EUROPE AND CENTRAL ASIA STUDIES

TIDES of Change

Igniting Productivity Growth in Europe and Central Asia



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Contents

Foreword *xv*
Acknowledgments *xvii*
About the Authors *xix*
Main Messages *xxiii*
Overview *xxxi*
Abbreviations *lix*

1 Drivers of Productivity Growth **1**
Productivity: Essential for Economic Growth in the Region 1
Pathways to Productivity Growth: Structural Transformation, Within-Sector Allocation, Creative Destruction, and Firm Upgrading 10
Structural Change in Europe and Central Asia 11
Productivity, Distortions, and Misallocation Within Sectors 22
Misallocation Through Enterprise Creation, Survival, and Destruction 37
Within-Firm Upgrading as a Complementary Channel to Reallocation 39
Productivity and Jobs 44
Conclusion and Policy Recommendations 51
Notes 56
References 57

2 Integration Unfulfilled: The Untapped Productivity Potential of Trade and Foreign Direct Investment **61**
Introduction 61
Trade Integration, Untapped Opportunities, and Productivity 62
Foreign Direct Investment Patterns, Untapped Opportunities, and Productivity 76
Conclusions and Policy Recommendations 86
Notes 89
References 90

3 Beyond Connectivity: How Technology Adoption Unlocks Productivity Potential **93**
Introduction 93
Digitalization and Productivity 94
The State and Evolution of Digital Technology Adoption 96
What Drives Firms' Adoption and Use of Digital Technologies? 107

Conclusion and Policy Recommendations 117
Notes 119
References 120

4 Aligning Energy and Productivity: Reform Pathways for a Low-Carbon Europe and Central Asia 123
Introduction 123
Productivity and Energy Efficiency: Two Closely Linked Efficiency Metrics 123
Improvements in Energy Efficiency but Lack of Allocative Efficiency 125
Factors That Drive Improvements in Within-Sector Energy Efficiency 130
Changes Needed in Europe and Central Asia's Policy Mix to Foster More Resource-Efficient Technologies 136
Conclusions and Policy Recommendations 138
Notes 140
References 141

5 From Learning to Earning: How Skills Power Productivity in Europe and Central Asia 143
Introduction 143
How Well Is Talent Allocated in Europe and Central Asia? 144
Static and Dynamic Productivity Consequences of Skill Misallocation 151
What Factors Explain Skill Misallocation? 156
Conclusions and Policy Recommendations 176
Notes 178
References 179

Boxes

1.1 Public procurement and productivity 36
1.2 Factors associated with higher wages 47
1.3 Industrial policy 55
3.1 Steps in firm digitalization: From access, to adoption, to intensive use 96
3.2 Artificial intelligence, productivity, and economic growth 104
3.3 Bridging the capability gap: Evidence from the Digitrans digitalization pilot for micro, small, and medium-sized enterprises 112
4.1 Effects of electricity price rationalization in Georgia 129
5.1 Measuring the incidence and nature of skills mismatch in Europe and Central Asia 148
5.2 Returns to experience and returns to tenure 154
5.3 Does on-the-job training improve wages and productivity? 163
5.4 International labor mobility and skills mismatch in ECA 174

Figures

MM.1 ECA economies have not regained the rate of GDP growth experienced before the GFC xxiv
MM.2 ECA countries could improve productivity significantly by achieving the allocative efficiency of advanced economies xxvi
O.1 For countries in ECA, efficiency gaps with the United States are larger than capital gaps, 2022 xxxiv
O.2 Markets and the business environment affect productivity growth in several ways xxxv
O.3 ECA countries could improve productivity significantly by achieving the allocative efficiency of advanced European economies xxxvi
O.4 Missing trade is pervasive among ECA countries xli
O.5 Exporters in ECA contribute disproportionately to key economic indicators xli
O.6 The positive relationship between productivity and firm digitalization is visible at the firm level xliv
O.7 Energy efficiency and productivity are closely linked xlvii
O.8 ECA countries display moderate returns to experience at best, especially compared to countries in Western Europe xlix
1.1 ECA economies have not regained the rate of GDP growth experienced before the global financial crisis 2
1.2 ECA exhibits decreasing returns to capital accumulation 3
1.3 Capital accumulation alone is not enough for GDP per worker in ECA countries to converge with that in the United States 4
1.4 For ECA countries, efficiency gaps with the United States are larger than capital gaps, 2022 5
1.5 The contribution of TFP growth to GDP growth has declined since the global financial crisis in ECA countries 6
1.6 TFP growth dynamics in ECA countries changed after the global financial crisis 7
1.7 The contribution of TFP growth to GDP growth contracted sharply in ECA compared with EAP (with and without China) after the global financial crisis 8
1.8 Reform momentum has stalled since 2010 9
1.9 Markets and the business environment affect productivity growth in several ways 10
1.10 The employment share of industry has declined in ECA since 2000 12
1.11 The employment share of services has increased in ECA since 2000 13
1.12 ECA has seen positive but limited productivity gains from structural change since 2000 14
1.13 The services sector has made the main sectoral contribution to structural change since 2000 15
1.14 The services sector accounts for most of the contribution of structural change to overall labor productivity gains 16

1.15	ECA countries have had limited productivity-enhancing structural change since the global financial crisis	17
1.16	The share of labor in low-skill services has risen in most ECA economies since the global financial crisis	20
1.17	Industrialization peaks are high for some ECA economies that deindustrialized	21
1.18	ECA countries have high levels of "missing trade" with countries and economies outside the region	22
1.19	Large productivity gains result from reallocating labor and capital to EU and United States efficiency levels	24
1.20	Misallocation and potential productivity gains in the manufacturing sector are larger in less advanced than in more advanced ECA economies	25
1.21	Markets are less efficient when they are more exposed to state-owned enterprises	27
1.22	State-owned enterprises are less productive than their private counterparts	28
1.23	SOEs are subsidized in financial markets, especially in less competitive markets and in sectors that are the greatest facilitators of the economy	30
1.24	Some high-productivity firms get less access to finance than some less productive firms	31
1.25	Slight productivity differences exist between firms with debt and those without debt	31
1.26	SOEs have a stronger presence in noncompetitive sectors, but their presence remains large economywide	32
1.27	Firms that win public procurement contracts tend to be more productive, but that relationship weakens under corrupt practices	34
1.28	State-owned enterprises benefit from a higher share of noncompetitive practices in public procurement	35
B1.1.1	Accessing a public procurement contract increases productivity	36
1.29	Many survivor firms in ECA display lower productivity levels than exiting firms	38
1.30	Young firms display more within-firm productivity growth across ECA	40
1.31	High-growth young firms have a lower employment share in ECA than in the United States	41
1.32	The share of high-growth firms among total firms tends to be lower in most of ECA, except Georgia, Kazakhstan, and Moldova, than in Western Europe	42
1.33	Frontier firms do not exhibit higher productivity growth than laggards in most of ECA	43
1.34	New firms in ECA countries are smaller than those in the United States	44
1.35	Older firms in ECA countries have more sluggish employment growth compared with similarly aged firms in the United States	45
1.36	High-productivity firms create more jobs and increase wages more than low-productivity firms	46
B1.2.1	Productivity, size, age, ownership, and capital intensity help explain wage differences across firms	48

1.37	Job growth is associated with productivity growth in ECA	49
1.38	Job growth is more responsive to productivity growth among higher-productivity firms in ECA	50
1.39	Job creation responds to productivity growth across ECA countries	51
2.1	Europe is the leading export destination for much of ECA, 2018–22	64
2.2	The composition of exports differs across country groups in ECA, 2018–22	65
2.3	Exports have grown in ECA—but not for all country groups, 2004–22	66
2.4	The total value of ECA's exports to all trading partners has increased, 2004–22	66
2.5	Exports have increased more in sectors with limited productivity growth potential, 2004–22	67
2.6	Missing trade is pervasive among countries in ECA, 2000–22	68
2.7	Poor logistics are linked to higher missing trade across all world countries, 2000–22	69
2.8	More-open countries tend to have less missing trade across all countries, 2000–22	69
2.9	Most of the missing trade in countries in ECA is with high-income countries and China, 2020–22 average	70
2.10	A large share of the missing trade in countries in ECA is in manufactured goods, 2020–22 average	71
2.11	Exporters outperform other firms in ECA along a wide range of performance measures (latest year available)	71
2.12	In many countries in ECA, manufacturing exporters are a small share of total manufacturing firms (latest data available)	72
2.13	Exporters in countries in ECA contribute disproportionately to key economic indicators (latest year available)	73
2.14	Exporters are drivers of growth in the more advanced countries in ECA (latest year available)	73
2.15	There is frequent entry and exit of export products and firms in countries in ECA, compared to countries in Europe (average over the three most recent years)	74
2.16	Exported products have low survival rates in countries in ECA, compared to countries in Europe (average over the three most recent years)	75
2.17	Incumbent exporters play a crucial role in export growth in countries in ECA (five-year average, most recent data)	76
2.18	FDI is dwindling and new FDI is shrinking in importance in ECA, 2000–22	77
2.19	Countries in ECA show higher levels of missing FDI opportunities, compared to other countries, 2023	78
2.20	Spillover effects in ECA are not automatic (average across the period)	81
2.21	Spillovers via backward linkages have been uneven across countries in ECA (average across the period)	82
2.22	Higher exposure to foreign direct investment is correlated with higher firm dynamism	85
2.23	Higher exposure to foreign direct investment is correlated with lower resource misallocation	86

3.1	The positive relationship between productivity and firm digitalization is visible at the firm level	94
3.2	A variety of measures of digital technology adoption by enterprises are positively correlated with value added per worker at the country-sector level	95
3.3	Access to the internet is nearly universal in ECA, but the digitalization gap in use with the European frontier is widening	98
3.4	Access to digital technologies is universal, but companies struggle to move from adoption to intensive use	99
3.5	To reap productivity gains from digitalization, firms must use digital technologies intensively, especially for administration, production planning, and marketing	100
3.6	The gap with the frontier in technology sophistication is wider for more-digitalized firms	101
3.7	Research and development spending averages 0.5 percent of GDP in ECA, with large variation across countries	102
3.8	More productive firms are more likely to adopt advanced software	103
3.9	Female workers in ECA are more exposed than male workers to automation risks from generative AI	106
3.10	Preparedness for implementing AI varies across ECA	107
3.11	Workforce and management skills and quality drive digitalization	108
3.12	Countries with fewer developers per capita need to pay higher IT wages relative to GDP per capita and the average salary	109
3.13	Subnational regions in ECA with a higher-skilled workforce lead in adopting digital technologies	110
3.14	Human capital and management quality explain 35–50 percent of the variation between firms at the 10th and 90th percentiles of digital intensity	111
3.15	Foreign-owned firms tend to be more digitalized	113
3.16	Firms with US parent companies are more digitalized than firms with owners from other parts of the world across all types of software	114
3.17	Firms in sectors with lower market concentration (higher competition) are more likely to adopt digital software	115
3.18	Sectors with a large presence of SOEs have a lower share of digital technology adoption	116
3.19	Operating in a sector with higher trade exposure is associated with a higher probability of adopting digital technologies	117
4.1	Energy efficiency correlates with productivity across countries and sectors	124
4.2	ECA is becoming more environmentally friendly but has not reduced its carbon footprint	125
4.3	Markets do not reallocate market shares in accordance with energy efficiency in less advanced parts of ECA	127
4.4	Energy remains heavily subsidized in less developed countries in ECA, reducing incentives for within-firm improvement and market reallocation based on energy efficiency	128
4.5	Large differences in energy efficiency within sectors	130

4.6	State-owned enterprises, domestically owned firms, and smaller firms are less energy efficient than privately owned enterprises, foreign-owned firms, and larger enterprises	131
4.7	Technology adoption is positively associated with energy efficiency and labor productivity	132
4.8	Firms with higher labor productivity have higher green management quality	134
4.9	Laggards are catching up to the frontier, but state-owned enterprises and large firms are doing so more slowly	135
4.10	Inconsistent fiscal spending: Increases in fossil fuel subsidies and decreases in environmental tax revenue, with parallel spending growth in environmental protection	137
4.11	Climate policy instruments and fossil fuel subsidies: Less access to finance and trade policies and more command-and-control policies, 2015–23	139
5.1	Lack of workforce skills remains an obstacle to firm growth	145
5.2	Literacy increases steadily with firm size in Germany and the United States	145
5.3	In ECA, there is little to no upward trend in literacy proficiency as firms grow in size	147
5.4	The prevalence of vertical skills mismatch is heterogeneous across ECA	149
5.5	Overqualification is lower (and underqualification is higher) for older workers and those with long tenures	150
5.6	There is a statistically significant relationship between skills mismatch—especially overqualification—and hourly wages	152
5.7	ECA countries display moderate returns to experience at best, especially compared to countries in Western Europe	154
B5.2.1	The patterns of returns to tenure are similar for high-income countries in Europe and countries in ECA	155
5.8	Skill levels across the current workforce in ECA are lower than those in high-income benchmark countries	157
5.9	In Poland, individuals with lower literacy receive a lower increase in wages at all levels of work experience, compared to individuals with higher literacy	159
5.10	In most countries in ECA, the wage-experience profile for individuals with lower literacy proficiency is substantially below that in European high-income countries	160
5.11	Among higher-skilled individuals, skills mismatch and overqualification are much more pronounced for those employed in private enterprises than for those employed in the public sector in ECA	161
5.12	Returns to experience are very low for small firms in ECA, but as firm size increases, returns to experience become more aligned with those in European high-income countries	162
B5.3.1	In former planned economies, workers who received formal on-the-job training in the previous year had 5–10 percent higher wages than workers who did not receive such training	165

5.13 Countries in ECA are far from the European high-income benchmark for returns to experience in manufacturing and, except for Türkiye, in all types of services 166
5.14 About half of the firms in ECA rarely or never dismiss an underperforming nonmanagerial worker, and more than a quarter of firms report that performance does not play any role in promotion decisions 168
5.15 In ECA, the minimum wage is positively correlated with returns to experience and negatively correlated with the prevalence of overqualification, and the countries with the strictest employment protection show the largest returns to experience and the lowest prevalence of overqualification 171
5.16 High prevalence of informality is a structural feature of the labor market that might affect skill allocation in ECA, but limited labor mobility does not appear to be a binding friction 173
B5.4.1 There is a strong negative relationship between emigration and skills mismatch in ECA domestic labor markets 175

Tables

1.1 Priority level for policy recommendations, by country group 55
2.1 Priority level for policy recommendations, by country group 89
3.1 Priority level for policy recommendations, by country group 119
4.1 Priority level for policy recommendations, by country group 140
5.1 Priority level for policy recommendations, by country group 177

Foreword

Three decades ago, countries across Europe and Central Asia (ECA) undertook one of the most ambitious economic transformations of our time—opening markets, reforming institutions, and integrating into global value chains. Trade volumes more than tripled, employment outpaced population growth, and real incomes rose by about 50 percent. By 2024, 10 ECA countries had reached high-income status. This progress was hard won—and it proves what the region can achieve with strong reform momentum.

