the Netherlands – the latter mostly because it is an organisational and logistical connection hub for other EU countries.

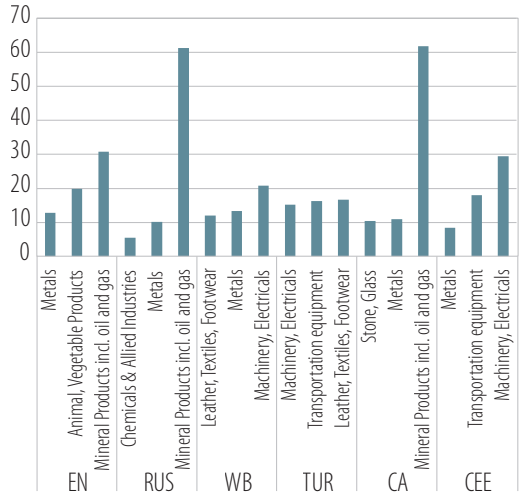
The industrial composition of economies that are more deeply integrated into GVCs comprises higher value added products. Economies less integrated in GVCs are trading mainly manufacturing products with lower value added or raw materials, while those integrated into GVCs are able to diversify away from commodities toward higher value added manufactured goods and services. Even though developing countries are mainly involved in the production process of parts and assembly of high-tech products, this contributes to a significant share of value added of the products, and it provides jobs for a large number of low-skilled workers – thereby contributing to economic growth and reducing poverty (Dollar, 2019). The exporting commodities in Central and Eastern Europe are concentrated in the automotive sector and related industries, such as electrical equipment and electronics (Figure 4). The sub-region has been able to increase the quality of its exports over time, notably through FDI (Gorodnichenko et al, 2021; Pellenyi, 2020; Javorcik, 2004). The top exporting products of the Western Balkans are increasingly moving from lower value added products, such as clothing and metallurgy, towards higher value added products, such as machinery and electrical equipment. Although textiles remain the top export commodity in Turkey, transport equipment and machinery are now also among the top exported products. The three sectors have similar shares and together represent almost 50% of total exports. Russia, Central Asia and the Eastern Neighbourhood stand out from the other sub-regions, with a high share of mineral products, including petroleum oil and gas (around 60% of total exports from Russia and Central Asia) and metalliferous products (around 10%).

Figure 3
Top five export markets in 2019



Source: *Authors' calculations based on Comtrade.*
Note: *The figure shows the relative trade flows of the top five export destinations for each region. The flows from each exporting block (left side in red) add up to 100%. The EU trade partners are coloured in blue, while trade with other partners are in green.*

Figure 4
Top three export commodities in 2019
(percentage of total exports)

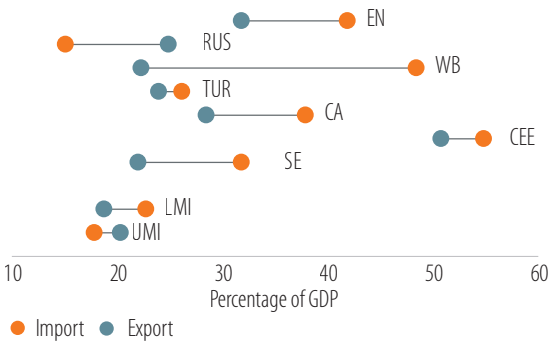


Source: *Authors' calculations based on Comtrade.*

As a share of GDP, the economies in the region tend to import more goods than they export, with relatively large trade deficits for three out of the six sub-regions. As the trade balance is the major driver of the current account balance, large deficits might be a source of a macro risk.[2] The current account deficit also implies an excess of investment over domestic savings, which could reflect the catching-up process of the less developed economies (Gosh and Ramakrishnan, 2020; Carranza, 2002). In 2019, all sub-regions except Russia had a negative trade balance, whereas the Central and Eastern Europe and Turkey had a relatively low deficit (Figure 5).[3] Central and Eastern Europe stands out, with trade integration at above 50% of GDP for both exports and imports of goods, significantly above the average of upper- and lower-middle-income benchmarks, which are around 20% of GDP. Imports represent 48% of GDP in the Western Balkans and are significantly higher than exports, which are at 22% of GDP. In the Eastern Neighbourhood and Central Asia, exports amount to 32% and 28% of GDP, while imports are at 42% and 38% of GDP – which is above the average for upper-middle-income countries.

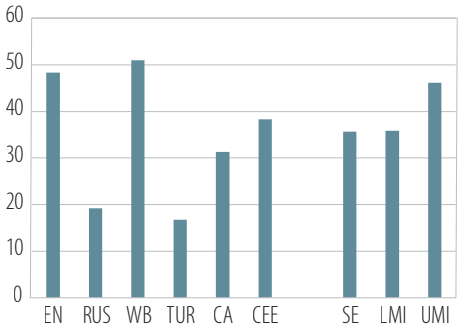
According to the Enterprise Survey, most firms in the region engage in trade. Overall, the breakdown of firms' trading profiles outlines the import dependence of most sub-regions, in particular in the Eastern Neighbourhood and the Western Balkans, where manufacturers report that half of their inputs are of foreign origin (Figure 6).[4] This may reflect the relatively small size of the economy in these countries. It may also indicate that firms are unable to find inputs on the domestic market or it may reflect policies overvaluing currencies, for example, due to pegged exchange rates to hard currencies in most countries in the Western Balkans. The share of non-traders is particularly large in Central Asia, Turkey and Russia. For Turkey and Russia, this needs to be interpreted in light of the size of the economy, as they are significantly larger than countries in other sub-regions, such as the Western Balkans.[5]

Figure 5
Imports and exports of goods in 2019
(percentage of GDP)



Source: *Authors' calculations based on World Bank World Development Indicators.*
Note: *Regional share calculated as simple average of the countries.*

Figure 6
Inputs of foreign origin
(percentage of total inputs)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Sample of manufacturing sector only.*

2 A current account deficit is considered unsustainable when it may trigger a drastic policy shift or when it leads to a crisis, for example, an exchange rate collapse that prevents the country from servicing its external obligations.

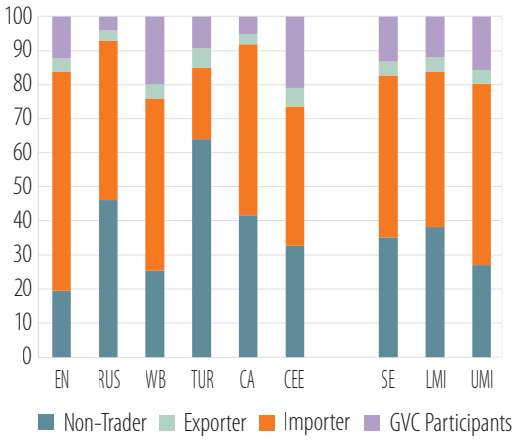
3 A slightly different picture emerges when taking account of trade of services: Central and Eastern Europe, Turkey and Southern Europe are net exporters (positive trade balance) in terms of trade in both goods and services, while the Western Balkans, the Eastern Neighbourhood and Central Asia have a relatively high trade deficit (17%, 7% and 13% of GDP, respectively). Turkey had sizeable current account (on average 5% over 2010-18) and trade deficits in the last decade while 2019 was an exceptional year of surplus due to lower imports stemming from the economic crisis.

4 Importers are defined as firms that purchase more than 10% of material inputs or supplies of foreign origin. Exporters are defined as firms exporting more than 10% of their sales directly.

5 For example, Turkey's GDP is seven times larger and Russia's GDP 15 times larger than the total GDP of the Western Balkans.

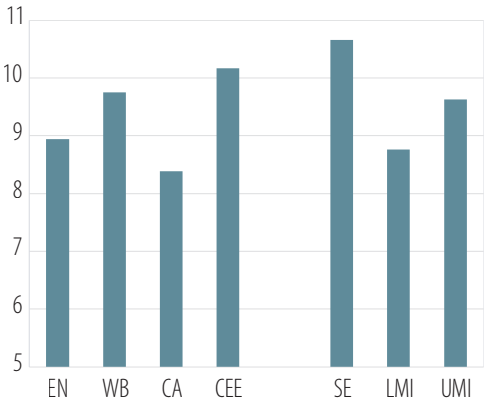
Most firms that export their goods or services also import at the same time, indicating that they participate in GVCs by importing, transforming and adding value before re-exporting. But the share of firms that participate in global trade varies across regions. Around one in four manufacturers in Central and Eastern Europe and the Western Balkans directly export goods abroad, a share that is significantly higher than the averages of lower- and upper-middle-income economies (Figure 7). For the Eastern Neighbourhood and Turkey, this share is above 15%, and in line with the average of comparable lower-middle-income countries, while Central Asia and Russia lag significantly, with a lower share of exporters in manufacturing, at around 7% of all firms. The share of participants in GVCs – which is proxied throughout this chapter by firms that both import and export – in Central and Eastern Europe and the Western Balkans is above comparator countries (OECD 2019). Firms in these sub-regions also tend to have higher labour productivity than in other sub-regions (Figure 8). Most economies in Central and Eastern Europe and the Western Balkans have opted for an economic model that is oriented toward exports and industrialisation supported by a proactive policy of attracting FDI (Hagmejer and Muck, 2019). This has enabled the transfer of technology and know-how, thereby supporting the rapid increase of total factor productivity (Bajgar and Javorcik, 2020; Damijan et al, 2013). For example, Central and Eastern Europe has become an important part of GVCs in the automobile industry (Delanote et al, 2021). Telecommunications, ICT and outsourcing service activities of large international corporations have also been among the fastest growing industries in Central and Eastern Europe.