Despite those achievements, the engine of convergence has been losing steam in the region. Since the global financial crisis, growth has slowed. Capital has kept accumulating, but with diminishing returns; too many of the new jobs are in low-skill, low-productivity activities; and the transition to competitive, well-functioning markets remains incomplete. The single most important reason for weaker growth in ECA has been the slowdown in productivity. This slowdown, mainly associated with a deceleration in the pace of reforms, has left the transition to efficient market economies unfinished.

The stakes are higher now. ECA must navigate an era of overlapping shocks and structural shifts: heightened geopolitical fragmentation that reshapes trade and investment patterns; rapid technological change led by digital and data-intensive business models; the urgency of accessing dependable, affordable, and clean energy; tighter and more volatile global financing conditions; and demographic aging that will shrink labor forces in many ECA countries. These forces have created headwinds; however, in some areas, they are beginning to turn into tailwinds for countries that can move first, eliminate frictions, and harness new sources of productivity.

This report aims to help countries seize that opportunity. Drawing on unprecedented evidence, based on over 40 million firm-level observations across 16 ECA countries, it offers a granular view of what has stalled productivity, why it happened, and what to do next. Its central message is straightforward: Igniting productivity—not just adding more capital—is the key driver of better jobs, higher wages, faster growth, and more resilient convergence.

The report proposes a focused reform agenda organized around TIDES—five mutually reinforcing pillars that can lift productivity within firms and reallocate resources to the most dynamic parts of the economy:

- **Trade.** Deepen integration to diversify markets and move up the quality ladder, anchoring firms in more dynamic value chains.
- **Investment.** Attract and retain efficiency-seeking and reinvesting foreign direct investment, crowd-in private capital, and strengthen links to domestic suppliers.
- **Digitalization.** Accelerate the diffusion and intensive use of cloud services, data, and artificial intelligence—backed by capabilities, competitive telecoms, and pro-innovation regulation.
- **Efficiency.** Raise market contestability, reduce the state's footprint where it distorts competition and finance, and unlock business dynamism through better allocation.
- **Skills.** Build strong foundational and managerial skills, align training with private sector demand, and improve labor market matching so talent flows to its most productive uses.

This agenda is not reform for reform's sake. The evidence shows that, when competition is robust, when firms can access technology and finance, and when workers have the skills to adopt technologies and adapt, productivity rises, first within firms, then across the whole economy as resources shift to the best performers.

The moment calls for leadership. The report urges policy makers, business leaders, and social partners across ECA to make productivity the organizing principle of economic strategy over the next decade. That means restoring reform momentum, hard-wiring contestability and transparency into markets and public procurement, mainstreaming the productivity agenda into national plans and budgets, and relentlessly measuring progress.

The choice is clear. ECA can settle for slower growth and shrinking opportunity, or it can ignite productivity and renew convergence—creating more and better jobs, raising living standards, and building a greener, more resilient future. This report offers a practical road map. The time to act is now.

Antonella Bassani
Regional Vice President
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Main Messages

This report finds that the prolonged growth slowdown in Europe and Central Asia (ECA) presents an opportunity to refocus on three key areas:

1. **Productivity first:** ECA's growth challenge centers on productivity—since the global financial crisis (GFC), gains from capital and labor have remained stable, but total factor productivity growth has halved.
2. **Investments are necessary but not sufficient:** Increasing investment alone is not enough to accelerate growth—addressing efficiency gaps is now more important than overcoming capital shortages alone. Without productivity improvements, the returns to additional capital investments yield less output than they used to.
3. **Reforms are central:** Renewed reform momentum is needed—recently stalled progress has allowed distortions to persist, and resources have not been allocated where they can yield the highest returns, limiting the region's potential.

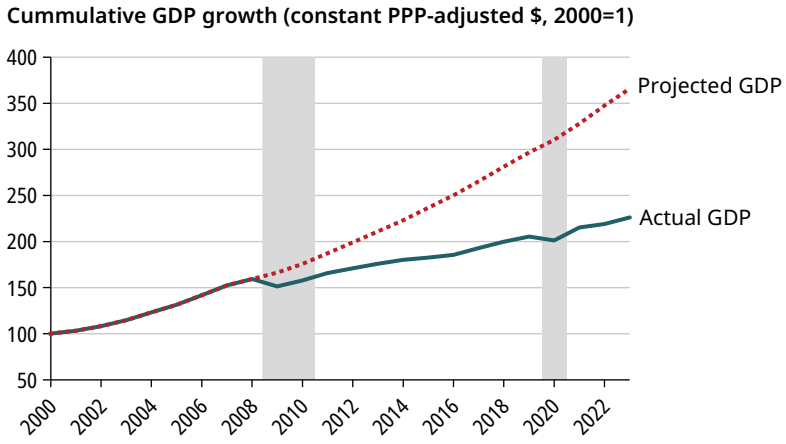
Together, these findings underscore the urgent need for a revitalized reform agenda to boost productivity, through targeted action across trade, investment, digitalization, efficiency, and skills (TIDES).

This report uses new and unique firm-level data to offer new insights into ECA's productivity challenges. A novel data exercise underpins the report's core diagnostics and policy simulations. More than 40 million firm-level observations were assembled from national statistical offices, tax revenue offices, and complementary sources and then were harmonized. This data, spanning 2008–23, multiple sectors, and more than 15 countries, allows original analysis of the magnitude and drivers of ECA's productivity challenge.

Why does productivity matter? Welfare and jobs.

Boosting productivity ultimately leads to increased welfare, more jobs, and higher wages. If ECA's post-2008 TFP growth had matched its pace before

FIGURE MM.1 ECA economies have not regained the rate of GDP growth experienced before the GFC



Source: Analysis based on data from World Bank, World Development Indicators.

Note: Projected GDP assumes that total factor productivity would have continued to grow with the same average growth rate as observed prior to the GFC. ECA = Europe and Central Asia; GDP = gross domestic product; GFC = global financial crisis; PPP = purchasing power parity.

the GFC, the region's gross domestic product (GDP) would be roughly 62 percent higher today (figure MM.1). Therefore, reforms that close efficiency gaps can generate large welfare dividends over the medium term. Furthermore, a 10 percent increase in productivity could add close to 2 million jobs in the ECA region. Estimates suggest that the effects are strongest among frontier and exporting firms that scale.

What happened? The growth downshift is a productivity story.

After the GFC, the region's productivity growth collapsed, but factor accumulation did not. Compared with 2000–08, TFP's contribution to growth fell sharply over 2008–23, explaining about 91 percent of the regionwide growth slowdown. In contrast, East Asia broadly maintained its growth drivers.

While investments continued, returns waned, indicating a lower efficiency of capital. Despite a faster rise in the real capital stock after 2008, GDP growth slowed, and the incremental capital-output ratio rose. These are classic signs of diminishing returns when efficiency lags. Simple counterfactuals underscore the point: If capital alone explained income gaps relative to the United States, many ECA economies would have already converged, but they have not.

Efficiency gaps are, in fact, the binding constraint. A benchmarking analysis shows that ECA workers operate with about 60 percent of US-level capital per

worker and achieve about 62 percent of US efficiency in using that capital—evidence that how resources are allocated and used matters at least as much as the amount of capital.

The collapse in productivity has overlapped with stalled market-oriented reforms. Since circa 2010, indicators of regulatory efficiency and open markets have plateaued or declined, mirroring a weaker competitive environment and slower financial sector reforms that hamper an efficient allocation of capital, which impede efficient credit allocation.

Why has productivity stalled? Misallocation has been the main cause.

Structural change has delivered too little. Over the past 25 years, in most ECA economies, labor has reallocated from industry to services, but the economic gains have been modest. Granular evidence shows that much of the reallocation has been toward low-skill, nontradable services rather than higher-productivity tradables, limiting the payoff from sectoral reallocation.

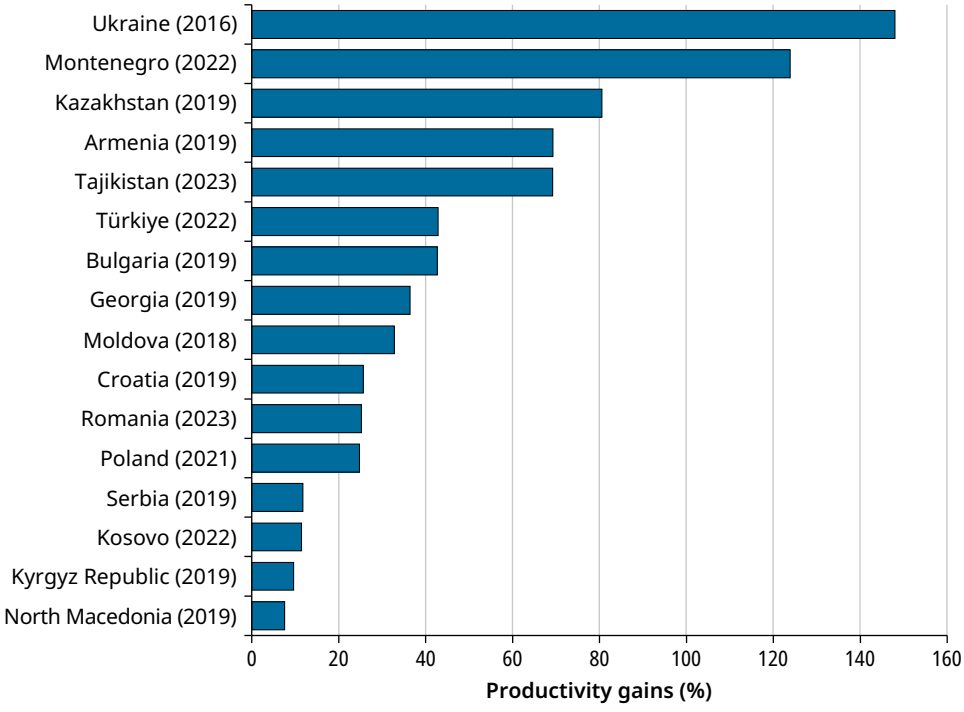
At the micro level, distorted markets have blunted selection and scaling. The large state footprint, concentrated market structures, and restricted access to finance have reduced competitive pressure and slowed the reallocation of capital and labor toward more productive firms. As a result, inefficient firms have survived or even expanded, while productive firms have been constrained from growing. *Removing these distortions to a level observed in advanced economies (eight European countries and the United States) could lift aggregate productivity by 10 to 70 percent in most of ECA*, with especially large potential in the region's less developed economies (figure MM.2).

State-owned enterprises (SOEs) and weak competition have depressed market dynamism. Sectors with heavier SOE presence are more concentrated, less allocatively efficient, and less dynamic. SOEs have been markedly less productive than private firms, and foreign-owned firms have been substantially more efficient than domestic ones. Uncompetitive public procurement and distorted access to finance have further skewed outcomes in ways that can hamper an efficient allocation of resources.

Trade and investment can be leveraged more fully to drive productivity and growth. Trade patterns have remained inward-looking, with "missing trade" in higher-value markets and insufficient export diversification, while foreign direct investment (FDI) spillovers have been uneven because of weak domestic links and absorptive capacity. Evidence shows that, when competitive conditions and capabilities are in place, trade and FDI activate four reinforcing productivity pathways: structural transformation, within-sector reallocation, creative destruction, and incumbent firm upgrading.

FIGURE MM.2 ECA countries could improve productivity significantly by achieving the allocative efficiency of advanced economies

Productivity gains, by country, latest data available for 2016–23



Sources: Estimates based on firm-level data from national statistical offices, Ministries of Finance, and Orbis.

Note: Productivity gains are reported relative to eight European advanced economies and the United States, based on Cusolito (2024) and Hsieh and Klenow (2009). Relative productivity gains are calculated as the ratio between the country-year gains $\frac{Y_E^c}{Y^c}$ and the EU and US average $\frac{\overline{Y_E}}{Y}$ as follows: $relative\ gain = \frac{Y_E^c / Y^c}{Y^E / Y} \times 100$. The included advanced European economies are Austria, Estonia, Finland, France, Germany, Italy, Norway, and Spain. For the date ranges and national sources of the data, refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788. The sample includes manufacturing firms with at least 10 employees.

New digital technologies have been widely accessible for firms, yet thin in use. Most firms have access to enabling digital technologies, but few have used advanced digital tools at scale and thus have missed out on the associated productivity benefits. The analysis in this report shows that convergence to the EU average cloud uptake is associated with productivity gains of up to 7 percent, and convergence to the European frontier is associated with gains of up to 25 percent. However, translating access into intensive use requires complementary skills, managerial capabilities, greater competition through facilitated entry of more domestic and foreign firms, and correct incentives through price signals (including energy pricing).

While low-carbon technologies align efficiency and productivity, energy subsidies have lowered the incentives to upgrade. The findings reveal that more productive firms have consistently demonstrated higher energy efficiency. However, fossil fuel subsidies and low electricity tariffs have dampened the incentives to upgrade equipment and optimize energy use, thus slowing the diffusion of resource-efficient technologies that raise productivity.

Workforce skills have also been misallocated and underdeveloped. Despite increasing educational attainment, proficiency in cognitive skills among the population has not improved. Furthermore, a significant share of the workforce—exceeding 30 percent in many ECA countries—have been employed in jobs for which they are overqualified. Returns to experience—a proxy for human capital accumulation in the workplace—have been low and, in some ECA countries, the returns to experience have been nearly flat across worker's life cycle. The poor quality of education, lack of robust demand, and frictions in the labor market have been some of the drivers of this skill misallocation.

What to do? Riding TIDES to higher productivity.

Restoring productivity growth is the region's most powerful lever for prosperity. The evidence assembled in this report suggests that tackling misallocation and catalyzing firm upgrading through the TIDES reforms could unlock large welfare gains, reverse the post–GFC slide, and put ECA back on a convergence path—one with more and better jobs, faster wage growth, and greater resilience. The region is not constrained by a lack of capital or connectivity but by how effectively these are used. Addressing this is now the central task.