Figure 7
Trading profiles in 2019 (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*

Figure 8
Median labour productivity in 2019 (log)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Labour productivity is calculated as value added per employment. Weighted median values are calculated for the manufacturing sector.*

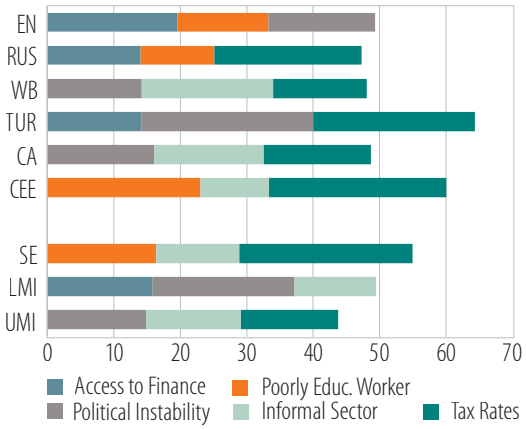
The business environment can be a constraint for firms that engage in international trade. Many productive firms might not be able to reap the scale and efficiency benefits from trade because of constraints in the business environment. The obstacles most often identified by traders include: practices of competitors in the informal sector; an inadequately educated workforce; access to finance; and political instability (Figure 9). Looking at cross-regional aspects, the traders in Central and Eastern Europe complain in particular about an inadequately educated workforce and tax rates, while traders in the Western Balkans and Central Asia more often mention political instability and competition from the informal sector as a major obstacle. Firms in the Eastern Neighbourhood mention access to finance as an obstacle, in addition to political instability and an inadequately educated workforce. For example, financial constraints can restrain the ability of domestic firms to export and invest in innovation, especially for small firms (Pietrovito and Pozzolo, 2021; Gorodnichenko and Schnitzer, 2013).[6]

6 See Chapter 4 of this report for in-depth analysis of financing constraints.

The presence of barriers and obstacles to trade, either through non-tariff or tariff measures, can reduce overall trading activity and volumes, both for importers and exporters. Compared with other trader profiles, customs and trade regulations appear to be particularly binding for participants in GVCs, especially in the Western Balkans and the Eastern Neighbourhood (Figure 10). Via its effects on volume and shipping frequency, the efficiency of customs is an important trade facilitator (Volpe et al, 2015, Hornok and Koren, 2015). Barriers to trade may reduce market competition and erode the gains from international trade. This may decelerate the growth of efficient firms, and even result in lower value added production (UNCTAD, 2005; Porter, 2000).

Figure 9

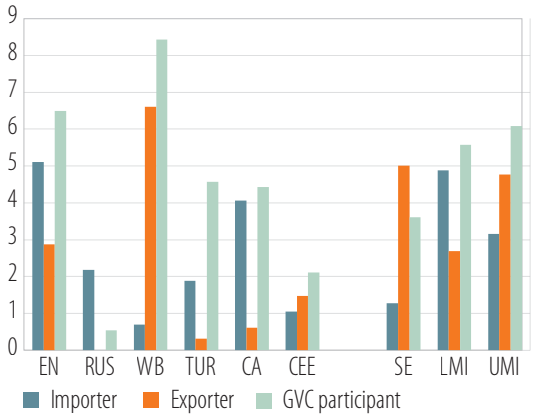
Top three business environment obstacles for traders (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Share of firms reporting that a given obstacle represents the biggest obstacle they face.*

Figure 10

Customs and trade regulation are the top business environment obstacle (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Share of firms reporting customs and trade regulation as the biggest obstacle they face.*

The average time to clear customs is lower in Eastern Europe and Central Asia than in comparator economies. Russia appears to be an exception, with more than 15 days on average to clear exports and more than 20 days to clear imports from customs – which is significantly above the average of upper- or lower-middle-income economies (Table 1). The share of firms that report making informal payments to export or import is closer to the average for comparator economies – outside Central and Eastern Europe and Turkey, where few firms report it being an obstacle. Likewise, there are indirect costs to trading, such as the quality of domestic infrastructure and logistic services (Iimi, 2011). One proxy for indirect costs is the percentage of products lost due to breakage or spoilage, which is relatively higher in Russia and Central Asia. Moreover, in large economies such as Russia and Turkey, internal distance from borders can add further time and costs.

Table 1
Business environment for traders

	Customs and trade regulations as a major obstacle (% of firms)	Days to clear exports through customs	Days to clear imports from customs	Informal payment to export (% of firms)	Informal payment to import (% of firms)	Export loss due to breakage and spoilage (% of sales)
EN	11.8	4.0	7.3	7.5	5.1	0.3
RUS	6.5	15.6	20.4	6.3	22.5	1.2
WB	13.9	1.9	2.7	7.9	13.5	0.3
TUR	9.8	2.6	2.8	2.9	2.2	0.4
CA	6.9	3.0	6.4	10.8	12.7	0.6
CEE	6.7	3.10	5.2	1.2	1.5	0.4
SE	7.7	7.3	6.3	3.4	0.9	0.7
LMI	17.7	4.6	10.5	8.7	14.1	1.1
UMI	12.3	4.0	5.4	5.8	8.1	0.3

Source: Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.

The profile of the traders in developing and emerging economies is typically characterised by a large number of firms engaging in low-level trade, with a few "superstar" exporters facing few competitors. Firms can be classified in different categories based on their export sales: superstar exporters, big player exporters and small players (EBRD, EIB, World Bank, 2016).[7] There are wide differences in terms of exporters' productivity premiums – the average difference in productivity between exporters and non-exporters (Table 2).[8] In particular, superstar exporters tend to have significantly higher labour productivity, while small players are not necessarily more productive than non-exporters. Similarly, the size-exporter and growth sales-exporter premiums are significantly larger for superstar exporters. The large premiums for superstar exporters may be explained by policies favouring large exporters and privileging capital-intensive firms – for example, through lines of credit by the banking sector, but also direct public support, such as land and energy subsidies. While economies of scale should be the major driver, large firms or multinationals may also receive subsidies, protection and privilege that make it difficult for smaller domestic firms to access export markets and reap the scale and efficiency benefits from trade.

7 Superstar exporters are defined as firms above the 95th percentile of the distribution of export sales; big player exporters are firms between the 50th and 94th percentile; and small player exporters are firms below the median.

8 The estimates corresponding to Table 2, but for each sub-region separately, are reported in Tables A.1, A.2 and A.3 in the Annex.

Table 2

Productivity, size and growth of sales premiums of exporters, by exporters' size categories

	(1) Labour productivity	(2) Firm size (log labour)	(3) Sales growth
Omitted category: firms that do not export			
Superstar	0.939***	2.924***	0.320*
	(0.183)	(0.211)	(0.183)
Big player	0.431***	1.408***	0.086
	(0.119)	(0.075)	(0.143)
Small player	-0.007	0.184***	0.037
	(0.139)	(0.050)	(0.112)
Observations	8,043	8,043	6,448

*Note: OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Superstar exporters are defined as firms above the 95th percentile of the distribution of export sales, big player exporters are firms between the 50th and 94th percentile, and small player exporters are firms below the median. Other firm characteristics included in the regression but not reported in the table include: country, industry, a binary variable whether the firm is foreign-owned (defined as those with foreign capital share of more than 10%), firm size (included as explanatory variables in columns 1 and 3), and labour productivity (in column 2).*

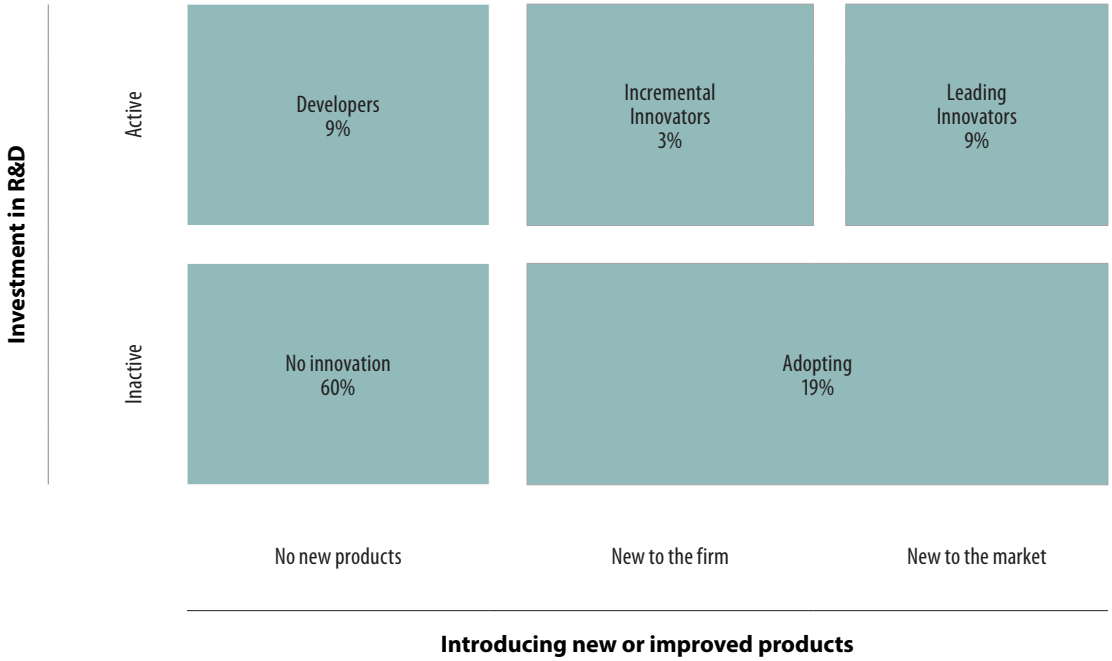
2.3. Innovation, management practices and firms' competitiveness

To be able to compete in global markets, firms need to invest in innovation to deliver continuous improvement in their productivity. This can be achieved in different ways, such as decreasing production costs, introducing new products and services, adopting new technologies and improving the process of production and delivery. Throughout this process, the availability of a qualified labour force and the quality of management practices are indispensable for firm performance, notably for firms in developing economies that engage in trade (Bloom et al, 2021; McKenzie and Woodruff, 2018; Bastos et al, 2018).

Beyond the new technologies that advance the global production frontier, innovation is a broader concept, which includes the introduction of new or improved products and processes. It can be in the form of improvements in technical specifications, components and materials, software development, design, user-friendliness, and other functional characteristics of existing goods and services (OECD Frascati Manual, 2015). It can also entail new or significantly improved production and delivery methods, such as the automation of work or organisational improvements through software to manage inventories or improve delivery. This will be considered to be innovation, even when it is only new to the firm but not necessarily to its market.

Firms can be classified under different innovation profiles based on investment research and development (R&D) and innovation activities. Following Veugelers et al (2019), the five innovation profiles are: basic firms that do not innovate; adopting firms; developers; incremental innovators; and leading innovators (Table 3). Basic firms do not invest in R&D (neither in-house nor acquired from other firms) and do not introduce new or improved products. Adopters do not invest in R&D but introduce new or improved products by adapting innovation developed elsewhere. Developers invest in R&D but do not (yet) introduce new products. The difference between incremental and leading innovators is based on whether the new or improved products are also new for the firm's main market – as opposed to being new only to the firm but not to its competitors in the same market.

Table 3
Innovation profiles

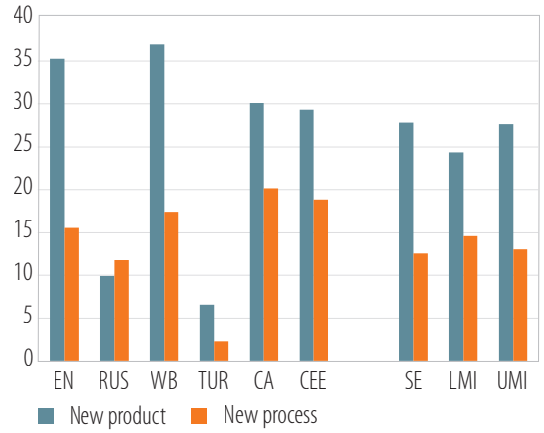


Around two-fifths of firms in the region invest in innovation, positioning them above the economies of comparable lower- and upper-middle-income countries (at around one-third). In addition to the product innovators (around 31% of firms), there are also 17% of firms that are introducing processes that are new or significantly improved (Figure 11).[9] The majority of the firms in all sub-regions are not engaged in any type of innovation activity (Table 3 and Figure 12). The share of firms that innovate by introducing new or improved products through the adoption of existing technologies developed elsewhere (the adopters) range from 17% in Central Asia to 25% in the Western Balkans – Russia and Turkey lag considerably, with shares of 6% and 2%, respectively. While a relatively low share of firms engage in innovation by both investing in R&D and developing new products, most of them report that the new or improved products are new to their main market, and not only to their firm.

The adoption of new products and processes is particularly important for emerging markets and developing economies, where firms have considerable room for improvement relative to the technological frontier. The adoption and adaptation of technologies developed elsewhere is the fastest way to catch up with more advanced economies (Hausmann and Rodrik, 2003). Investing in R&D activities could even allow them to move up the value added scale and close the gap with developed economies. The low share of innovative firms in Russia and Turkey is noteworthy: 80% of Russian and 87% of Turkish firms do not introduce new products and do not invest in R&D. This could be explained mainly by cyclical factors, although some structural problems may also persist, most notably due to the worsening financing constraints and a deterioration in the business environment given the financial and economic crises since 2018, which discouraged firms to invest and innovate.

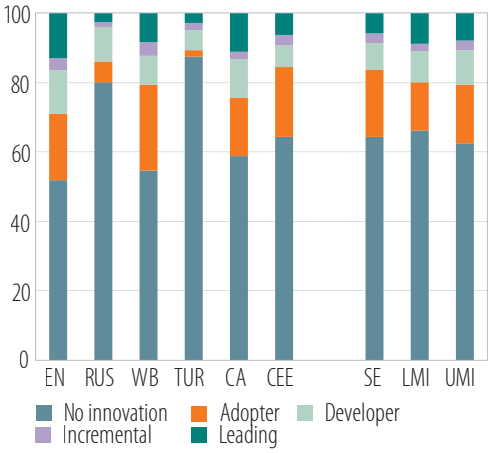
9 Firms can introduce product and process innovations at the same time. The definition of innovation profiles in Table 3 and Figure 12 only focus on product innovation. In the rest of this chapter, innovators are firms that invest in R&D or introduce new products or processes.

Figure 11
Innovation rates (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*

Figure 12
Innovation profiles (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Innovation profiles are defined in Table 3.*

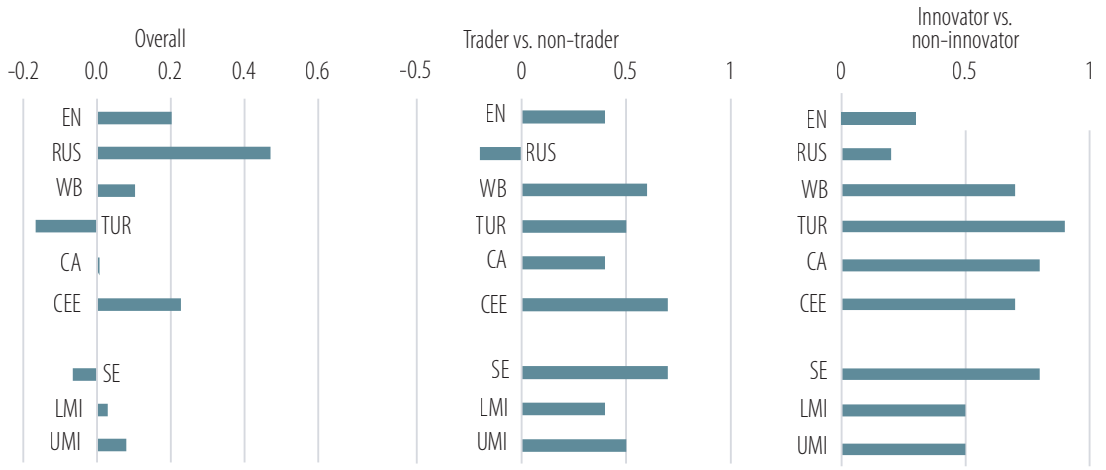
The availability of a qualified labour force and the quality of management practices are critical for improving firm productivity and competitiveness. Various studies show that there is a strong correlation between the quality of management practices, investment in innovation and firm performance in the region (Bartz-Zuccala et al, 2018; Veugelers, 2011). Furthermore, the lack of management skills has been shown to be one explanation for the lower performance of state-owned firms (Bloom et al, 2012; Estrin et al, 2009; Brown et al, 2006).

Enterprise Survey data show that, on average, firms that invest in innovation and engage in trade are better managed. The survey includes detailed questions on core management practices related to addressing problems arising in operations, monitoring of performance indicators, production targets and incentives rewarding staff performance.[10] This information is summarised in a normalised management index, where a higher score reflects better practices. Firms engaging in trade or investing in innovation clearly have higher scores in all sub-regions – with the exception of traders in Russia (Figure 13).[11] The average difference in the index between traders and non-traders across countries is highest in Central and Eastern Europe. In the other sub-regions, this difference is similar to those in upper- and lower-middle-income countries. Furthermore, compared with similar economies, the average difference between innovators and non-innovators is particularly high in Central Asia and Turkey.

10 The question on operations focuses on how the firm takes action when a problem in the production process arises. The question on monitoring covers the number of performance indicators. The questions on production targets (such as production volume, quality, efficiency, waste or on-time delivery) focus on the time frame for production targets and the difficulty of achieving them, as well as the awareness of managers and staff workers. The questions on incentives cover criteria for performance bonuses for managers, promotion practices for non-managers and measures to address under-performance of non-managers.

11 The evidence for Russia is in line with the results of Schweiger and Friebel (2013), who find that management practices explain relatively little in terms of firm performance in the country.

Figure 13
Management practices (z-score)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note : *The z-score is based on management practices in the areas of operations, monitoring of performance indicators, production targets, and incentives rewarding staff performance. Only manufacturing firms with at least 20 employees were asked all these questions. The scores of the four different management practices are converted into z-scores, by normalising each practice so that the mean is 0 and the standard deviation is 1. The management index is based on an average of the z-scores of the four management practices.*

2.4. International trade and innovation

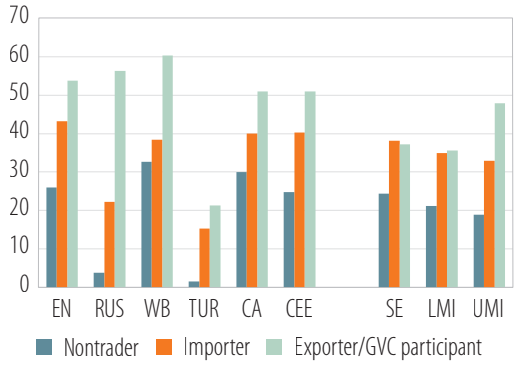
International trade and innovation are strongly intertwined, as both can be considered drivers of firm productivity and competitiveness. On the one hand, innovation and managerial quality have a direct impact on the quality of output, allowing firms to compete and survive on global markets. On the other hand, access to international markets, and especially to a globalised system of production through GVCs, opens up new ways for firms to learn from trade partners and improve their productivity further (Banh et al, 2020; Benkovskis et al, 2017).

Two main mechanisms involving the interplay between trade and innovation can be distinguished in the literature: self-selection into trade; and learning-by-exporting. The direction of the causal relationship is also key. The idea of a self-selection process argues that only the most productive firms are able to cover the sunk costs of exporting and engage in trade (Bernard et al, 2012; Wagner, 2007; Melitz, 2003). Trade participation requires significant and continuous investment in innovation, which may also influence the degree of internationalisation (Teruel et al, 2021). For example, the use of new technologies can enable new marketing and sales channels or reduce costs related to entry into foreign markets – factors that hamper smaller firms with limited resources. Lowering the cost of entry into trade can make the selection process work more efficiently. More firms will be able to compete with international counterparts, while the least productive firms, faced with expanded competition from home and abroad, will exit the market.

The idea behind the learning-by-exporting mechanism is that exporters gain knowledge from exposure to foreign markets and practices, allowing them to grow and increase their efficiency. The presence of factors that affect entry costs into trade or preferential access to foreign markets – for example, specific regulatory barriers, the time to clear customs, and direct informal or formal payments – will make it more difficult for firms to learn from global markets, adopt new technologies and become more innovative. This is particularly true for firms that are part of GVCs and may gain knowledge from foreign partners and competitors or through reacting to the demands of foreign markets (De Loecker, 2013; Bernard et al, 2007).

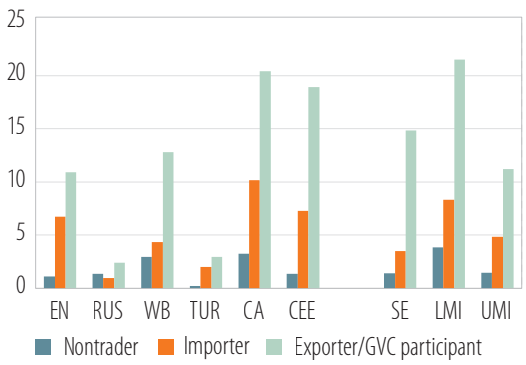
Enterprise Survey data show that firms that trade in international markets tend to innovate more. Among non-exporters, the share of innovative firms is about 30%, while it increases to close to 40% for importers (Figure 14). Innovation is particularly prevalent among exporters and participants in GVCs, where the majority of firms introduce new products and processes in all regions (with the exception of Turkey). Unsurprisingly, foreign ownership is also strongly associated with participation in GVCs (Figure 15). When the right conditions are in place, attracting FDI fosters investment in new or improved products and processes, and participation in GVCs tends to increase the quality of exports and stimulate product upgrading (Javorcik et al, 2017; Harding and Javorcik, 2012).