Trade: Reconnect to dynamic markets, and reduce trade costs.
Igniting trade-led productivity in ECA requires a renewed reform push to deepen the region's integration into global and regional value chains. The focus should shift from simply expanding trade volumes to enhancing firms' ability to connect, compete, and move up the value chain. This entails reducing the costs of cross-border commerce, aligning trade frameworks with the realities of digital trade, and ensuring that export promotion efforts foster firm-level learning and survival in global markets. By tackling barriers at and behind the border, governments can unlock the reallocation, scale, and learning effects that drive sustained productivity growth.

Investment: Anchor FDI, and amplify spillovers.
A credible, predictable investment climate—combined with open and well-regulated service sectors—can attract high-quality investors.

However, reclaiming productivity momentum from foreign investment requires not only attracting more FDI but also turning it into a catalyst for domestic upgrading. This means integrating foreign investors into the domestic economy so that competition and collaboration drive innovation and productivity gains. At the same time, strengthening domestic capabilities, supplier networks, and innovation ecosystems ensures that foreign investment drives broader structural transformation rather than creating isolated enclaves. By anchoring FDI and amplifying its spillovers, ECA economies can accelerate firm-level upgrading and push frontier practices deeper into domestic production networks.

Digitalization: Diffuse frontier technologies, strengthen capabilities, and deepen effective use.

Realizing the benefits of closing the region's digitalization gap requires more than improving connectivity. It demands stronger firm capabilities, better incentives, and a more competitive environment that encourages technology adoption. Governments should shift from policies that simply subsidize technology purchases toward those that promote the effective and intensive use of digital tools. Equally important are complementary investments in human capital, competition, and finance, which enable firms to absorb and deploy new technologies productively. By creating the right incentives, skills, and market conditions, ECA countries can turn connectivity into competitiveness.

Efficiency: Level the playing field and unleash reallocation.

Policies to promote efficiency should focus on removing distortions that trap resources in low-productivity firms and enabling markets where productive firms can enter, grow, and replace less efficient ones. This translates into making markets contestable, eliminating distortions that shield incumbents and restrict new entrants. Ensuring competitive neutrality for the state itself is equally critical. For instance, SOEs engaged in commercial activities should compete on equal terms with private firms. Efficient reallocation of resources also depends on mitigating a misallocation of finance. Governments should promote modern and inclusive financial systems that direct financing toward productive and innovative firms. Strengthening the core enabling environment for access to finance can deliver significant impact with limited fiscal costs.

These reforms can be complemented with well-designed, targeted, and proven financial interventions. These interventions often carry significant fiscal costs and can introduce distortions. Careful design and selection are, therefore, critical, because each intervention has unique characteristics that influence its impact and feasibility.

Skills: Align talent, and drive lifelong upskilling.
Policies to enhance skills should focus on rebuilding foundational competencies, improving the alignment of talent with labor market needs, and fostering lifelong learning. Education systems should ensure strong foundational skills while also promoting competency-based, flexible learning that adapts to evolving labor market demands. Complementary measures can encourage continuous upskilling to enable firms and workers to fully leverage productivity-enhancing technologies and practices. By aligning talent with private sector needs and embedding lifelong learning, ECA countries can boost firm-level productivity and drive economywide growth.

Overview

Years of reform-driven growth have given way to a persistent slowdown, leaving the Europe and Central Asia (ECA) in need of new ways to regain economic momentum. Once buoyed by the transformative effects of postsocialist transitions and early waves of global integration, the region has experienced a marked slowdown in economic growth over the past 15 years. Weaker productivity, coinciding with a deceleration in reforms, is at the core of this slowdown. Capital deepening alone is no longer sufficient to fuel income convergence with high-income countries. This report argues that the path forward lies in igniting productivity growth through better resource allocation, greater technology adoption, deeper international integration, and more effective use of human capital. Three findings presented in this report support the following overarching message.

First, productivity growth has been the main contributor to sustained economic growth and income convergence in ECA. As is true for many other countries around the world, the growth engine of ECA countries has decelerated because of low-productivity growth and falling returns to capital accumulation. After nearly a decade of robust growth in the early 2000s, growth in ECA slowed with the global financial crisis (GFC) of 2008–09, more than in all other regions. What caused the sharp deceleration? Nearly 91 percent of the decline in growth stems from falling productivity growth.

Second, the misallocation of resources, both across and within sectors, is key to understanding productivity growth in the region. This misallocation, where labor and capital flow to less productive activities and firms, is a key factor dragging down aggregate productivity growth while also reducing incentives for firms to invest in capabilities.

Online annexes for this report are available at https://hdl.handle.net/10986/43788.

Structural changes in most ECA countries over the past 25 years, with manufacturing sectors contracting and service sectors expanding their labor shares, have contributed little to productivity gains. The contribution of such resource reallocation between sectors has been more limited in ECA than in other regions. Although labor shifts from the manufacturing sector to the service sector could have enhanced productivity, because of higher average levels of productivity in services, a more granular sectoral disaggregation reveals that this has not been the case in the region. For example, in several economies, high-productivity industries like manufacturing have contracted, while less productive sectors, such as low-skill, nontradable services, have expanded.

Substantial gains in productivity are possible by reducing resource misallocation through reforms shrinking the state's economic footprint and strengthening competition in domestic markets. Priority measures include boosting competition, enhancing capital allocation, redesigning labor institutions and public procurement, limiting the role of state-owned enterprises (SOEs), and reducing skill mismatches. Sectors with a larger SOE presence are less competitive, have lower allocative efficiency, and are less dynamic (lower job and firm turnover). In addition, SOEs are crowding out access to finance for more productive private enterprises. Overall, ECA needs to remove distortions to complete the transition to market economies and pave the way for aggregate gains in productivity and welfare.

Most ECA countries could increase aggregate productivity by 10 to 70 percent by removing market distortions to the level of advanced economies (eight European countries and the United States). The potential gains would be largest for the less advanced economies in the region, as shown by the analysis in this report, which relies on a novel firm-level data set covering more than 40 million observations across 15 years (2008–23).

Policies to reduce misallocation and strengthen competition need to be accompanied by appropriate incentives and programs to increase firms' managerial and technical capabilities. Although removing distortions is a necessary condition for productivity growth, past work by the World Bank and others has shown that it may not be a sufficient condition (Cusolito and Maloney 2018; Iacovone et al. 2025). Studies have highlighted the importance of firm upgrading to face the competition unleashed by more efficient markets. Recent evidence from ECA has shown that the region's middle-income countries, which represent the majority of ECA, are struggling to boost within-firm productivity (Iacovone et al. 2025). If firms' capabilities are not strengthened, competition- and entry-enhancing policies might eliminate not only inefficient incumbents but also high-potential firms that lack managerial skills or sufficient skilled workers to grow their business. Chapters 3, 4, and 5 of the report shed more light on this firm upgrading channel by providing evidence on the importance of technology adoption and skills development for productivity growth.

Third, boosting productivity growth is key to creating more and better jobs. Firms in ECA countries grow less on average and more slowly than firms in the United States, for example. ECA start-ups are smaller than their US peers and grow less over their life cycle, generating fewer jobs. Firms that are more productive have higher employment growth rates, and productivity increases have larger effects on job creation in higher-productivity firms than in lower-productivity firms. Productivity growth also contributes to higher wages (both higher levels and higher growth rates) and thus helps create better jobs. Estimates indicate that a 10 percent increase in productivity could add close to 2 million jobs in the ECA region.

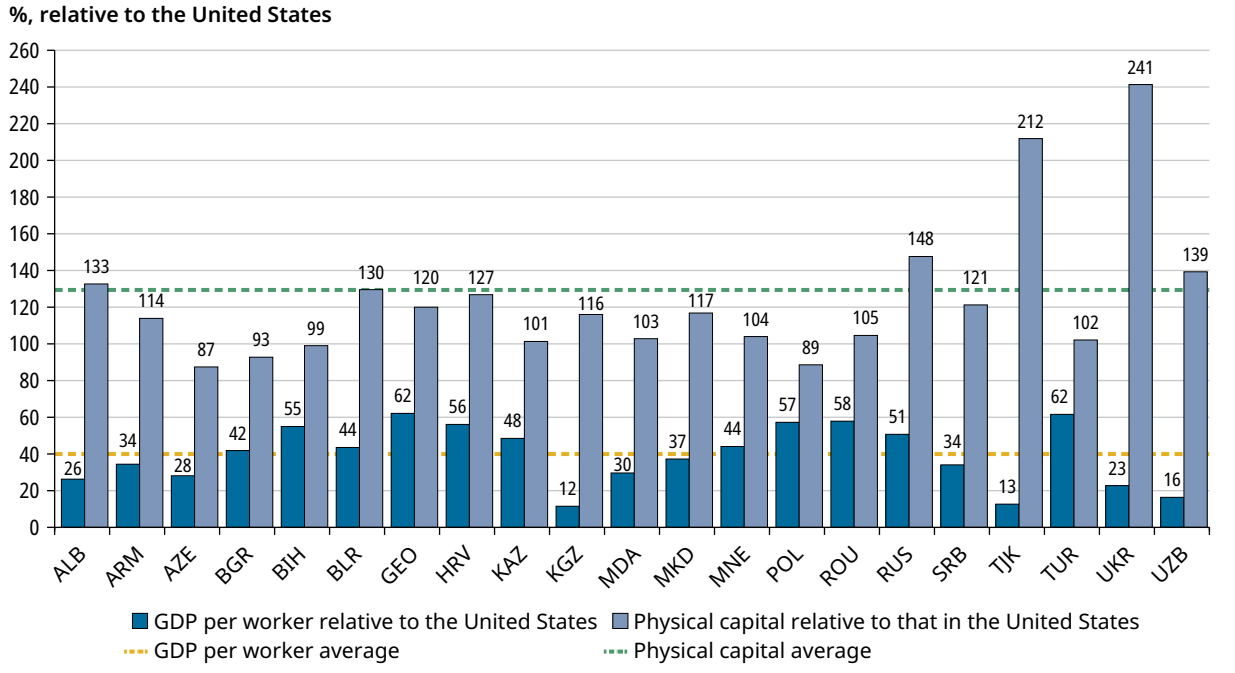
Productivity Is Essential for Economic Growth

Per capita income in most ECA countries has been constrained mainly by low levels of efficiency (efficiency gaps) rather than low levels of accumulation of productive factors (capital gaps). Comparing the gap in gross domestic product (GDP) per worker between ECA countries[1] and the United States with the gap in the capital-output ratio provides a clear message: ECA countries' capital-output ratio gap cannot explain the gap in GDP per worker (figure O.1). Estimates of the gaps for ECA countries show that, on average, not only do workers in ECA countries have about 60 percent of the human and physical capital per worker as a US worker (capital gap), but the efficacy of their use of those factors is only 62 percent of that in the United States (efficiency gap). Because both human and physical capital are highly susceptible to changes in efficiency, the capital gap and the efficiency gap contribute to the overall productivity gap. To close the efficiency gap with the United States, ECA countries need to improve both factor allocation and factor efficiency.

The large contraction in the contribution of total factor productivity (TFP) to growth after the GFC explains the region's weaker growth performance compared to East Asia. The combined contribution of capital and labor to economic growth in ECA remained constant between 2000–08 and 2008–23, but TFP's contribution to growth fell by half. Over the same period, countries in the East Asia and Pacific (EAP) region, excluding China, maintained roughly similar contributions of capital, labor, and TFP to their growth. Including China makes the contribution of TFP to EAP countries' growth proportionally less pronounced, but not to the extent of the contraction in the ECA region. If the ECA region had maintained the same TFP growth after the GFC as before, its growth in the later period would have been comparable to that of the EAP region including China. It would, in fact, have been stronger than that of the EAP region excluding China. Even more important, GDP in 2023 would have been 62 percent higher.

FIGURE O.1 For countries in ECA, efficiency gaps with the United States are larger than capital gaps, 2022

Relative GDP per worker and relative capital-output ratio



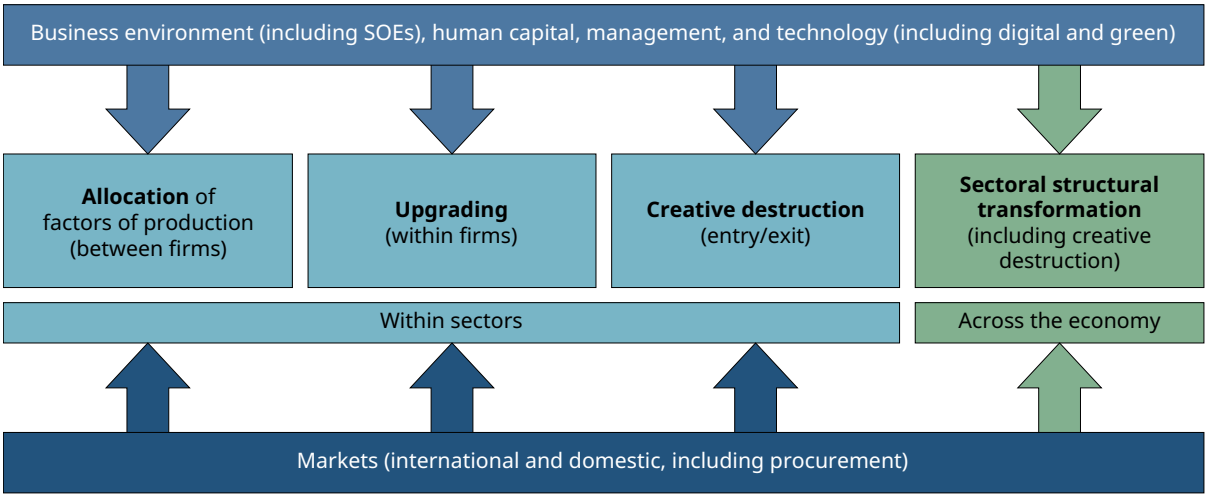
Source: Estimates based on Penn World Table Data 11.0 (Feenstra, Inklaar, and Timmer 2015).

Note: The dark blue bars show GDP per worker relative to the United States, and the light blue bars represent the capital-output ratio relative to the United States. The yellow and green dashed lines indicate the unweighted means for all countries displayed. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia; GDP = gross domestic product.