Figure 14
Innovative firms (percentage of firms), **by trading profile**



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Innovative firms are defined as those investing in R&D or introducing new products or processes.*

Figure 15
Foreign-owned firms (percentage of firms), **by trading profile**



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Foreign-owned firms are defined as those with foreign ownership of more than 10%.*

Firms trading in international markets tend to invest more in R&D and to renew machinery and equipment. Compared with non-traders (firms that do not trade or are only importers), they tend more often to introduce new or improved products that are new to their main market, suggesting that they develop more innovation (Table 4). Similarly, they are more likely to invest in R&D and to upgrade machinery and equipment. In turn, imports of materials and machinery may also increase productivity of firms, as it often accompanied with investment in skills and further process innovation (Halpern et al, 2015).

Table 4
Investment in new or improved products and processes, R&D, and machinery and equipment upgrades (percentage of firms)

	Innovation type		R&D and machinery and equipment upgrades	
	New to the firm	New to the market	R&D investment	Machinery and equipment upgrades
Traders	12.1	20.6	24.4	44.8
Non-traders	6.8	13.5	12.0	38.5

Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*

At the firm level, participation in GVCs is strongly associated with innovation activities, foreign ownership and the use of foreign licensed technology. Innovation is positively associated with participation in GVCs across all sub-regions – as it is in regression analysis that controls for the effects of country, sector and additional firm characteristics (Table 5). Innovators are on average 5% more likely to be participants in GVCs. Foreign ownership and the use of foreign licensed technology (excluding office software) are also positively related to participation in GVCs, but there is some variation across sub-regions: for example, foreign ownership matters for firms in Central and Eastern Europe and the Western Balkans. Larger firms are more likely to participate in GVCs (although for Turkey is not significant). In this analysis, controlling for size is important, as larger firms are also more likely to use foreign licensed technology, use a website, have recently upgraded their machinery or use international quality certification (Figures A.2 to A.5 in the Annex).

Table 5
Determinants of participation in GVCs

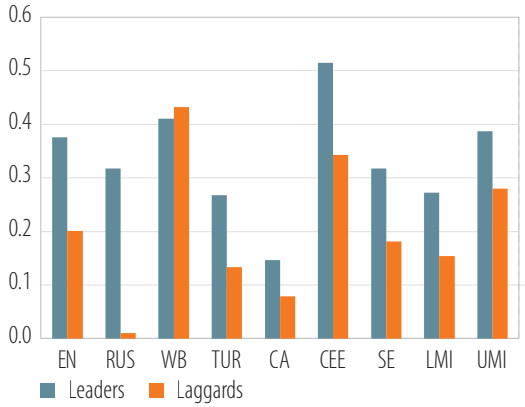
	All	EN	RUS	WB	TUR	CA	CEE
Innovation	0.055***	0.053***	0.100***	0.075***	0.061**	0.026	0.049***
	(0.011)	(0.020)	(0.030)	(0.027)	(0.026)	(0.019)	(0.019)
Foreign ownership	0.080***	0.041	-0.042	0.121***	0.036	0.021	0.108***
	(0.017)	(0.029)	(0.052)	(0.041)	(0.070)	(0.030)	(0.032)
Foreign licensed tech	0.037***	0.012	0.100***	0.010	0.019	0.055**	0.058**
	(0.014)	(0.027)	(0.029)	(0.030)	(0.038)	(0.027)	(0.025)
Firm size	0.034***	0.025***	0.024**	0.041***	0.014	0.020**	0.049***
	(0.004)	(0.008)	(0.010)	(0.010)	(0.012)	(0.010)	(0.008)
Observations	16,479	3,278	1,015	1,640	1,351	2,932	5,775

*Note: Marginal effects from logit estimation using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firm size is defined as the log of number of employees. Other firm characteristics included in the regression but not reported in the table include: country, industry, binary variables for whether the firm was formally registered when it began operations, whether the firm has a written business strategy with clear key performance indicators, whether the top manager is female, whether annual financial statements are checked and certified by an external auditor, whether the firm is a young firm (under five years old), and the years of experience of the top manager (in log).*

Confirming the idea of self-selection into trade, firms engaging in exporting tend to be more productive. To explore the link between trade participation and productivity, productivity leaders (or frontier firms) are defined as firms in the top 90th percentile of the distribution of labour productivity, while laggards are in the bottom 10th percentile. In most regions, productivity leaders are almost twice as likely to be involved in international trade. The Western Balkans and Turkey are the only regions where, on average, exporters are not significantly more productive than non-exporters (Figure 16). Similarly, productivity leaders are more likely to use foreign licensed technology, except in Turkey (Figure 17).[12] This highlights the role of foreign licensed technologies in improving productivity.

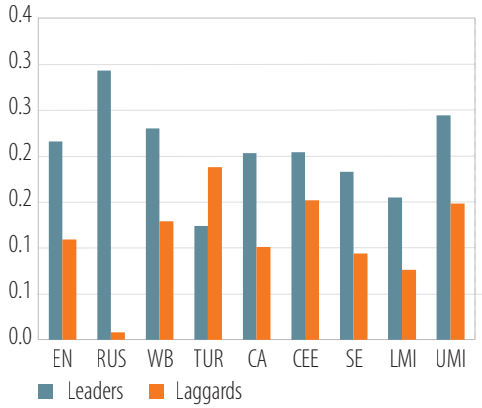
12 The regression estimates corresponding to Figures 16 and 17 are reported in Tables A.4 and A.5 of the Annex.

Figure 16
Exporting (percentage of firms), **by productivity level**



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Predicted probability of being an exporter for firms at the top 90th percentile (leaders) or bottom 10th percentile (laggards) of the productivity distribution. The logit regression also controls for the effects of country, industry, firm size and foreign ownership. The sample only includes manufacturing firms. Exporting firms also include GVC participants.*

Figure 17
Use of foreign licensed technology (percentage of firms), **by productivity level**



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Predicted probability of using foreign licensed technology for firms at the top 90th percentile (leaders) or bottom 10th percentile (laggards) of the productivity distribution. The logit regression also controls for the effects of country, industry, firm size and foreign ownership. The sample only includes manufacturing firms.*

Firms that trade and innovate at the same time tend to be much more productive than other firms. There are significant productivity and firm size premiums associated with trade participation (Table 6).[13] Traders are on average 14% more productive and 20% larger than non-traders. But the premiums are even higher for firms that trade and innovate at the same time (increasing by 28 and 51 percentage points, respectively). In addition, innovative firms tend to have higher sales growth on average by 30%, but this association is even larger for firms that also participate in trade (increasing by 18 percentage points). In line with the self-selection hypothesis, there is a concentration of large, productive and innovative firms that are able to compete and grow on the international market.

Table 6
Productivity, size and growth of sales premiums of traders and innovators

	(1) Productivity	(2) Firm size (log)	(3) Sales growth
Trader	0.141**	0.200***	0.041
	(0.066)	(0.052)	(0.097)
Innovation	0.029	0.238***	0.299**
	(0.098)	(0.072)	(0.152)
Trader & innovation	0.283***	0.511***	0.184*
	(0.082)	(0.053)	(0.101)
Observations	8,390	8,390	6,672

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country, industry, a binary variable whether the firm is foreign-owned, firm size (included as explanatory variable in columns 1 and 3) and labour productivity (in column 2).*

13 The estimates corresponding to Table 6, but for each sub-region separately, are reported in Tables A.6, A.7 and A.8 in the Annex.

To analyse the learning-by-exporting effect, it needs to be asked whether trade participation has a causal effect on innovation, which is not obvious. Box 1 discusses two different estimation methods that can be used to control for endogeneity between international trade and innovation and mitigate the potential sample selection bias (based on observable firm characteristics, including labour productivity) between trading and non-trading firms. The results reported in Table 7 suggest that trade participation has a positive effect on innovation.

Box 1

Effects of trade on innovation activity

The effect of internationalisation on the probability of being innovative is estimated using the following equation:

$$Prob(Innovator)_i = \beta_1 Trader_i + \beta_2 X_i + \varepsilon_i$$

The dependent variable is a binary taking value 1 if the firm i is an innovator – defined as a firm that introduces new or improved products and processes or invests in R&D. Trader is a binary variable taking value 1 if the firm participates in trade – by importing, exporting or participating in GVCs – and X is a set of explanatory variables, which includes various firm characteristics, country and sector fixed effects, and is a disturbance term. The firm characteristics include: binary variables for whether the firm was formally registered when it began operations; whether the firm has a written business strategy with clear key performance indicators; whether the top manager is a woman; whether annual financial statements are checked and certified by an external auditor; whether the firm is a young firm (under five years old); and the years of experience of the top manager (in log).

To address the endogeneity issues of omitted variable bias and reverse causality, which cannot be addressed directly, two indirect approaches are taken: coarsened exact matching (CEM); and propensity score matching with overlapping covariates.

CEM is a non-parametric estimation method that establishes a covariate balance between treated and control units (Lamperti et al, 2017; Iacus et al, 2012; Blackwell et al, 2009). It creates different strata based on the covariates *X* included in the analysis. CEM thus meets the congruence principle and restricts the matched data to areas of common support. The results are reported in column (2) and confirm that trade participation has a positive effect on innovation.

Propensity score matching with overlapping covariates aims to compare traders and non-traders with otherwise similar characteristics (following the method described in Imbens and Wooldridge, 2009). As in CEM, the exercise consists of two steps: first, a logit regression is run to express the conditional probability of being a trader using productivity as an ancillary variable. In a second step, after having obtained the propensity score for each firm, the sub-sample of traders is trimmed by excluding the top quartile of the propensity score distribution for traders. Similarly, non-traders in the bottom quartile of their prospective score distribution is dropped. As a result, the number of firms included in this second step is lower. This estimation confirms the CEM results of a positive and significant effect of trade on innovation.

Table 7
Trade as a driver of innovation

	(1) Innovation (Logit)	(2) Innovation (CEM)	(3) Trader	(4) Innovation (trimmed)
Trader	0.117***	0.125***		0.071**
	(0.016)	(0.016)		(0.029)
Productivity			0.029***	
			(0.009)	
Foreign ownership	-0.023	0.011	0.159***	0.044
	(0.028)	(0.021)	(0.052)	(0.044)
Foreign licensed tech	0.175***	0.136***	0.127***	0.184***
	(0.020)	(0.012)	(0.028)	(0.031)
Firm size	0.034***	0.016***	0.041***	0.042***
	(0.006)	(0.005)	(0.010)	(0.011)
Observations	16,515	12,285	8,133	8,091

Note: *Marginal effects from logit estimation using sampling weights. Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Labour productivity is used as an ancillary variable both for CEM (column 2) and propensity score matching with overlapping covariates (columns 3 and 4). Firm size is defined as the log of number of employees. Other firm characteristics included in the regression but not reported in the table include: country, industry, binary variables for whether the firm was formally registered when it began operations, whether the firm has a written business strategy with clear key performance indicators, whether the top manager is female, whether annual financial statements are checked and certified by an external auditor, whether the firm is a young firm (under five years old), and the years of experience of the top manager (in log).*

2.5. The European Union as a trade facilitator and driver of innovation

The European Union acts as a trade facilitator for firms in Eastern Europe and Central Asia, especially for participants in GVCs and innovative firms. Trade integration with EU markets for these countries can be boosted by engaging with higher value added sectors (Bussière et al, 2005). To understand the determinants of exports to the European Union by firms in the region, there is the workhorse tool of gravity models (see Box 2 for a discussion of the methodology). The results confirm the two key standard findings of gravity equations, namely the evidence on the negative association between trade flows and geographical distance, and the positive association with the level of GDP in the destination country (Table 8). The results also confirm that innovative firms and participants in GVCs tend to trade more than other firms.

The European Union is a key trading partner for firms in the region. Firms that export to EU markets tend to export much more than firms exporting elsewhere (Table 9). This may be expected due to the relatively large size and high level of income of the European Union as a destination market. But the European Union is also more likely to attract trade from innovative firms and sectors (Table 9).

Box 2

A gravity model of trade combining bilateral data on trade flows and the Enterprise Surveys

First introduced by Tinbergen (1962), gravity equations analyse the determinants of bilateral trade flows taking account of geographical distance between trading partners. The general form of a structural gravity model follows Anderson and van Wincoop (2003). After controlling for size (proxied by GDP), bilateral trade between exporter i and importer j depends on bilateral trade barriers between i and j, relative to the product of their multilateral resistance terms, that is, the average trade barrier each country/region has with the rest of the world. Bilateral trade barriers may be determined by various factors, including trade agreements, institutions, geographical proximity, cultural similarities and historical bonds (Head and Mayer, 2014; Dhingra et al, 2017).

A gravity model is developed to study the determinants of exports, by the traditional bilateral trade barriers, but also taking account of the role of innovation and GVC participation, with the following equation:

$$\ln(exports_{ijk}) = \alpha_i + \alpha_j + \alpha_k + \beta_1 innovator_{ik} + \beta_2 GVC_{ik} + \gamma_1 distance_{ij} + \gamma_2 commonlang_{ij} + \gamma_3 contiguity_{ij} + \varepsilon_{ijk}$$

$\alpha_i, \alpha_j, \alpha_k$ are importer, exporter, and sector fixed effects respectively. $innovator_{ik}$ is a binary variable taking value 1 if a firm in sector *k* and country *i* is an innovator, and GVC_{ik} is a binary variable taking value 1 if the firm is a GVC participant. $distance_{ij}$, $commonlang_{ij}$, $contiguity_{ij}$ are proxies of bilateral trade barriers indicating the log-weighted distance between country *i* and country *j*, whether they share their official language and whether they have a common border.

In the analysis, Enterprise Survey firms are matched to BACI data at the industry level, which provides disaggregated data on bilateral trade flows for more than 5000 products (that were reclassified in industry) and 200 countries (Gaulier and Zignago, 2010). The information on whether firms trade is from the Enterprise Survey, while the information on bilateral trade flows varies across industries.

Table 8

Gravity estimation: determinants of exports

	Dependent variable: ln(exports)			
	(1)	(2)	(3)	(4)
Firm is an innovator	0.587***		0.353***	0.374***
	(0.071)		(0.072)	(0.075)
Firm is a GVC participant		1.399***	1.342***	1.310***
		(0.071)	(0.073)	(0.075)
(Log of) GDP per capita of destination country				0.107**
				(0.044)
(Log of) distance	-0.312***	-0.313**	-0.330***	-0.035
	(0.121)	(0.124)	(0.123)	(0.049)
Common border for trading partners	0.074	0.034	0.029	0.141
	(0.121)	(0.119)	(0.119)	(0.096)
Common official/primary language	0.369	0.362	0.364	0.269
	(0.253)	(0.249)	(0.249)	(0.210)
Observations	13,201	13,015	12,927	12,798
R-squared	0.277	0.324	0.330	0.292

Note: *OLS regressions with sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Only the top five export destinations are used for the estimation. The regression control for sector, exporting country, and importing country fixed effects.*

Table 9
Gravity estimation: determinants of exports

	Dependent variable: *ln(exports)*		
	Full sample	Only non-innovators	Only innovators
EU = 1	0.288***	0.228*	0.291***
	(0.089)	(0.131)	(0.090)
(Log of) distance	-0.058	-0.041	-0.118
	(0.074)	(0.091)	(0.085)
Common border for trading partners	-0.070	-0.109	-0.0479
	(0.141)	(0.129)	(0.146)
Common official/primary language	0.445*	0.362*	0.445*
	(0.243)	(0.199)	(0.245)
Observations	12,684	4,297	8,300
R-squared	0.226	0.309	0.286

Note: *OLS regressions with sampling weights. Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Only the top five export destinations are used for the estimation. The regression control for sector fixed effects, and for the big countries, such as Russia, China and USA, while the omitted variable is the rest of the world.*

2.6. COVID-19 adaptability of innovators and traders

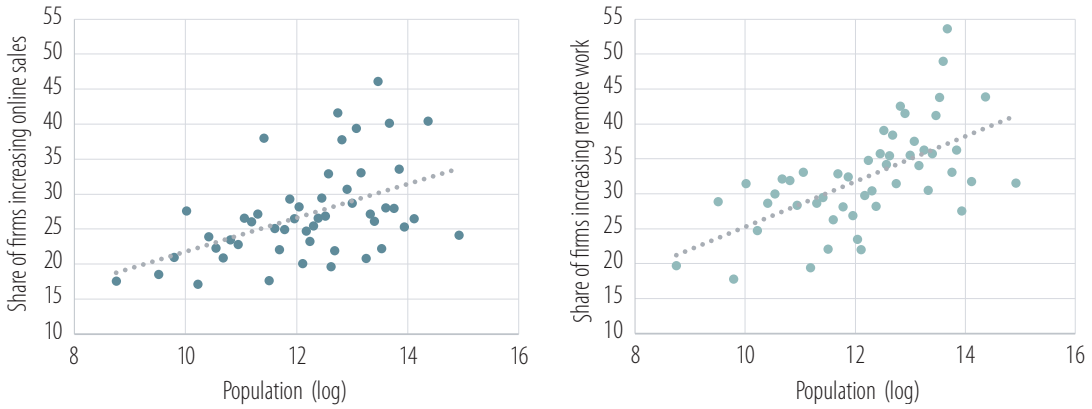
The COVID-19 crisis has led to wider recognition of the importance of innovation and digital transformation. Until recently, the implementation of digital technologies was considered an important contributor to market success and usually associated with the most innovative and modern companies. But the pandemic has made the digital transformation an integral part of many firms' survival. Digitalisation is indispensable to preventing business disruption, organising work remotely, improving communication with customers, suppliers and employees, and selling products and services online. Despite its strong negative impact on business activity, which may accelerate structural changes, the COVID-19 crisis may also be a driver of positive transformation towards a new normal, where flexibility, innovation and digital technologies will be of even greater importance for firms' competitiveness.

As a response to the COVID-19 crisis, traders and innovators are more likely to adapt better. Traders were more likely to start or increase remote working arrangements and adjust production compared with non-traders. Similarly, innovative firms were more likely to start or increase remote work, and to adjust production.[14] Location-based analysis shows that firms located in areas with higher population density tend to adapt faster (see Box 3). Areas with a higher share of traders and innovators also had a higher share of firms that started or increased online sales and remote working arrangements – even after taking account of the differences across countries and industries (Figure 18). The results highlight the importance of supporting ICT infrastructure, education and training activities in facilitating innovation in less populated areas. This may be explained by the availability of digital infrastructure, which is reflected in the higher share of firms having their own website. Moreover, the share of innovative firms tends to be higher in areas with higher population density, confirming the concentration of innovation clusters and hubs in higher populated areas, where a skilled workforce is easier to access (Figure 19).

14 See Chapter 1 for in-depth analysis of the impact of COVID-19 on the private sector.

Figure 18

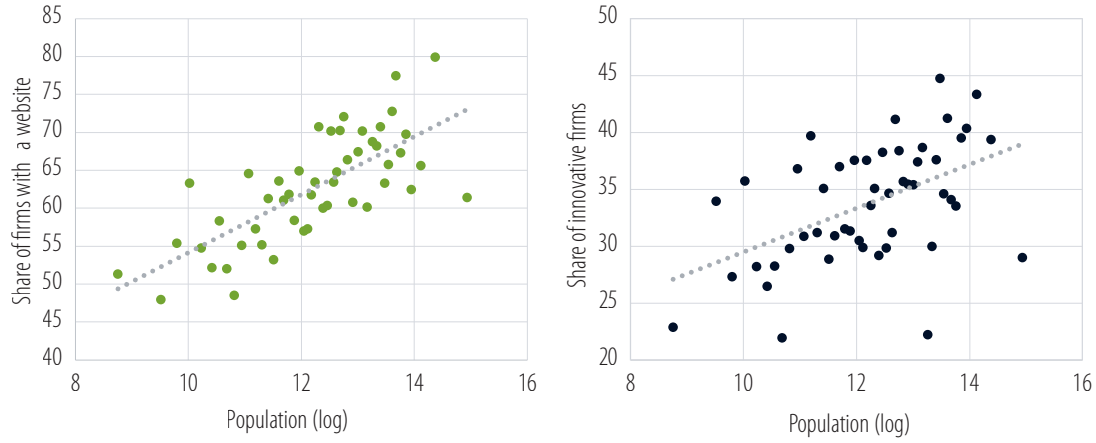
COVID-19 adaptability: increasing online sales and remote work arrangements, by population density



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note : *For visualisation purposes, the figures show binned scatterplots using 50 bins each accounting for 200 observations.*

Figure 19

Digital infrastructure and innovation rate, by population density



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *For visualisation purposes, the figures show binned scatterplots using 50 bins each accounting for 200 observations.*

Box 3

Location-based development measures

Location-based analysis indicates that firms in areas with higher population density tend to adapt faster. Socioeconomic data for sub-national administrative regions, such as provinces, districts or municipalities, are unavailable for most developing countries – and if they exist, they are often of poor quality. The lack or poor quality of the data has hindered attempts to understand economic growth, poverty, health status and environmental quality in these countries. In the absence of reliable sub-national data, economists and social scientists have started to use alternative measures to proxy local economic activity in studies of economic growth and development. One such measure is luminosity: measures of night-time light visible from space calculated using weather satellite recordings (Chen and Nordhaus, 2011).