The Pathways to Productivity Growth

Four main pathways are essential to understanding ECA's productivity challenge. Aggregate changes in productivity growth can occur through these pathways, which operate within or across sectors (figure O.2). Within sectors, productivity growth can take place through three channels. The first pathway is market reallocation between firms, which can occur through shifts in the market shares across incumbents, toward more productive firms. The second pathway is within-firm upgrading and refers to changes in a firm's productivity level over time, which could be driven by efficiency- or quality-improving investments in technology, organization, or skills. The third pathway is firm selection, through the entry of more productive firms and the exit of less productive firms, often referred to as *creative destruction*. Finally, aggregate productivity can grow through a fourth mechanism: structural transformation. In this pathway, shifts in

FIGURE O.2 Markets and the business environment affect productivity growth in several ways



Source: World Bank based on Cusolito and Maloney 2018.

Note: SOEs = state-owned enterprises.

the relative weights of sectors over time can lead to higher aggregate productivity if more resources are allocated to sectors with higher levels of productivity.

These four pathways do not operate in isolation but interact with each other. For example, greater misallocation within sectors can negatively affect the entry and exit of firms, as distortions affect which firms survive. Misallocation can also reduce the returns to upgrading investments, thus reducing the incentives for firms to invest in new skills or technologies.

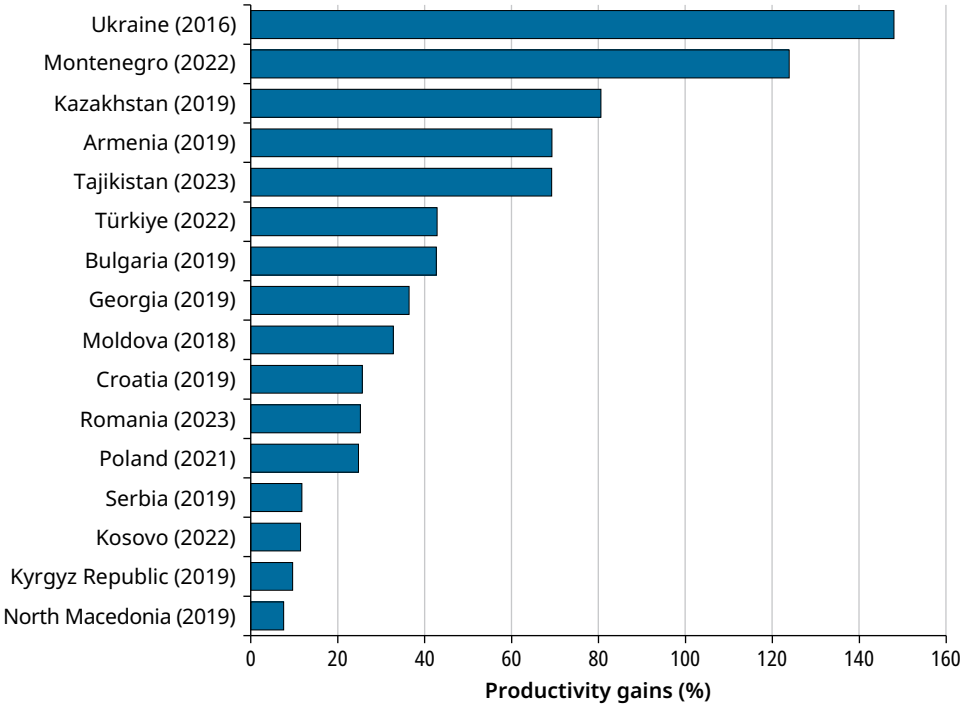
Misallocation: The Productivity Killer

Misallocation of resources—between and within sectors—stands at the heart of the region's underwhelming productivity performance. Structural change in ECA has not always been productivity-enhancing. Rather than shifting toward high-productivity tradable sectors, labor has often moved into low-skilled, nontradable services. These changes have resulted in limited aggregate gains, particularly when compared to more dynamic regions like East Asia. Within sectors, the picture is even starker. Despite decades of market-oriented reforms, many ECA economies continue to exhibit features of incomplete transitions. Large SOEs, concentrated market structures, and restricted access to finance have dampened competition and hindered the reallocation of labor and capital to more productive firms. As a result, inefficient firms survive and expand, while productive firms are held back.

A novel firm-level data set reveals large potential gains from reducing resource misallocation. Firm-level data covering more than 40 million observations across 15 years (2008–23) reveal a sobering reality: If ECA achieved the efficiency of advanced economies (eight European countries and the United States), it could raise aggregate productivity by 10 to 70 percent in most countries (figure O.3). The gains would be especially pronounced in the region's less advanced economies, where market frictions are more pervasive and the state footprint is larger.

FIGURE O.3 ECA countries could improve productivity significantly by achieving the allocative efficiency of advanced European economies

Productivity gains, by country, latest data available for 2016–23



Sources: Estimates based on firm-level data from national statistical offices, Ministries of Finance, and Orbis.

Note: Productivity gains are reported relative to eight European advanced economies and the United States, based on Cusolito (2024) and Hsieh and Klenow (2009). Relative productivity gains are calculated as the ratio between the country-year gains $\frac{Y_E^c}{Y^c}$ and the EU and US average $\frac{\overline{Y_E}}{Y}$ as follows: $relative\ gain = \frac{Y_E^c / Y^c}{Y^E / Y} \times 100$. The included advanced European economies comprise Austria, Estonia, Finland, France, Germany, Italy, Norway, and Spain. For the date ranges and national sources of the data, refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788. The sample includes manufacturing firms with at least 10 employees.

Structural transformation and misallocations across sectors

In the early 1990s, as many countries in the ECA region began to transition to a market economy, the sectoral structure of their economies changed. During the first 10 years of the transition, the employment and output shares of industry, the largest employment sector in most ECA countries, declined, while the shares of services expanded. Over the following 10 years, the shares of services in employment continued to expand relative to those of industry, although at a slower pace, while agriculture gradually shrunk. Most ECA country groups have experienced the same falling-industry dynamic, except for the agricultural and less advanced Eastern European groups, and the concurrent rise in the share of labor in services, except for the less advanced Eastern European group. However, the pace of the shift toward services has varied across country groups.

Structural change has played a positive but limited role in driving productivity growth across both the formal and informal sectors. Productivity growth within sectors has accounted for most of the growth in overall labor productivity (GDP per worker) in ECA, whereas the effects of labor shifts between sectors (structural change) have contributed only minor shares. The effect of structural change on labor productivity growth has been larger in EAP than in ECA, and the difference has widened in recent years.

The service sector has led structural transformation across ECA, driving both labor productivity and wage growth. In all the ECA country groups, the service sector has been the main driver of structural change and, thus, the main reason for the contribution of structural change to labor productivity growth. However, the service sector encompasses subsectors with heterogeneous skill requirements. Furthermore, it is evident from firm-level data that low-skill services have driven the growth in labor productivity in services, whereas high-skill services have driven wage growth. Thus, the labor shifts that underpin structural change are dominated by employment shifts toward low-skill services, stunting the productivity growth potential of the service sector and its contribution to the overall labor productivity gains from structural change.

A more granular sectoral analysis of the formal economy, based on firm-level data, reveals a consistent story of limited contribution of structural change to productivity growth. The minor role of sectoral shifts in driving productivity growth across ECA countries is observed not only at the broad sectoral level but also at a more granular level. The correlation between changes in sectoral labor shares and initial value added per worker over 2006–24, although positive in many countries, was weak and close to zero. This correlation implies a limited contribution of the reallocation of labor between sectors (structural change) to productivity growth.

Economic distortions can also reduce the productivity growth arising from structural change by allowing economies to deindustrialize prematurely. Two factors could account for the contraction in industry's shares of employment and output: the natural forces of structural transformation, as resources shift from industry to services, and policy distortions that disproportionately burden industrial firms and workers.

The expansion of low-skill services in ECA, combined with a contraction of the industrial sector, suggests that the structural shift to services has not been entirely productivity-inducing. In a majority of ECA countries, the share of labor in low-skill services increased in the period after the GFC. On average, technological change, specifically digitalization, has been labor-augmenting for both high- and low-skill workers. However, technological change has been biased toward high-skill workers in the manufacturing sector and biased toward low-skill workers in the service sector. Thus, technological change has resulted in higher wages in the manufacturing sector, reduced demand for labor in manufacturing, and reallocated labor to the service sector.

Misallocation among firms and activities

Resource misallocation affects aggregate economic outcomes through three main mechanisms: resource allocation across firms, firm entry and exit, and technology upgrading and innovation. First, distortions can result in resources such as labor and capital not being directed to the most productive firms in a sector. Second, by affecting firms' entry and exit decisions, distortions can influence which firms survive and operate. Third, distortions can lower the returns to firms from technology adoption and innovation.

Removing misallocations in labor and capital markets could achieve the largest gains in economic growth. Eliminating distortions is the quickest way to increase the value of the marginal product of workers and capital without increasing labor and capital costs. Removing distortions in factor and output markets that lead to misallocations could increase productivity by 10 to 70 percent in most ECA countries, if they moved to the levels of allocative efficiency observed in advanced economies (eight European countries and the United States). Ukraine, and other countries at earlier stages of development, could increase productivity on average by more than 90 percent. This increase would be over three times more than the average gains from removing distortions in EU accession countries. These productivity gains are also nearly 60 percentage points higher than those from removing factor market distortions in Estonia, France, Germany, and the United States. Countries in the Caucasus and Central Asia, including Armenia, Georgia, and Kazakhstan, could increase productivity by 35 to 80 percent if they moved to the efficiency levels observed in advanced economies.

The higher prevalence of distortions in less advanced ECA economies implies that a better reallocation of resources would lead to higher gains in lower-income countries. Using the correlation between revenue-based TFP and quantity-based TFP as a measure of allocative efficiency (a higher correlation indicates less allocative efficiency) shows that misallocation at the economywide level is greater in less advanced ECA economies than in those that are more advanced. Therefore, the potential productivity gains from reducing misallocation would be larger in less advanced ECA economies.

Removing distortions, especially those related to the state's footprint in the economy, is key to fostering productivity growth in the region. Although ECA countries started shifting from planned economies to market economies in the early 1990s, a strong state footprint remains in many countries, and this incomplete market transition affects productivity growth today. Three developments have recently reignited the debate about the distortionary effect of SOEs. First, the state is present in competitive sectors where no economic rationale exists for state economic involvement. Second, SOEs underperform private enterprises on average. Third, there is a need to rebuild fiscal buffers in several economies that have limited fiscal space or are in debt distress.

Not only does the presence of SOEs reduce market dynamism, but SOEs themselves are also less productive than private companies. On average, a worker in an SOE produces only about 60 percent of the value added produced by a domestic private company, even when the companies operate in the same sector and geographic region, are the same size and age class, and display similar capital intensity (capital per worker). The differential is similar for foreign-owned firms, which are nearly 60 percent more efficient than domestic firms. Market concentration—a proxy for weak competition and measured as the combined market share of the five largest companies in each sector (at the 3-digit level)—negatively correlates with the labor productivity of firms. Therefore, in addition to the negative association between SOE presence and market dynamism, SOEs are less productive than their private counterparts.

As firms in ECA mature, on average they do not become more productive. In competitive, well-functioning markets, selection mechanisms coupled with learning should make continuing firms increasingly productive, following an up-or-out dynamic as less productive firms exit. In highly competitive sectors, businesses innovate and upgrade to beat the competition, reducing marginal costs relative to noninnovative firms. However, the average productivity of firms tends to decline faster in older cohorts in less advanced ECA economies, compared to a less pronounced decline in the more advanced ECA economies. This tendency suggests that firms in ECA, especially in less advanced economies, struggle to become more productive as they mature and market forces are unable to weed out less efficient firms.

Productivity differences are larger for younger cohorts and shrink only slowly as firms age, supporting the idea that selection mechanisms can increase resource misallocation. In more advanced ECA economies, especially high-income ones, the relationship is negative between productivity dispersion and age, but this pattern does not hold in less advanced ECA economies (except the Kyrgyz Republic, where the relationship is negative and initial dispersion is high). Productivity dispersion typically declines during the first five years of a firm's life and then flattens. Patterns in productivity dispersion suggest that market selection mechanisms and expected postentry growth of incumbents do not work to benefit more productive firms. In other words, misallocation, driven by inefficient market functioning, seems to be dampening aggregate productivity growth in ECA.

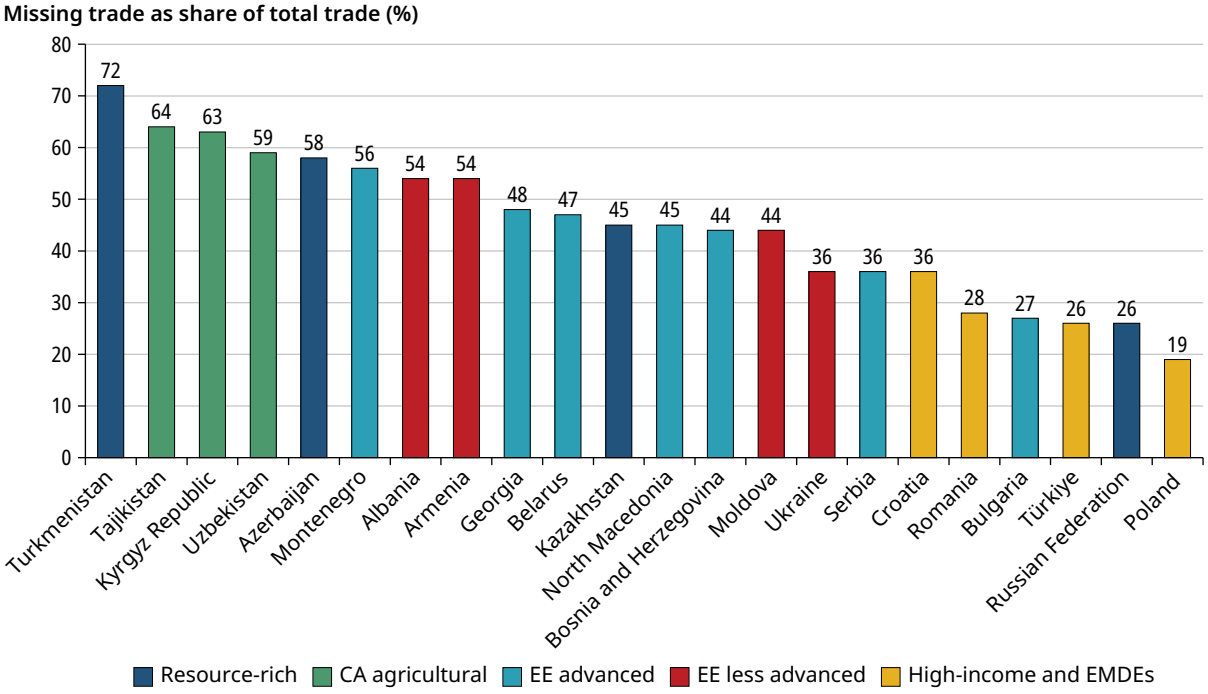
Unleashing Productivity—Through Trade and FDI

Global economic integration—through trade and foreign direct investment (FDI)—offers some of the most powerful yet underused levers for productivity growth in ECA. ECA's trade patterns are not fully aligned with what would maximize productivity. Exports are not diverse enough and are tilted toward lower-complexity products and nearer markets, suggesting unexploited opportunities to "trade up" in quality and reach. Although recent shocks have reshaped trade flows (including a shift toward intraregional trade and "friendshoring"), ECA still trades below its potential with the most dynamic global markets (figure O.4).