The approach uses Visible Infrared Imaging Radiometer Suite (VIIRS) satellite images, collected by the NOAA and NASA. In this analysis, the data consist of annual average night-time light densities for 2016, which contain cloud-free average emitted radiances. First, using their geo-coordinates, Enterprise Survey firms are mapped at the smallest level of administrative units. Second, raster values for night-time light are extracted by masking the shape files of the areas of interest. Finally, mean night-time light raster values are assigned to the survey firms to proxy for local economic development. Night-time light raster values are higher in Central and Eastern Europe, the Western Balkans and Turkey, while they seem to be much more concentrated in a few areas in the Eastern Neighbourhood, Russia and Central Asia (Figure B3.1).

The previous literature shows that night-time light can be used as a relatively good proxy for variables such as urbanisation, city dynamics, population movements, GDP per capita and other development indicators at the sub-national level.[15] In line with the previous literature, these results show that night-time light is positively associated with urbanisation, measured as the distance-weighted population (in logs) of nearby urban centres (Figure B3.2).[16]

The study proxies the level of local development using night-time light or urbanisation, and explores its association at the local level with innovation and trade participation.[17] Furthermore, it investigates whether firms located in more developed regions are able to adapt faster to shocks, such as the new business circumstances of the pandemic – that is, whether firms started or increased online sales and adopted remote working structures.

Figures 18 and 19 use population density as a proxy for local economic development. Table A.9 in the Annex reports the estimates of regression analysis using night-time light as an alternative measure. The results are very similar when using either population density or night-time light, as they are both strongly associated with COVID-19 adaptability or innovation.

15 Night-time lights have been used in a variety of studies, such as gross domestic product estimation (Ghosh et al, 2010; Sutton, Elvidge and Gosh, 2007), economic decline detection (Li et al, 2017) and human well-being measurement (Ghosh et al 2013).

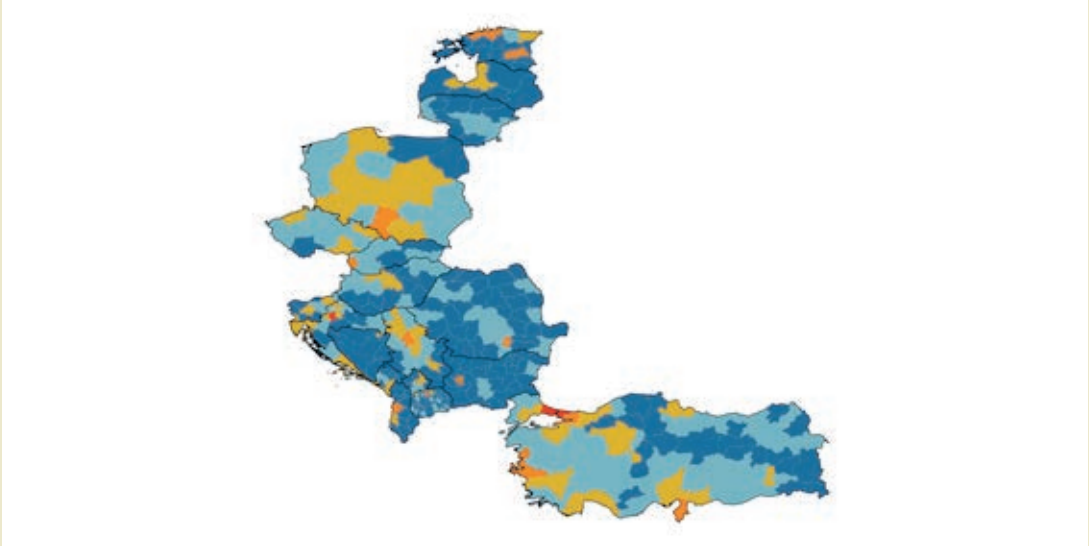
16 Our source for the population of urban centres is the Basic World Cities Database from Simplemaps.com.

17 See Bircan and De Haas (2020) for location based credit market analysis of identifying the impact of bank lending on innovation activities of Russian firms.

Figure B3.1

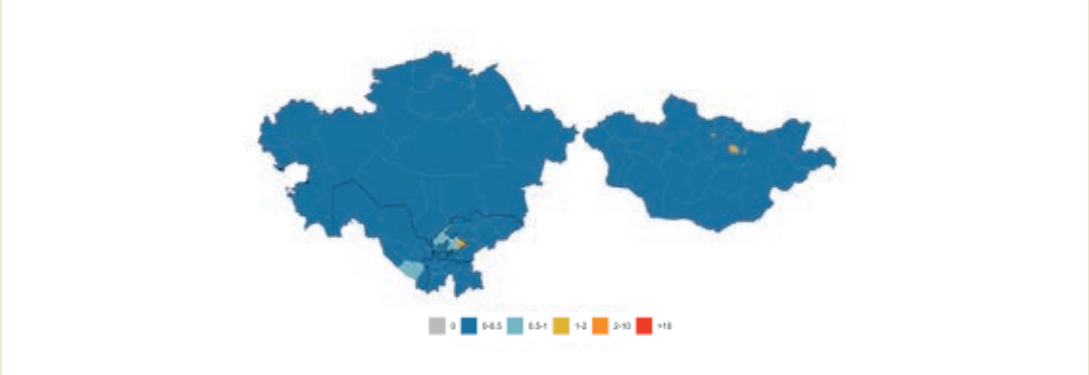
Night-time light density in Eastern Europe and Central Asia

Central and Eastern Europe, Western Balkans and Turkey



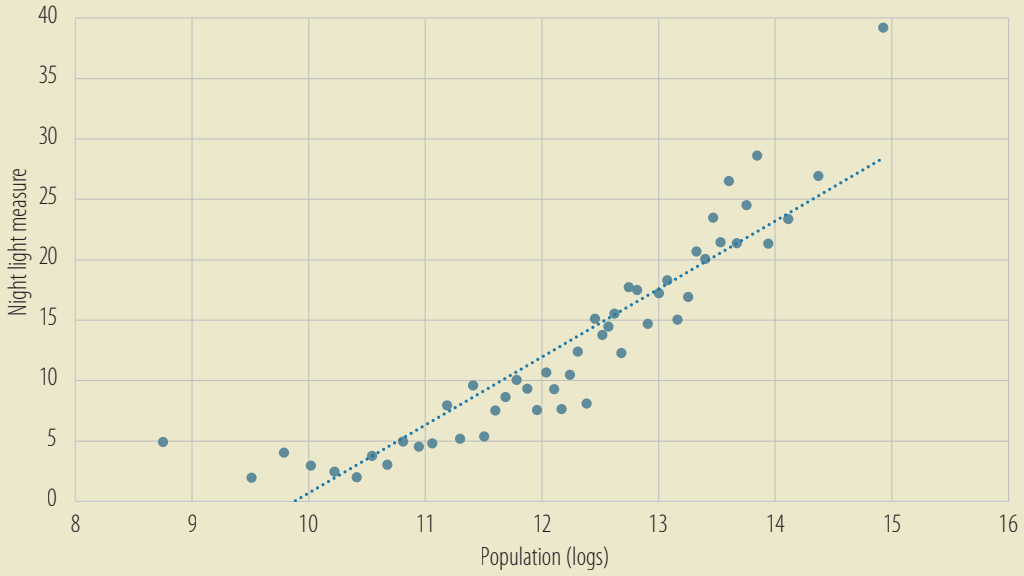
Eastern Neighbourhood and Russia

Central Asia



Source: *Authors' calculations based on NOAA/NASA.*
Note: *Values corresponds to night-time light radiances. For visualisation purposes, radiances are grouped into five different categories.*

Figure B3.2
Association between night-time light and population density

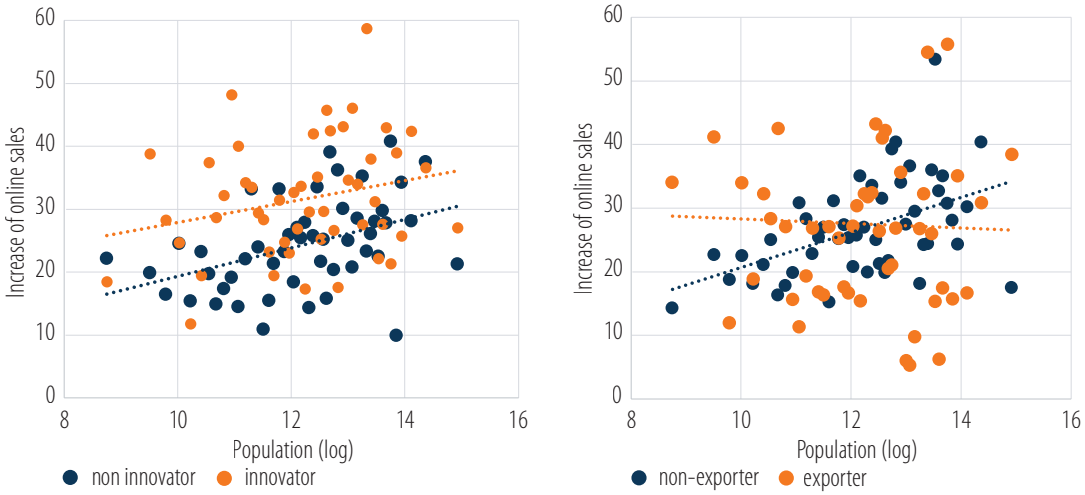


Source: *Authors' calculations based on NOAA/NASA and Basic World Cities Database.*
Note: *Population is calculated as the inverse distance weighted average (log) population of closest urban centres. For visualisation purposes, the figure shows binned scatterplots using 50 bins each accounting for 460 observations.*

As a response to COVID-19, population density plays an important role: regardless of their innovativeness, firms close to large urban areas were more likely to take action to adapt to the crisis (Figure 20 and Figure 21). For exporters, the distance from dense urban areas plays a less critical role in increasing online business activity, presumably because their destination market is the international market via well-established networks (Figure 20). In contrast, firms that do not export and which focus on traditional channels – because they sell their products and services in local and domestic markets – were much more in need of alternative business solutions. A rapid switch to online sales and business activity was possible for firms that already had their own website. In terms of the introduction of remote work arrangements, exporters were better able to adapt, which may be related to their location (close to dense urban areas or not), presumably because digital infrastructure and connectivity are a precondition for such arrangements.

Figure 20

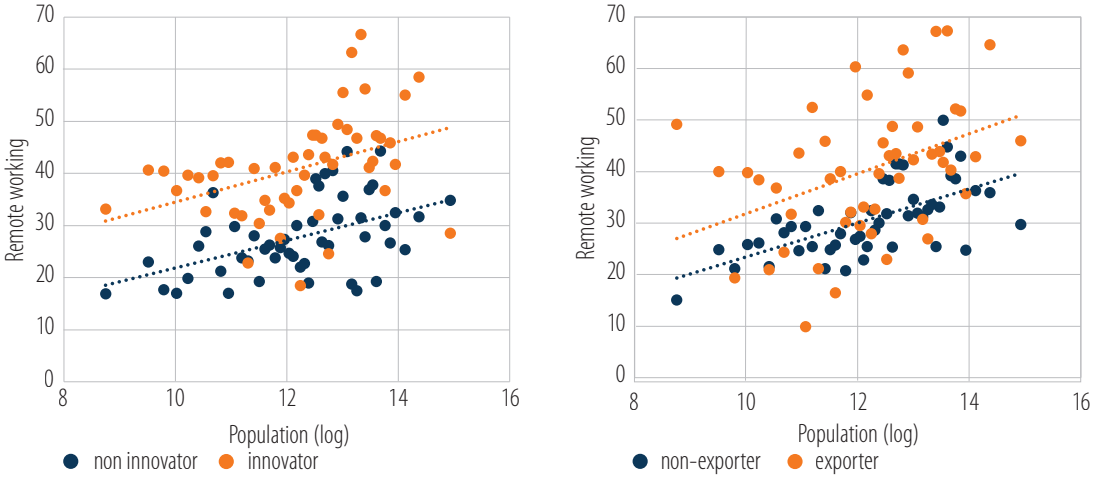
COVID-19 adaptability: online sales by innovation and trading profile



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *For visualisation purposes, the figures show binned scatterplots using 50 bins each accounting for 130 observations for non-innovator, 70 for innovators, 160 for non-exporters and 40 for exporters.*

Figure 21

COVID-19 adaptability: remote working by innovation and trading profile



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *For visualisation purposes, the figures show binned scatterplots using 50 bins each accounting for 130 observations for non-innovator, 70 for innovators, 160 for non-exporters and 40 for exporters.*

2.7. Conclusions and policy implications

The analysis in this chapter shows that firms participating in international trade, in particular in GVCs, are more innovative, better managed and more productive. Moreover, there is a strong positive correlation between firm size and trade participation, which highlights the role of scale economies and competitiveness in foreign markets. The productivity gains associated with trade participation are driven by very large firms and superstar exporters – while small firms tend to be less productive, regardless of whether they participate in trade. Small traders may lack incentives to expand but still have incentives to continue to trade while being less efficient. Besides the superstar traders, the winners from trade in terms of productivity gains and innovation are firms that get access to foreign technology.

The economies of the region generally invest more in innovation activities than comparator economies, even though the innovation process is led by adapting new technologies developed elsewhere. Innovation and trade are closely intertwined. Innovative firms tend to be more productive when they trade, while exporters tend to grow faster (in terms of sales) when they also invest in innovation. Innovation and trade are thus closely intertwined and both are necessary elements to improve firms' competiveness. Trade integration with developed economies, in particular the European Union, access to information and know-how through participation in GVCs, foreign licensed technology and modern management practices are among the most important ingredients for boosting innovation.

Innovativeness and connectivity to international markets are critical for faster adaptation, greater resilience and coping better with economic shocks such as the COVID-19 crisis. Innovation activities also depend on the places in which firms are located, such as more populated urban centres, where digital infrastructure and skilled labour are available. Innovative and trading firms adapted better than non-innovative and non-trading firms located in the same areas. This highlights the role of the business and operating environment, including digital infrastructure and education, in boosting innovation at the local level.

Taken together, these findings suggest several measures that policymakers might implement to accelerate economic development, by improving productivity through deeper trade integration and increasing incentives to invest in innovation. First, improving customs and trade regulations, which will lower entry costs for firms to engage in trade, will increase access to international markets for a larger share of firms, especially smaller ones. But these measures should not only target small firms or give preference to certain groups of firms. This may not improve competition and productivity in the economy: small traders are not more productive than firms that do not engage in trade. Instead, improving the incentives to invest in innovation, in particular for small firms, might be more effective, as small and innovative firms have higher growth prospects and better chances of surviving in international, competitive markets.

Second, a large share of firms in the region is reliant on imports, resulting in trade deficits for several economies. Policies that aim to rebalance the deficit should not introduce restrictions on imports that serve as inputs of production and intermediary goods for domestic firms, especially those participating in GVCs. Imports also make it possible for local firms that do not engage in trade and sell their products and services in the local economy to source components and parts of a better quality (or at a lower cost) than those available in the domestic market.

Third, to improve innovativeness and economic development, there should be incentives for the acquisition of foreign licensed technologies by both trading and domestic firms. To increase the participation of local firms in GVCs, reforms to the business environment, through reducing informality and political uncertainty, should be promoted: this will help to create a more stable and predictable operating environment for trading partners and foreign investors. Foreign-owned companies are more likely to be part of global trade and they are important players in the international knowledge diffusion network. Under the right conditions, they can contribute to creating local ecosystems that will connect domestic firms to indirect exports. In addition, foreign licensed technology can be accessed by non-trading, domestic firms, thereby improving their innovativeness.

Finally, policymakers should prioritise investment in digital infrastructure and facilitate improvements in management practices and workers' skills. Government could encourage intensive training programmes, in particular aimed at improving the management of SMEs and incentives to reskill the workforce, including in less well-connected areas to attract innovative firms. Combined with investment in digital infrastructure, this could help to rebalance discrepancies within the region in terms of development, and improve resilience and adaptability to shocks, such as the COVID-19 crisis.

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2.9. Annex

Table A.1

Productivity premiums of exporters (by exporters' size categories)

	EN	RUS	WB	TUR	CA	CEE
Omitted category: firms that do not export						
Superstar exporter	1.106***	0.425	0.127	1.438***	2.006***	1.159***
	(0.312)	(0.496)	(0.578)	(0.348)	(0.518)	(0.197)
Big player	0.601**	0.420	-0.268	0.837***	0.944**	0.624***
	(0.275)	(0.363)	(0.383)	(0.205)	(0.401)	(0.111)
Small player	-0.103	1.496**	-0.646	0.178	0.0268	0.201***
	(0.114)	(0.606)	(0.599)	(0.131)	(0.255)	(0.0724)
Observations	1,585	621	609	655	1,634	2,939
R-squared	0.078	0.130	0.104	0.078	0.093	0.197

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Superstar exporters are defined as firms above the 95th percentile of the distribution of export sales, big player exporters are firms between the 50th and 94th percentile, and small player exporters are firms below the median. Other firm characteristics included in the regression but not reported in the table include: country, industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.2

Size premiums of exporters (by exporters' size categories)

	EN	RUS	WB	TUR	CA	CEE
Omitted category: firms that do not export						
Superstar exporter	3.198***	3.425***	3.090***	2.837***	2.350***	3.018***
	(0.238)	(0.548)	(0.233)	(0.253)	(0.282)	(0.173)
Big player	1.077***	2.714***	1.604***	1.618***	1.724***	1.591***
	(0.274)	(0.277)	(0.182)	(0.105)	(0.319)	(0.105)
Small player	0.183	-0.518*	0.260*	0.309*	0.210	0.206**
	(0.117)	(0.267)	(0.143)	(0.171)	(0.261)	(0.0921)
Observations	1,585	621	609	655	1,634	2,939
R-squared	0.255	0.211	0.370	0.310	0.250	0.356

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Superstar exporters are defined as firms above the 95th percentile of the distribution of export sales, big player exporters are firms between the 50th and 94th percentile, and small player exporters are firms below the median. Other firm characteristics included in the regression but not reported in the table include: country, industry, a binary variable whether the firm is foreign-owned and labour productivity.*

Table A.3

Growth of sales premiums of exporters (by exporters' size categories)

	EN	RUS	WB	TUR	CA	CEE
Omitted category: firms that do not export						
Superstar exporter	0.313	-4.888***	0.737***	-1.438**	1.466***	-0.006
	(0.594)	(0.928)	(0.285)	(0.605)	(0.565)	(0.244)
Big player	-0.348	-0.093	0.138	-0.579	0.670**	0.141
	(0.518)	(0.441)	(0.235)	(0.733)	(0.323)	(0.161)
Small player	-0.415	1.669***	0.069	0.238	0.137	0.112
	(0.398)	(0.397)	(0.261)	(0.424)	(0.349)	(0.125)
Observations	938	323	799	399	1,161	2,828
R-squared	0.108	0.066	0.051	0.069	0.041	0.061

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Superstar exporters are defined as firms above the 95th percentile of the distribution of export sales, big player exporters are firms between the 50th and 94th percentile, and small player exporters are firms below the median. Other firm characteristics included in the regression but not reported in the table include: country, industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.4

Association between export status and productivity leaders, difference in expected probability, by sub-region