Many countries—particularly resource-dependent and Central Asian agricultural economies—export less than expected to key partners such as Organisation for Economic Co-operation and Development (OECD) members and China, largely because of weak trade logistics and restrictive trade policies. Much of this unrealized trade lies in manufacturing, limiting the region's ability to leverage the four channels of growth and innovation.

ECA countries' substantial missing trade reflects the challenges that firms face in engaging in international markets and the forgone opportunities of not serving foreign markets. After all, it is not countries that export, it is firms, and those that export show an outstanding performance. Despite being few, ECA exporters disproportionately contribute to their countries' value added, employment, salaries, and fixed assets and are the main drivers of growth in these performance measures (figure O.5). In other words, exporters can be key pillars for creating new and better opportunities and enhancing productivity across the region.

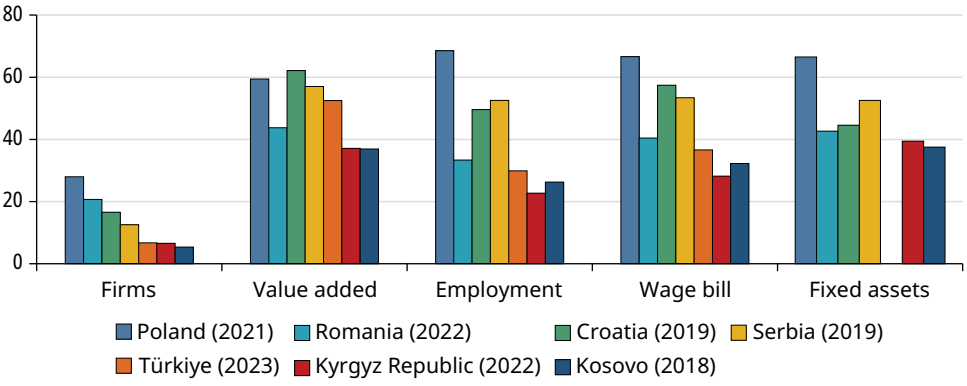
FIGURE O.4 Missing trade is pervasive among ECA countries



Source: World Bank based on data from UN Comtrade database, United Nations Statistics Division (accessed October 30, 2024), https://comtrade.un.org/.

Note: The estimates are from a gravity model. For a description of this model, refer to online annex 2B, available at https://hdl.handle.net/10986/43788. CA = Central Asia; ECA = Europe and Central Asia; EE = Eastern Europe; EMDEs = emerging markets and developing economies.

FIGURE O.5 Exporters in ECA contribute disproportionately to key economic indicators



Sources: World Bank estimates based on firm-level data from national statistical offices and Orbis.

Note: Fixed assets data not available for Türkiye.

FDI inflows, often concentrated in a few sectors, are not sufficiently embedded in the domestic economy. Although FDI holds the potential to boost domestic firm performance, whether these benefits materialize depends on specific conditions. In ECA, there are additional untapped productivity gains because the presence of foreign firms in the region does not lead to significant improvement in performance for domestic companies, at least for those in the supplying sectors.

Four interconnected pathways highlight the multifaceted ways in which trade and FDI can enhance productivity. A robust competitive environment facilitates creative destruction and incumbent upgrading. Foreign investment plays a role across these channels. The overall productivity impact depends on these linked effects and supportive domestic policies and institutions. For ECA, this means continued structural reforms, competition-friendly regulation, flexible labor markets, and accessible finance. Investments in education, skills, and innovation empower firms to learn and upgrade. When these conditions are in place, the gains from trade and FDI can be substantial. Conversely, domestic barriers can mute these benefits.

Given current global uncertainties, getting the domestic basics right is crucial. Adapting to shifting trade patterns may require finding new markets or investment sources. A flexible, productivity-oriented economy can navigate these shifts. By strengthening the enabling environment for the pathways, ECA countries can better harness trade and FDI for growth, leading to more competitive, innovative, and dynamic economies.

To leverage structural transformation (pathway 1), policies should facilitate resource mobility across sectors. To address the challenge that resources are trapped in low-productivity sectors, policies should facilitate the mobility of labor and capital toward more productive sectors. Doing so involves removing distortions that trap labor or capital in unproductive areas, such as reducing subsidies for declining industries and enhancing labor market flexibility for retraining and relocation. Similarly, improving infrastructure to connect lagging regions with dynamic economic centers can help reallocate resources.

To translate the benefits of integration through reallocation of resources between firms (pathway 2), policies should unlock constraints to firms' growth. Resource reallocation requires pro-competition reforms—for example, streamlining business licensing, simplifying regulations, and breaking up monopolies—that complement trade by enabling the growth of efficient new firms that challenge incumbents. Removing reallocation barriers is crucial, including improving access to finance for high-performing small and medium enterprises and phasing out support for failing ("zombie") firms. Flexible labor markets and adequate schemes for reskilling also assist workers' transitions to expanding firms.

To maximize the benefits from integration through creative destruction (pathway 3) requires a dynamic business environment with easy entry for new firms and orderly exit for inefficient ones. Policy makers should reduce bureaucratic hurdles for start-ups (including by enabling foreign investments) and reform insolvency frameworks to expedite the exit or restructuring of unviable firms. Strengthening bankruptcy laws and removing barriers that discourage firm exit are vital in many ECA countries. Flexible labor market policies, supporting retraining and relocation, enable quicker replacement of shrinking firms with expanding ones. Fostering access to risk capital is also key for firm creation. Active labor market policies can cushion displaced workers during trade liberalization, maintaining support for openness. Overall, a policy framework prioritizing economic flexibility and innovation ensures that global integration yields net positive productivity effects.

To foster the benefits of firm upgrading from integration (pathway 4), policies should facilitate firms' learning and absorptive capacities. Promoting upgrading requires investing in human capital and encouraging technology adoption (for example, through tax incentives for research and development). Building domestic capacity is essential for local firms to partner with and learn from foreign companies. Supplier development programs linking domestic suppliers with multinationals can amplify FDI spillovers. A competitive services market (for example, telecommunications and logistics) provides manufacturers with better inputs. Trade facilitation (simplifying customs and improving airports) reduces the costs of engaging in importing and exporting. For export promotion, targeted support, like helping firms meet international standards, can be beneficial, as can addressing information externalities through targeted interventions such as "meet-the-buyer" events and providing information about prospective market opportunities.

Technologies for Productivity—Digital and Low-Carbon

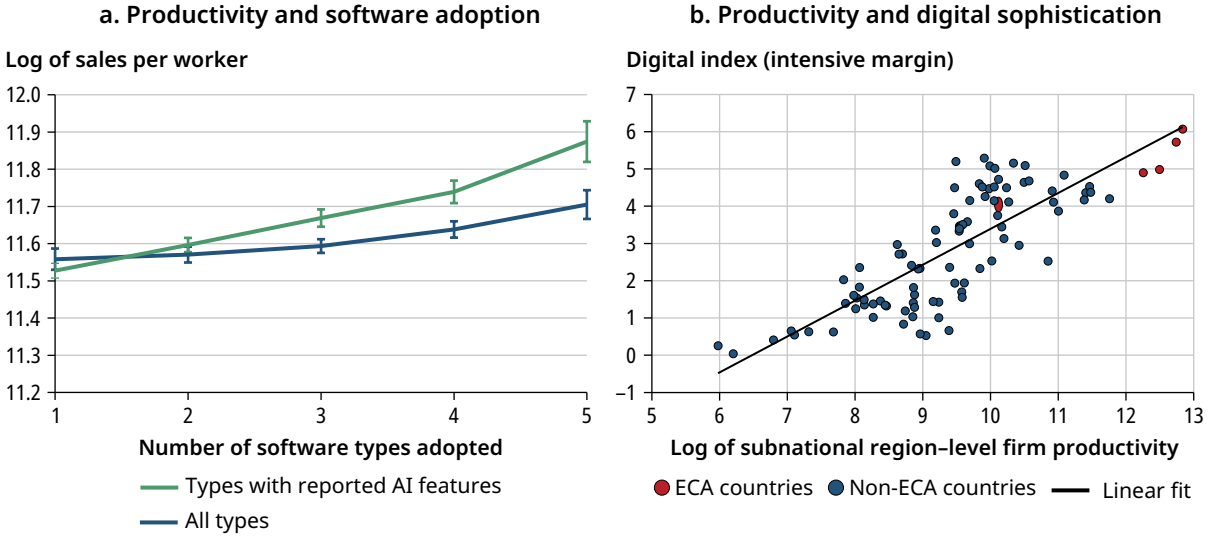
The adoption and intensive use of modern technologies are another important driver for productivity growth and complementary to the gains from reallocation. Digital and modern low-carbon technologies can be sources of within-firm upgrading (figure O.2), because they enhance the efficiency of operations and resource use inside the firm or provide access to new markets. At the same time, removing market distortions can foster technology adoption because doing so increases firms' incentives to invest.

Digital technologies—productivity engines within reach

Digital technology can boost within-firm productivity growth in ECA. Although most firms have access to digital enablers such as broadband and computers, the promise of digital transformation in the ECA region has been largely unrealized. The gap is not one of access but of effective utilization and integration of digital technologies into core business processes. Addressing this gap requires upgrading firms' organization, expanding investments in digital skills, and removing barriers to growth to sharpen the incentives to invest and increase the returns to those investments.

First, digital technology adoption is clearly associated with higher productivity growth. Both sector- and firm-level evidence confirms significant productivity benefits from greater digital technology adoption (figure O.6). A simulation at the country level suggests that if ECA economies reached the EU average in cloud adoption, productivity could rise by up to 7 percent, and by up to 25 percent if they reached the European frontier.

FIGURE O.6 The positive relationship between productivity and firm digitalization is visible at the firm level



Sources: Panel a: Orbis and Spiceworks Ziff Davis; panel b: World Bank Firm-level Adoption of Technology survey.

Note: In panel a, the regression controls for firm size, ownership (foreign or domestic), and two types of fixed effects (sector at the 1-digit statistical classification of economic activities [NACE] and country levels). In panel a, AI–related software is software that has publicly reported AI features. In panel b, the digital index indicates whether the most frequently used technology to perform tasks across six general business functions (administration, planning, sourcing, marketing, sales, and payments) is manual (value of 0), basic digital (value of 1), or advanced digital (value of 2). The values on the y axis are the regional averages of the digital index. Subnational region-level firm productivity is the average value added per worker in each subnational region, after controlling for sectoral differences, adjusted by PPP. AI = artificial intelligence; ECA = Europe and Central Asia; NACE = European Statistical Classification of Economic Activities; PPP = purchasing power parity.

Second, despite almost universal access to basic digital enablers (such as internet, personal computers, and smartphones), a significant gap remains in the use of these technologies, and it has been widening in most ECA countries. ECA firms struggle with the effective incorporation of digital technologies into their routine and productive processes. Although firms may initially purchase and adopt new technologies, they often do not use them intensively in their core business functions. Simply promoting access to and adoption of new technologies might not be enough, because firms might require complementary managerial or technical skills to make full use of these technologies.

Third, the adoption and use of digital technologies depends on two enabling and connected channels: within-firm upgrading and more efficient markets. Within-firm upgrading through digital technology adoption requires both workforce and managerial skills. Wider availability of digital skills in the workforce is associated with lower labor costs and higher adoption levels. Similarly, higher levels of managerial skills are associated with more intensive use of advanced digital technologies, because skilled managers enable firms to integrate new solutions into their workflows successfully.

In addition, more efficient market conditions play an equally important role in digital technology adoption. Higher levels of competition, whether through lower market concentration or greater exposure to trade, correlate with increased investments in digital technologies. Conversely, greater presence of SOEs in a sector is associated with lower levels of digital technology adoption. One potential explanation for lower technology adoption in more distorted markets is that firms perceive lower returns to investment.

Firms in ECA are becoming more digital, but they need to speed up their use of digital technologies to avoid falling further behind the frontier and to reap important productivity benefits. The productivity gains from digitalization can be significant. Catching up to the European frontier in cloud services would boost productivity between 18 and 25 percent; however, firms may need to overcome a variety of barriers to integrate novel technologies into their business processes. Skills, market competition, and access to finance stand out as the three main facilitators to promote the digitalization process. What can governments do to lower these barriers and help firms digitalize faster and more deeply? Concrete policy solutions require a deeper understanding of each country's context, the country-specific constraints that firms face, and how different firms react to these challenges.

Subsidizing access and adoption of digital technology alone is insufficient, because governments need to incentivize its widespread use within firms. The report shows that universal access to basic digital enablers, like the internet or computers, does not guarantee the widespread use of more advanced digital technologies in firms. Policy instruments that solely incentivize the purchase of digital technologies might thus fall short, because companies could have difficulties in integrating more advanced technologies into their routine processes.

Policy makers should also prioritize results-based support for technology adoption—focusing not just on access but also on effective use. This support includes conditional subsidies tied to performance outcomes and tailored advisory services for firms navigating the digital transition.

Different policies are needed across different countries and firms because constraints differ. The considerable variation in terms of digitalization across different types of firms suggests the need for tailored solutions. For example, the distance to the frontier in the intensive use of digital technologies is driven more by older firms than younger ones, suggesting that firms that are more mature have greater difficulties in digitalizing their business functions. Similarly, in the use of basic digital enablers (such as the cloud or e-commerce), smaller firms in less advanced ECA countries struggle to catch up with the frontier countries, although this is not the case for Croatia and Poland.

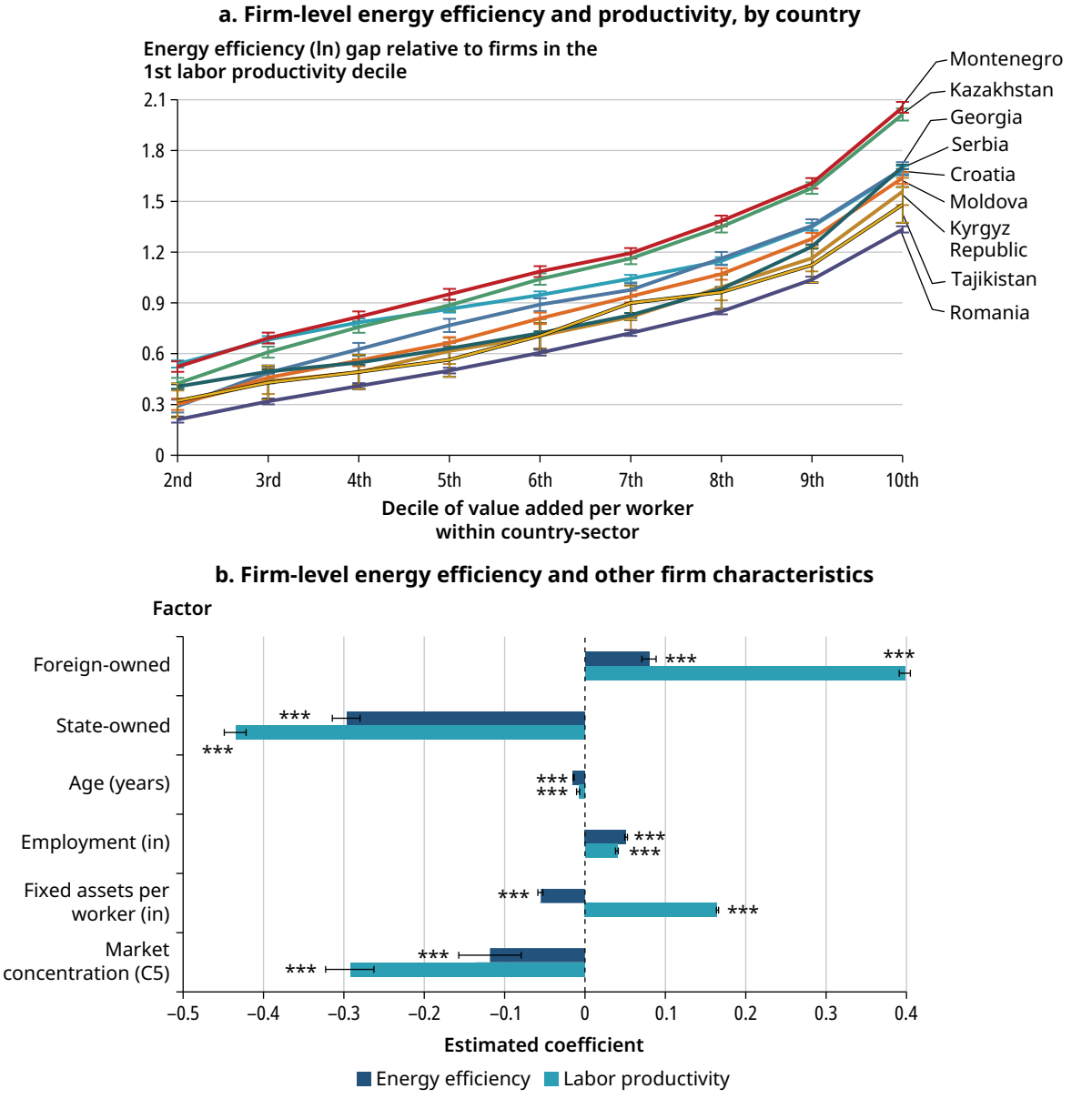
Low-carbon technologies—aligning resource efficiency with productivity

Becoming more energy efficient is strongly linked with firm-level productivity. Energy is an essential input for production and a key cost component for firms. More productive companies (those using production inputs more efficiently) also use energy more efficiently (figure O.7, panel a). Moreover, firm attributes that are positively associated with higher productivity (such as foreign ownership or larger size) are also correlated with greater energy efficiency (figure O.7, panel b). Similarly, factors that are negatively associated with productivity (such as state ownership or operating in highly concentrated markets) tend to correlate negatively with energy efficiency.

Energy efficiency and low-carbon technologies offer a dual benefit for ECA countries, which lag in aligning their climate and economic strategies. Modern low-carbon technologies can both mitigate environmental impact and improve firm productivity. However, fossil fuel subsidies, artificially low electricity prices, and weak carbon pricing provide perverse incentives for firms. ECA has some of the world's highest fossil fuel subsidies. Paired with low, subsidized electricity prices, these subsidies introduce strong distortions by decreasing production costs for fossil fuel–based technologies and reducing overall incentives for resource efficiency because of low energy prices.

Firms that adopt resource-efficient technologies—whether cleaner machinery, smart lighting, or energy monitoring—tend to be more productive. Although they create up-front costs for firms, technologies or processes that are more energy efficient ultimately pay off through higher productivity. However, these gains are largely achieved through within-firm improvements rather than market-driven reallocation. The market dynamics in many ECA countries often move in the wrong direction, rewarding less efficient firms, because of price signals that distort incentives. The result is a misalignment between efficiency and competitiveness. SOEs and highly concentrated sectors perform worse both environmentally and economically.

FIGURE O.7 Energy efficiency and productivity are closely linked



Source: Calculations based on firm-level data from national statistical offices.

Note: Energy efficiency is measured as sales divided by energy costs. Labor productivity is measured as value added per worker. The cross-country sample covers 2006–23 (different time periods per country). C5 = joint market share of the five largest firms in a sector; LP = labor productivity; VA = value added.

Improved resource allocation toward productive sectors and firms would not only benefit productivity but also foster resource efficiency, by altering firms' incentives to adopt more efficient technologies. Policy reforms must start by rationalizing fossil fuel subsidies and moving toward cost-reflective pricing. Doing so creates a level playing field for clean technologies. At the same time, investment in public research and development, access-to-finance tools, and

green innovation programs can accelerate technology uptake. Evidence from countries like Georgia shows that even modest tariff reforms can spark significant efficiency improvements and lead to equipment upgrading.

Reforms of the policy mix are crucial. ECA must also improve the targeting of its environmental spending and shift toward first-best instruments such as emissions pricing, rather than relying solely on command-and-control measures. A consistent and credible green policy framework would improve resource efficiency and boost productivity and economic resilience.

People for Productivity—Jobs, Skills, and Human Capital

Start-ups and other new firms tend to enter the market at a small scale in ECA, at less than half the size of new firms in the United States. Although smaller firm size at entry may suggest lower entry barriers firm creation can be the result of entry due to necessity rather than opportunity. Although the share of necessity-driven entrepreneurs in ECA is similar to the share in OECD countries, the share of purely opportunity-driven founders is slightly lower in ECA. Firms created because of necessity tend to remain in a low-growth, subsistence equilibrium and contribute little to jobs and productivity. Creating an enabling business environment that rewards productive firms and investment by improving access to finance and increasing trade integration is key to encouraging larger, capital-intensive, and innovative companies.

Boosting the entry of high-productivity firms matters for job creation and job quality. When firms are more productive, they can decide to rely less on workers, because their efficiency is higher. They are also likely to have larger output, which may lead them to expand their workforce. Which of these forces dominates is an empirical question.

This report's firm-level analysis suggests that the positive output effect dominates, because the average five-year employment growth rate has a strong positive association with the initial productivity of the firm. For instance, a firm whose productivity is within the first quintile of the distribution displays an average employment growth rate that is substantially lower than that among firms in higher productivity quintiles. Frontier companies (those in the fifth quintile) exhibit average employment growth that is two times higher than that of firms in the fourth quintile and 10 times higher than that of firms in the first quintile. Promoting the entry of innovative, more capital-intensive firms is good for economic growth and employment creation. Similarly, wages rise faster in frontier firms than in lower-productivity firms, although the relationship is weaker than for job creation.

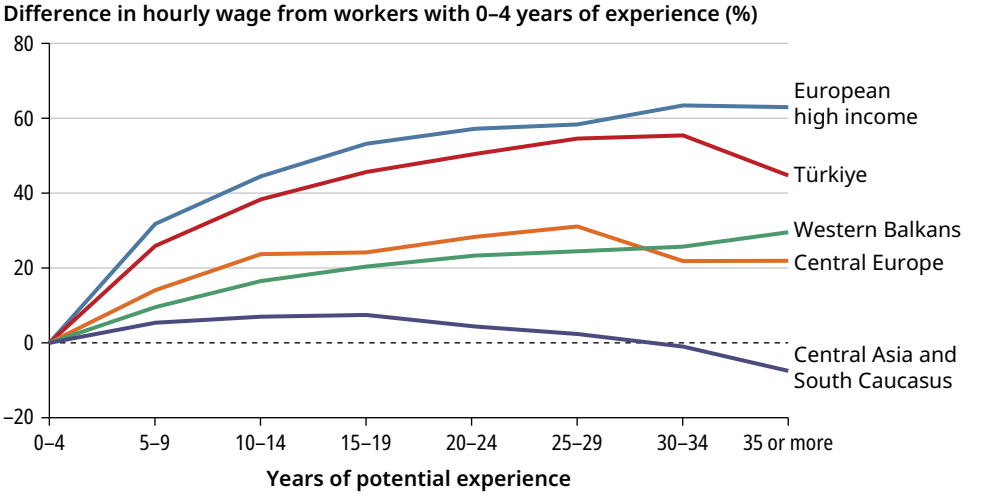
Productivity growth drives job creation, and this link is stronger among high-productivity firms. Productivity growth can be labor-reducing if efficiency is achieved through the adoption of labor-saving technologies. However, productivity

growth may also lead to labor expansion as output expands and the firms scale up. On the basis of firm-level analysis, the report finds a positive association between productivity growth and employment creation. Firms with larger productivity gains tend to have greater employment growth in the long term (over five years). Although this finding could be interpreted as smaller firms making larger efficiency improvements and employment changes, these job growth patterns are robust to the initial employment of the firm and its position in the productivity distribution.

Human capital—not only the stock but also the match between worker skills and job demands—is both a source of strength and a critical constraint across ECA countries. Skills gaps have been constraining, and several key findings should guide policy makers to improve productivity in the region in the coming years:

- *There is significant skill misallocation,* particularly in middle- and low-income ECA countries. Skilled workers are often not placed in larger, more productive firms, and vertical skill mismatches—such as, for example, when workers' education differs from what their jobs require—are common, especially with overqualification.
- *The misallocation results in considerable productivity losses.* Overqualified workers are approximately 12 percent less productive than their well-matched counterparts. Furthermore, returns to experience—an indirect measure of learning on the job—are significantly lower in middle- and low-income ECA countries than in advanced European economies, suggesting ineffective skill accumulation in the workplace (figure O.8).

FIGURE O.8 ECA countries display moderate returns to experience at best, especially compared to countries in Western Europe



Sources: Bossavie, de Hoyos, and Torre 2025, based on data from national labor force surveys and the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

Note: The sample includes only wage employees. The data correspond to 2010–23 (different time periods per country).

- *Underwhelming proficiency in foundational skills is both a drag on productivity and a critical reason for skill misallocation.* Proficiency in foundational skills among ECA workers is low, and learning outcomes for 15-year-olds on international assessments, such as the Programme for International Student Assessment (PISA), have stagnated or declined in many countries, threatening future human capital development. This low proficiency has a direct effect on productivity, because poorly skilled workers are, per se, less productive. It also has a compounding effect on workplace learning, because only workers with high levels of proficiency in foundational skills experience substantial skill accumulation, reflected in a steep earnings-experience profile.
- *Insufficient demand for skills plays a significant role in skill misallocation.* In some ECA countries, a large public sector may be restricting the private sector's demand for high-skill workers. Furthermore, employment in small firms and low-skill service sectors does not foster human capital accumulation throughout a professional career. Although on-the-job training can enhance workplace productivity, it remains underused in ECA relative to high-income countries.
- *Structural characteristics of the labor market matter as well.* Although some institutional features of the labor market—such as minimum wage laws and strict employment protection—do not have a clear relationship with efficient skill allocation, structural characteristics, such as the extent of informal employment, are linked to higher levels of mismatch and lower returns to experience.
- *Poor managerial skills and inefficient firm organization can lead to weak labor outcomes.* Overall managerial skills across firms in ECA are lacking, which contributes to both skill misallocation and poorer firm performance.

These findings point to a multipronged policy approach. First, education systems should focus on building strong foundational skills to ensure a steady pipeline of adaptable, trainable workers. Second, firm-level policies should expand access to on-the-job training and promote skills development through modular certifications and cost-sharing partnerships between the public and private sectors. Last, labor market policies should foster an environment that supports skill use and accumulation by minimizing mismatches, encouraging job mobility, and enabling integration into dynamic, innovation-driven markets.

Education reforms should guarantee that all students attain mastery in essential competencies such as literacy and numeracy at an early stage. This mastery is especially critical given the rise of automation and the increasing complexity of tasks in labor market dynamics. Effective interventions might include high-dosage tutoring, personalized instruction, and strategies to enhance teacher effectiveness, especially in underperforming school systems.

Reforms should target all levels of education, particularly vocational training and higher education. ECA countries' education systems are characterized by a large footprint of vocational education in upper secondary and high enrollment rates in higher education. These subsystems are usually not the focus of reform efforts aimed at improving foundational skill proficiency. However, graduates from both vocational and tertiary education have disappointing levels of cognitive skills, indicating the need to address these skills gaps even at these levels of education.

Credentialing systems require reform to reflect actual competencies more accurately. Excessive reliance on formal degrees obscures significant disparities in skill proficiency among graduates and contributes to overqualification. By transitioning to modular, competency-based certification frameworks that acknowledge both formal and informal learning, policies should enhance labor market signaling and promote lifelong learning. Such reforms would not only help mitigate skill mismatches but also enable workers to acquire and demonstrate their skills in more flexible and job-relevant ways.

Policies should enhance workplace learning by increasing access to training opportunities. Although most firms provide limited on-the-job training, productivity gains are significant when such training is available, particularly for workers with stronger foundational skills. Governments can support cost-sharing initiatives for training, promote diagnostic assessments of skills to tailor programs to workers' specific needs, and ensure that foundational skills gaps are addressed before investing in more advanced technical training. When implementing these policies, it is important to include mechanisms such as retention incentives and strong certification systems: Without them, firms' investment in broad-based training will remain limited.

Improving managerial practices can enhance skill allocation and firm performance. Global experiences indicate that governments can assist firms in enhancing their managerial practices cost-effectively, especially by using both individual and group-based consulting services.