	EN	RUS	WB	TUR	CA	CEE
Labour productivity	7.978***	8.495*	-1.070	-3.156	3.658**	13.382***
	(2.244)	(5.136)	(3.767)	(2.952)	(1.518)	(2.146)
Observations	1,303	626	383	676	1,370	2,360

Note: *Marginal effects from logit regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.5

Association between the use of foreign licensed technology and productivity leaders, difference in expected probability, by sub-region

	EN	RUS	WB	TUR	CA	CEE
Labour productivity	5.309***	7.538	5.653*	-3.985**	4.176***	4.708**
	(1.520)	(5.552)	(3.300)	(1.879)	(1.554)	(1.931)
Observations	1,305	627	383	696	1,370	2,360

Note: *Marginal effects from logit regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.6
Productivity premium of traders and innovators, by sub-region

	EN	RUS	WB	TUR	CA	CEE
Trader	0.135	-0.260	-0.179	0.044	0.354**	0.206**
	(0.146)	(0.270)	(0.220)	(0.237)	(0.173)	(0.089)
Innovator	-0.215	-0.187	0.188	-0.352	0.043	0.126
	(0.193)	(0.515)	(0.246)	(0.430)	(0.208)	(0.147)
Trader & innovator	0.432***	0.737*	-0.173	0.015	0.495**	0.320***
	(0.157)	(0.397)	(0.305)	(0.269)	(0.201)	(0.088)
Observations	1,670	688	625	671	1,646	3,090
R-squared	0.079	0.141	0.082	0.097	0.098	0.180

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.7
Size premium of traders and innovators, by sub-region

	EN	RUS	WB	TUR	CA	CEE
Trader	0.247**	0.253*	0.481***	0.213	0.235**	0.105
	(0.121)	(0.149)	(0.166)	(0.143)	(0.111)	(0.074)
Innovator	0.378**	1.222***	0.388**	0.209	0.269**	0.063
	(0.175)	(0.431)	(0.194)	(0.277)	(0.122)	(0.102)
Trader & innovator	0.528***	0.048	0.730***	0.665***	0.420***	0.479***
	(0.116)	(0.151)	(0.132)	(0.140)	(0.115)	(0.087)
Observations	1,670	688	625	671	1,646	3,090
R-squared	0.189	0.236	0.271	0.300	0.196	0.209

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.8
Growth of sales premium of traders and innovators, by sub-region

	EN	RUS	WB	TUR	CA	CEE
Trader	0.247**	0.253*	0.481***	0.213	0.235**	0.105
	(0.121)	(0.149)	(0.166)	(0.143)	(0.111)	(0.074)
Innovator	0.378**	1.222***	0.388**	0.209	0.269**	0.063
	(0.175)	(0.431)	(0.194)	(0.277)	(0.122)	(0.102)
Trader & innovator	0.528***	0.048	0.730***	0.665***	0.420***	0.479***
	(0.116)	(0.151)	(0.132)	(0.140)	(0.115)	(0.087)
Observations	1,670	688	625	671	1,646	3,090

Note: *OLS regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned and firm size (log).*

Table A.9

Population density and night-time light (as proxies for local economic development) **and their association with COVID-19 adaptability and innovation**

	Increase online sales		Increase remote work		Firm has a website		Innovator	
Population	2.551***		3.674***		4.312***		1.980***	
	(0.661)		(0.769)		(0.480)		(0.523)	
Nightlight		1.370**		3.089***		2.670***		0.784*
		(0.545)		(0.559)		(0.437)		(0.448)
Observations	8,338	7,579	8,683	7,924	19,753	17,881	19,676	17,814

Note: *Marginal effects from logit regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned, labour productivity, and firm size (log).*

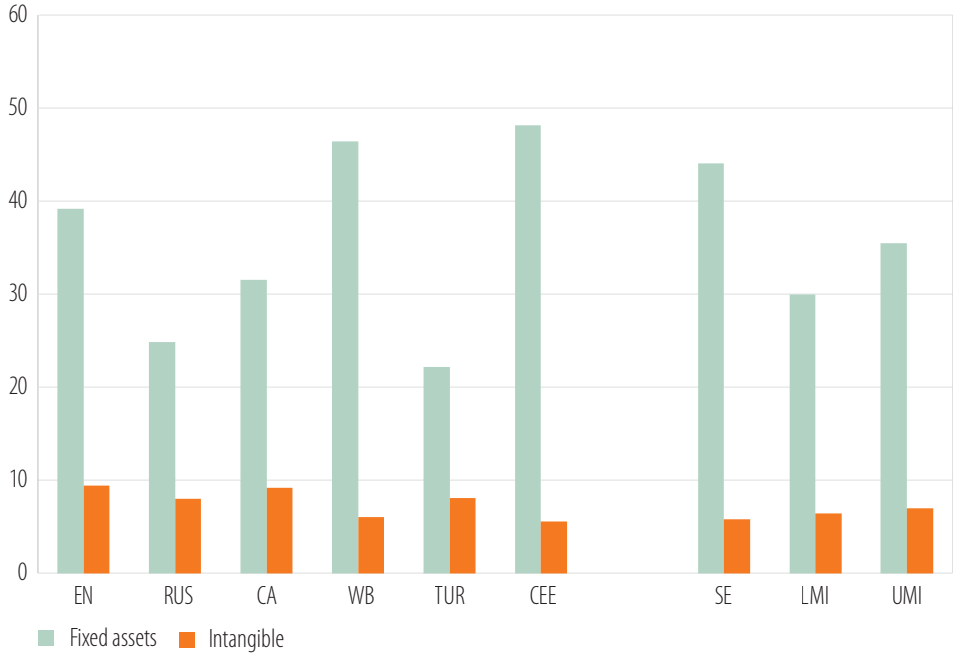
Table A.10

Population density and night-time light (as proxies for local economic development) **and their association with COVID-19 adaptability and innovation**

	Increase online sales				Increase remote work			
	Non-exporter	Exporter	Non-innovator	Innovator	Non-exporter	Exporter	Non-innovator	Innovator
Population	2.555***	1.090	2.533***	1.713	3.234***	5.630***	3.104***	3.384***
	(0.753)	(1.558)	(0.817)	(1.150)	(0.885)	(1.709)	(0.973)	(1.269)
Observations	6,484	1,809	5,011	3,270	6,753	1,884	5,296	3,330
Nightlight	1.360**	0.339	2.223***	-0.477	3.064***	2.882**	2.111***	3.902***
	(0.642)	(1.035)	(0.596)	(1.077)	(0.643)	(1.238)	(0.763)	(0.964)
Observations	5,761	1,776	4,442	3,087	6,030	1,851	4,727	3,147

Note: *Marginal effects from logit regressions using sampling weights. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Other firm characteristics included in the regression but not reported in the table include: country and industry, a binary variable whether the firm is foreign-owned, labour productivity and firm size (log).*

Figure A.1
Investment in fixed tangible and intangible assets (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*

Figure A.2
Use of foreign licensed technology (percentage of firms)

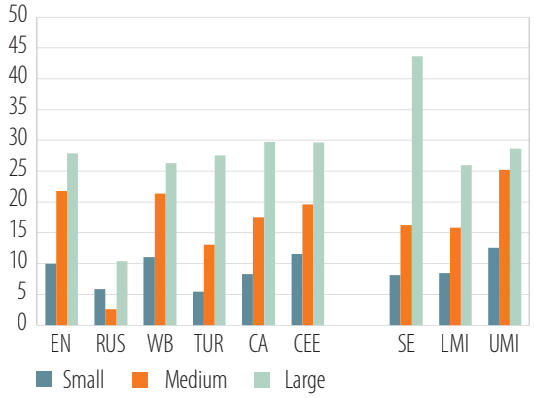
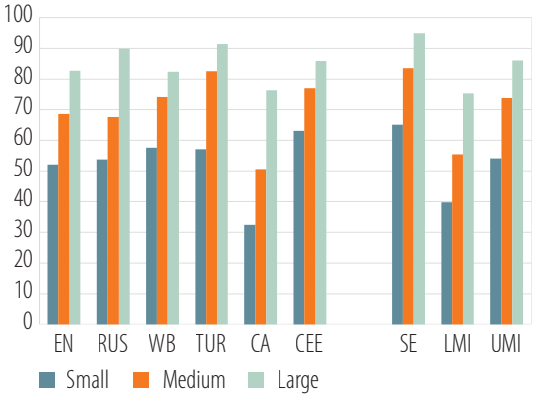


Figure A.3
Having a website (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Small: 1-19 employees; medium: 20-99 employees; large: 100+ employees.*

Figure A.4
Machinery upgrade (percentage of firms)

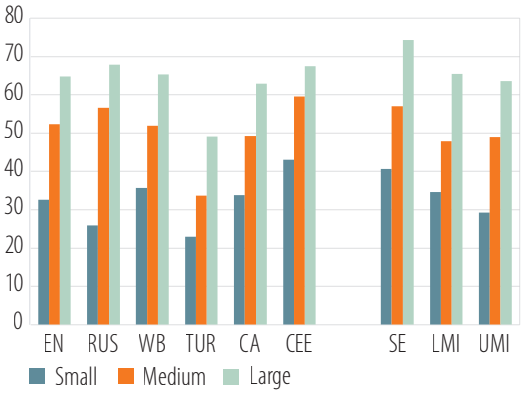
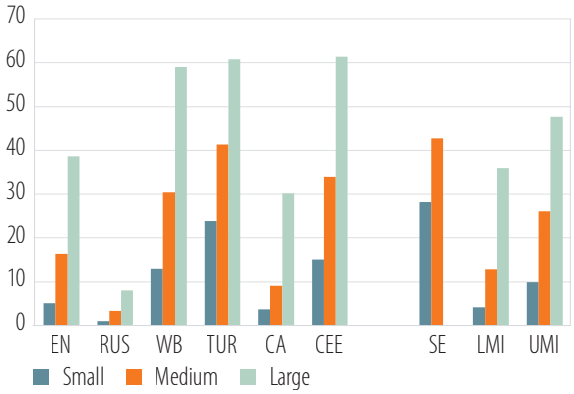


Figure A.5
Use of international quality certification (percentage of firms)



Source: *Authors' calculations based on EBRD-EIB-WBG Enterprise Survey.*
Note: *Small: 1-19 employees; medium: 20-99 employees; large: 100+ employees.*