Labor markets require improved tools to address the mismatches between workers' skills and job requirements. Enhancing labor market observatories that monitor skill demand and wage returns—together with modern, data-driven public and private employment services—can assist job seekers, especially youth, in making more informed decisions about training and employment opportunities. Implementing better-matching mechanisms is crucial for reducing both the prevalence and persistence of skill mismatches and overqualification.

Policy Agenda for Productivity and Prosperity

ECA countries need to complete the transition to market-based economies and address the misallocation of resources across and within sectors while also strengthening firms' capabilities through technology adoption and skills development. They need to complete the transition to market economies and embrace a productivity-centered development strategy. To do so, reforms must address distortions, support technology adoption, and equip people and firms to adapt. Removing frictions and distortions in labor and financial markets would facilitate the reallocation of economic resources to more productive firms and increase productivity. In labor markets, governments should increase flexibility in labor market regulations, by eliminating preferential treatment for SOEs and any type of preference not based on fundamentals, such as size-based subsidies. Modernizing insolvency regimes can also support the reallocation of resources to the most productive firms and activities. Welcoming FDI (both public and private, with know-how and expertise in key upstream sectors) can increase aggregate productivity. These business environment reforms need to be accompanied by policies and programs that increase the use of digital and resource-efficient technologies and strengthen the foundational skills of workers and managers.

This report lays out priority actions for trade, investment, digitalization, efficiency, and skills—to ride the "TIDES" to higher productivity.

Priority 1: Ignite trade-led productivity by launching a fresh reform push that deepens ECA's integration into regional and global value chains.

Trade—connect and compete. Igniting trade-led productivity growth in ECA requires a renewed reform push to deepen the region's integration into global and regional value chains. The focus should shift from simply expanding trade volumes to enhancing firms' ability to connect, compete, and move up the value chain. This entails reducing the costs of cross-border commerce, aligning trade frameworks with the realities of digital trade, and ensuring that export promotion efforts foster firm-level learning and survival in global markets. By tackling barriers at and behind the border, governments can unlock the reallocation, scale, and learning effects that drive sustained productivity growth.

Depending on country context, specific recommendations may include

- **Lower trade costs** by, for example, simplifying customs procedures, harmonizing standards, and improving logistics infrastructure, especially to help smaller and first-time exporters.
- **Modernize trade frameworks** to enable digital trade and cross-border data flows, positioning firms to compete in knowledge-intensive services.

- **Facilitate value chain integration** by, for example, advancing regional cooperation and streamlining border processes.

Priority 2: Maximize the benefits from foreign investment by improving links with and spillovers to the domestic economy.

Investments—anchor FDI and amplify spillovers. A credible, predictable investment climate—combined with open and well-regulated service sectors—can attract high-quality investors. But reclaiming productivity momentum from foreign investment requires not only attracting more FDI but also turning it into a catalyst for domestic upgrading. This means integrating foreign investors into the domestic economy so that competition and collaboration drive innovation and productivity gains. At the same time, strengthening domestic capabilities, supplier networks, and innovation ecosystems ensures that foreign investment drives broader structural transformation rather than creating isolated enclaves. By anchoring FDI and amplifying its spillovers, ECA economies can accelerate firm-level upgrading and push frontier practices deeper into domestic production networks.

Depending on the country context, specific recommendations may include

- **Enhance the investment climate** through, for example, transparent rules, efficient administrative processes, and predictable incentives that attract and retain high-quality FDI.
- **Deepen services liberalization** in, for example, digital, logistics, and finance, to support the operations of multinational firms in the local economy and improve local market efficiency.
- **Foster strong linkages** between foreign investors and domestic firms, for instance through supplier development programs, partnership platforms, and targeted capacity-building support.
- **Align fiscal incentives with productivity goals** by, for example, redirecting tax breaks toward initiatives supporting innovation, research and development partnerships, and workforce mobility that spread foreign know-how across the economy.

Priority 3: Foster investments in upgrading and technology adoption through incentives.

Digitalization—diffuse frontier technologies, strengthen capabilities, and deepen use. Realizing the benefits of closing the region's digitalization gap requires more than improving connectivity. It demands stronger firm capabilities, better incentives, and a more competitive environment that encourages technology adoption. Governments should shift from policies that simply subsidize technology purchases toward those that promote the effective and

intensive use of digital tools. Equally important are complementary investments in human capital, competition, and finance, which enable firms to absorb and deploy new technologies productively. By creating the right incentives, skills, and market conditions, ECA countries can turn connectivity into competitiveness.

Depending on the country context, specific recommendations may include

- **Address market distortions** that discourage private investments in digital solutions, for example, by strengthening competition.
- **Integrate digital skills into educational and training systems** to better align them with evolving labor market needs.
- **Pair digital technology support with management and organizational capacity-building support** to help firms use new tools effectively and improve internal processes.[2]
- **Promote responsible adoption of digital financial services** to expand access to finance—especially for underserved firms—enhance financial management practices, and support broader business digitalization.

Priority 4: Remove distortions and misallocation of resources by fostering competitive domestic markets.

Efficiency—level the playing field and unleash reallocation. Policies to promote efficiency should focus on removing distortions that trap resources in low-productivity firms and enabling markets where productive firms can enter, grow, and replace less efficient ones. This requires making markets contestable and removing distortions that shield incumbents and restrict new entrants. Ensuring competitive neutrality for the state itself is equally critical. For instance, SOEs engaged in commercial activities should compete on equal terms with private firms. Efficient reallocation of resources also depends on mitigating a misallocation of finance. Governments should promote modern and inclusive financial systems that direct financing toward productive and innovative firms.

Strengthening the core enabling environment for access to finance can yield substantial impact with limited fiscal costs. These reforms can be complemented with well-designed, targeted, and proven financial interventions. These interventions often carry significant fiscal costs and can introduce distortions. Careful design and selection are, therefore, critical, because each intervention has unique characteristics that influence its impact and feasibility.[3]

Depending on country context, specific recommendations may include

- **Promote contestability** by, for example, conducting systematic reviews of regulations, licenses, tax incentives, and procurement rules to identify measures that protect incumbents or restrict market entry, exit, and expansion.

- **Ensure competitive neutrality for SOEs** by, for example, requiring SOEs to operate under market-based financing, transparent governance, and clear accountability mechanisms, while also phasing out preferential treatment such as subsidies.
- **Strengthen the enabling environment for finance,** drawing on international and regional good practices by, for instance, enhancing credit infrastructure, diversifying the range of financial providers and products, and leveraging fintech innovation, while ensuring associated risks are adequately managed.
- **Improve the effectiveness of targeted financial interventions** by, for example, improving targeting of beneficiaries and financial intermediaries, financial additionality, especially through private capital mobilization, and accountability through robust monitoring and evaluation systems.

Priority 5: Unlock productivity through foundational learning by aligning talent and driving lifelong upskilling.

Skills—align talent and accelerate learning. Policies to enhance skills should focus on rebuilding foundational competencies, improving the alignment of talent with labor market needs, and fostering lifelong learning. Education systems should ensure strong foundational skills, while also promoting competency-based, flexible learning that adapts to evolving labor market demands. Complementary measures can encourage continuous upskilling to enable firms and workers to fully leverage productivity-enhancing technologies and practices. By aligning talent with private sector needs and embedding lifelong learning, ECA countries can boost firm-level productivity and drive economywide growth.

Depending on country context, specific recommendations may include

- **Strengthen foundational skills** by, for example, ensuring universal early mastery of literacy, numeracy, and digital reasoning, tracked through national assessments benchmarked internationally. This effort should also include interventions in underperforming vocational and higher education.
- **Support lifelong learning** by, for example, supporting on-the-job skill development, especially in digital and technical areas.
- **Enhance education–employer linkages** by, for example, facilitating collaboration between firms and education providers.
- **Support better labor market matching** by, for example, strengthening mechanisms that connect workers with opportunities, ensuring that skills are fully utilized.

Gains from improved resource allocation and firm capabilities are often interdependent, highlighting the importance of addressing holistically all five elements of TIDES. Building capabilities alongside competition is key.

Without investments in technical and managerial skills and new technologies, domestic firms might struggle to respond to new competition unleashed by market reforms and improved integration. Empirical evidence suggests that, without firm capabilities, even the least distorted economies might fail to reap the benefits of reallocation (Cusolito and Maloney 2018). However, this interdependence runs both ways: Eliminating misallocation also increases firms' incentives to invest in technologies and skills, because the returns to these investments tend to be higher in more efficient markets (Bloom et al. 2022).

Beyond these priorities, it is crucial to mainstream the productivity agenda in countrywide growth strategies, underpinned by strong institutions and robust statistical data and analytics, alongside an independent national productivity board empowered to keep score. Every ECA government issues multiyear development plans, yet few make productivity their organizing principle. Each new plan should contain a dedicated productivity pillar with hard targets for TFP growth, misallocation reductions, and skills upgrading, to be monitored with the same rigor as fiscal rules. OECD experience has shown that national productivity boards work when they are independent, multidisciplinary, and data rich. Their toolkits should include a "red-flag" mechanism requiring ministries to justify measures that harm productivity, a public dashboard tracking key indicators, and peer reviews with other national productivity boards to share lessons. Delivering this agenda hinges on statistical upgrades, especially richer business microdata and modern data service functions, to enable timely and high-quality diagnostics to guide policymaking and improve accountability. With these enablers, ECA can convert reform blueprints into measurable productivity gains.

Notes

1. For the purpose of this report, ECA economies were classified into five groups using k-means clustering based on a variety of economic, geographic, and institutional factors (GDP share of agriculture, natural resource rents [percent of GDP], trade openness, distance to the geographic center of the European Union, and Bertelsmann Stiftung's Transformation Index): (1) high-income and emerging markets and developing economies (Croatia, Poland, Romania, and Türkiye), (2) Eastern Europe advanced economies (Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Montenegro, North Macedonia, and Serbia), (3) Eastern Europe less advanced economies (Albania, Armenia, Moldova, and Ukraine), (4) resource–rich economies (Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan), and (5) agricultural Central Asia economies (the Kyrgyz Republic, Tajikistan, and Uzbekistan). However, completeness of groups may vary due to data availability. Notes below figures list the exact countries included in each group.
2. Strengthening managerial practices increases firms' capabilities to integrate and intensively use new technologies (Cirera, Comin, and Cruz 2024; Cirera and Maloney 2017). For a detailed review of policy instruments to build firm capabilities and accelerate technological catch-up, refer to Cirera et al. (2020).
3. Refer to Carvajal and Didier (2024) for specific recommendations based on an assessment of the effectiveness of policies to improve access to finance for under-served businesses.

References

Bloom, N., L. Iacovone, M. Pereira-Lopez, and J. Van Reenen. 2022. "Management and Misallocation in Mexico." Working Paper 29717, National Bureau of Economic Research, Cambridge, MA.

Bossavie, L., R. de Hoyos, and I. Torre. 2025. "Human Capital Accumulation at Work: Insights from Returns to Experience in Europe and Central Asia." Background paper for this report. World Bank, Washington, DC.

Carvajal, A. F., and T. Didier. 2024. *Boosting SME Finance for Growth: The Case for More Effective Support Policies*. Washington, DC: World Bank.

Cirera, X., D. A. Comin, and M. Cruz. 2024. "Anatomy of Technology and Tasks in the Establishment." Working Paper 32281, National Bureau of Economic Research, Cambridge, MA.

Cirera, X., J. Frias, J. Hill, and Y. Li. 2020. *A Practitioner's Guide to Innovation Policy*. Washington, DC: World Bank.

Cirera, X., and W. F. Maloney. 2017. *The Innovation Paradox: Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up*. Washington, DC: World Bank.

Cusolito, A., R. Fattal-Jaef, D. Mare, and A. Singh. 2024. "The Role of Financial (Mis)allocation on Real (Mis) allocation: Firm-Level Evidence from European Countries." Policy Research Working Paper 10811, World Bank, Washington, DC. http://hdl.handle.net/10986/41744.

Cusolito, A. P., and W. F. Maloney. 2018. *Productivity Revisited: Shifting Paradigms in Analysis and Policy*. Washington, DC: World Bank. http://hdl.handle.net/10986/30588.

Feenstra, R. C., R. Inklaar, and M. P. Timmer. 2015. "The Next Generation of the Penn World Table." *American Economic Review* 105 (10): 3150–82. www.ggdc.net/pwt.

Hsieh, C., and P. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics* 124 (4): 1403–48. https://doi.org/10.1162/qjec.2009.124.4.1403.

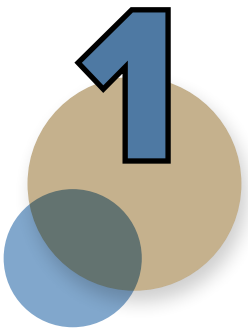
Iacovone, L., I. V. Izvorski, C. Kostopoulos, M. M. Lokshin, R. Record, I. Torre, and S. Doczi. 2025. *Greater Heights: Growing to High Income in Europe and Central Asia*. Europe and Central Asia Studies. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-2206-3.

Abbreviations

AI	artificial intelligence
C5	five-firm concentration ratio
CO_2	carbon dioxide
EAP	East Asia and Pacific
ECA	Europe and Central Asia
EE	energy efficiency
ERP	enterprise resource planning
EU	European Union
FDI	foreign direct investment
GDP	gross domestic product
GFC	global financial crisis
HICs	high-income countries
HS	Harmonized System
IEA	International Energy Agency
IFC	International Finance Corporation
ILO	International Labour Organization
IMF	International Monetary Fund
ISCO	International Standard Classification of Occupations
IT	information technology
LP	labor productivity
MGI	mixed green investment
ML	machine learning
MWh	megawatt-hour
NACE	European Statistical Classification of Economic Activities
OECD	Organisation for Economic Co-operation and Development
OLS	ordinary least squares
PGI	pure green investment
PIAAC	Programme for the International Assessment of Adult Competencies
PISA	Programme for International Student Assessment

R&D	research and development
SMEs	small and medium enterprises
SOEs	state-owned enterprises
STEP	Skills Toward Employment and Productivity
TFP	total factor productivity
TIDES	trade, investment, digitalization, efficiency, and skills
VA	value added

All dollar amounts are US dollars unless otherwise indicated.



Drivers of Productivity Growth

Productivity: Essential for Economic Growth in the Region

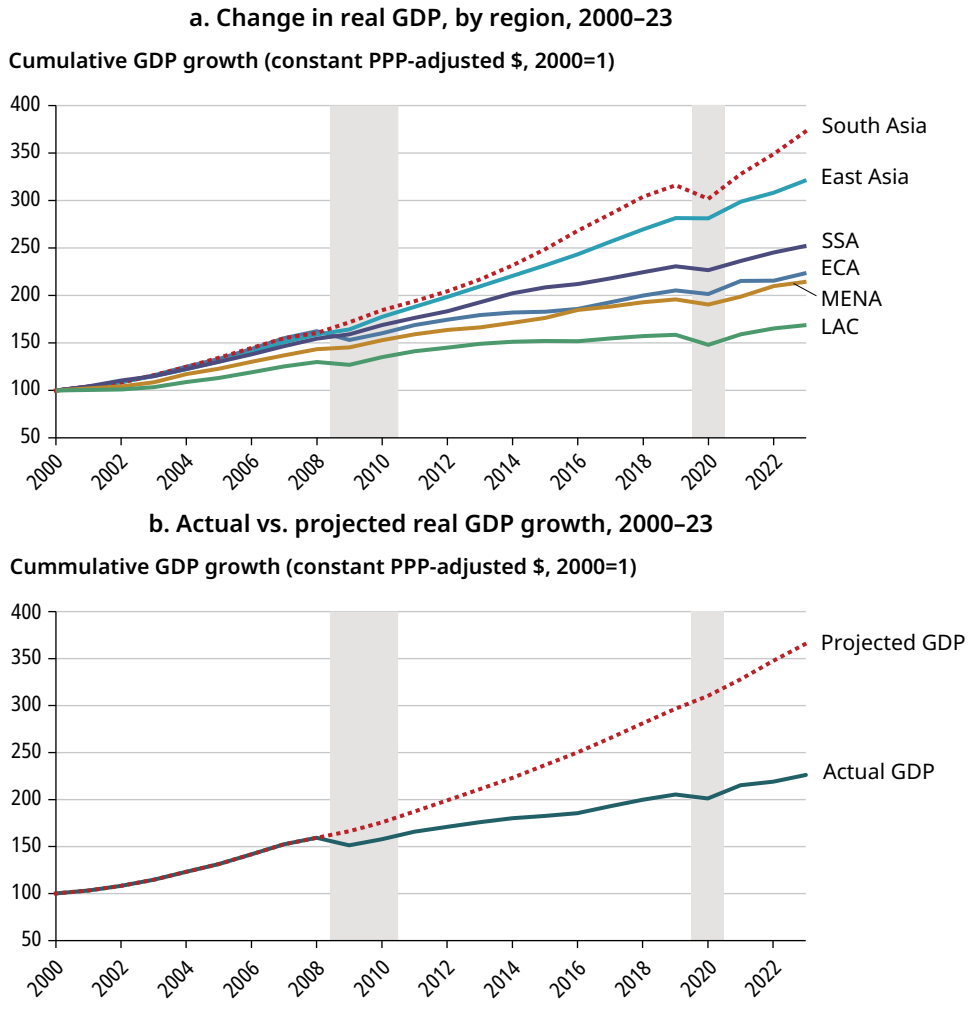
Economies in Europe and Central Asia (ECA) have not regained the pace of economic growth experienced before the global financial crisis (GFC) of 2008–09. Over the past two decades, ECA countries suffered two serious setbacks to economic growth: first the GFC and then the COVID-19 pandemic in 2020. ECA suffered more than other regions such as East Asia and Pacific (EAP), South Asia, and Sub-Saharan Africa from the impact of the GFC, both from the economic recession brought on by the crisis and from the slowed pace of gross domestic product (GDP) growth since then (figure 1.1a). ECA economies grew at an average annual rate of 2.2 percent in real terms between 2008 and 2023, down from 6.3 percent between 2000 and 2008. Had the ECA region maintained the same growth pace as before the crisis, its current output would have been 62 percent higher (figure 1.1b). This forgone economic growth has meant less job creation, lower wages, and lower welfare.

Despite steady growth in capital stock, economic growth has slowed in ECA in the post-GFC period. Between 2001 and 2008, capital stock in the ECA region grew 12 percent in real terms, and real GDP grew 6 percent. Capital stock grew even more rapidly between 2008 and 2023, at 34 percent in real terms, but real GDP grew more slowly, at 2.7 percent. Thus, capital has become less productive in generating output, reflecting diminishing returns to capital accumulation—as evidenced by a much larger incremental capital–output ratio over 2008–23 than in preceding periods (figure 1.2).



Online annexes for this report are available at https://hdl.handle.net/10986/43788.

FIGURE 1.1 ECA economies have not regained the rate of GDP growth experienced before the global financial crisis

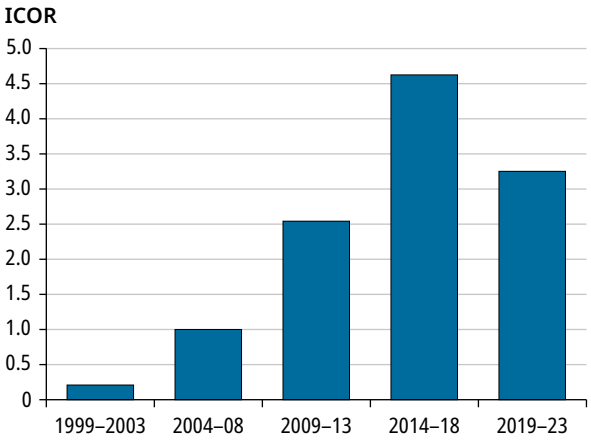


Source: Analysis based on data from World Bank, World Development Indicators.

Note: Projected GDP assumes that total factor productivity would have continued to grow with the same average growth rate as observed prior to the global financial crisis. ECA = Europe and Central Asia; GDP = gross domestic product; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SSA = Sub-Saharan; Africa. PPP = purchasing power parity.

FIGURE 1.2 ECA exhibits decreasing returns to capital accumulation

Average annual ICOR, 1999–2023



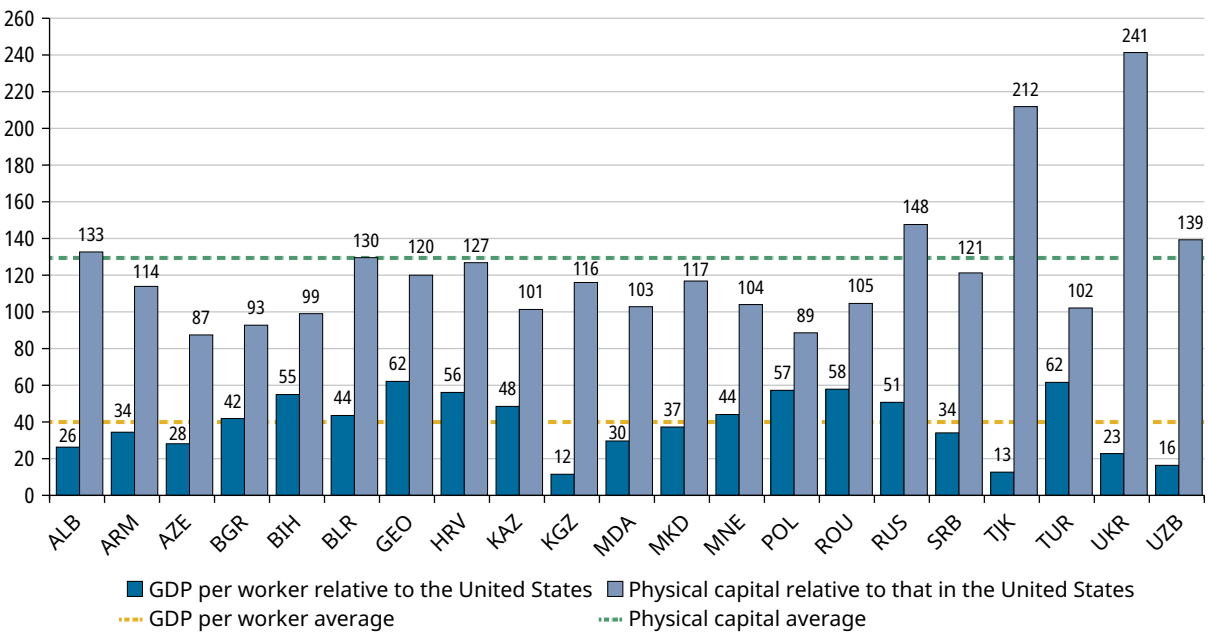
Sources: Estimates based on data from World Bank, World Development Indicators and Penn World Table (Feenstra, Inklaar, and Timmer 2015); World Bank 2024a.

Note: Averages exclude 1999, 2009, and 2020, when the ICOR was negative because of negative GDP growth. ICOR = incremental capital–output ratio.

Capital accumulation alone is not enough to enable income levels in ECA countries[1] to converge with those of high-income economies such as the United States. If capital were the only factor explaining differences in GDP per worker between ECA countries and the United States, many ECA countries would be at a similar level as the United States (figure 1.3). However, GDP per worker in most ECA countries is less than half that in the United States. The difference in GDP per worker between ECA countries and high-income countries is explained not by the differences in factor endowment but by efficiency gaps in how productive factors (physical capital) are allocated and used across the economy.

FIGURE 1.3 Capital accumulation alone is not enough for GDP per worker in ECA countries to converge with that in the United States

Relative GDP per worker and relative capital–output ratio, by country



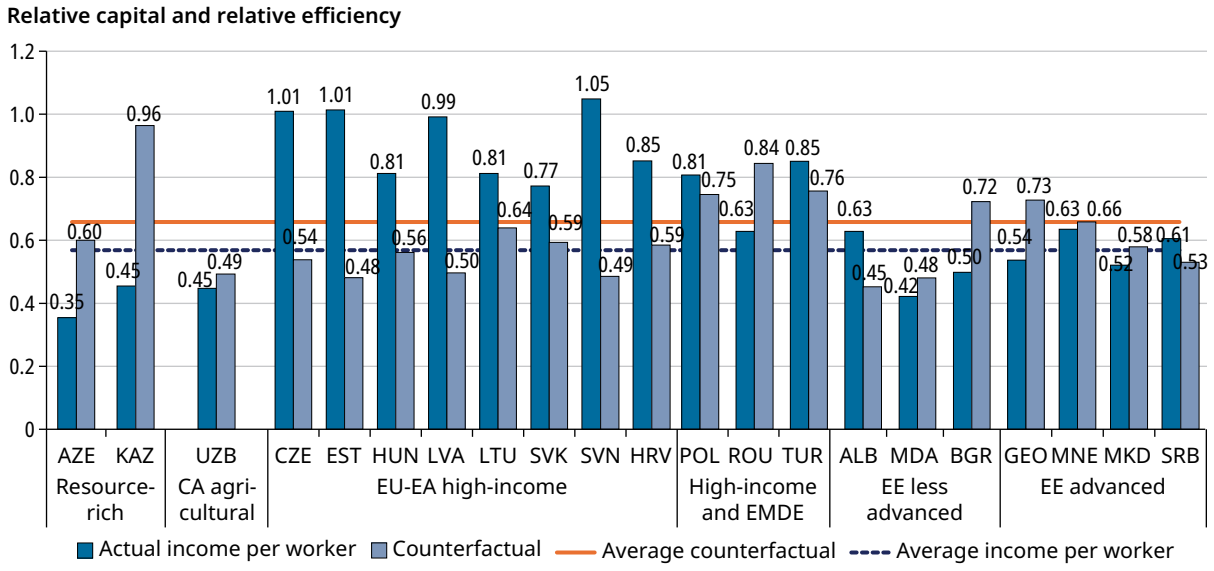
Source: Estimates based on Penn World Table Data 11.0 (Feenstra, Inklaar, and Timmer 2015).

Note: The dark blue bars show GDP per worker relative to the United States, and the light blue bars represent the capital-output ratio relative to the United States. The yellow and green dashed lines indicate the unweighted means for all countries displayed. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia; GDP = gross domestic product.

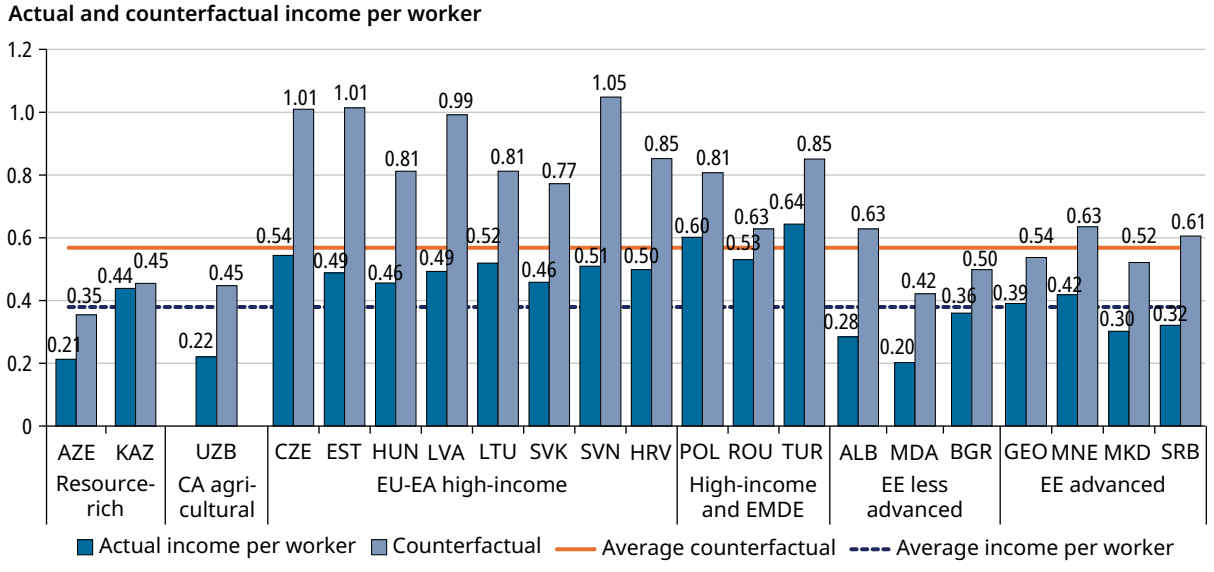
Per capita income in most ECA countries is constrained relative to that in the United States not only by lower levels of factor endowment (capital gaps) but also by lower capital efficiency (efficiency gaps) such that parts of the capital gaps are likely to be explained by the efficiency gaps. Estimates of these capital and efficiency gaps find distributions of physical and human capital for ECA workers consistent with their being about 60 percent as productive as US workers (capital gap) and find an efficacy of factor utilization at 62 percent of that in the United States (efficiency gap) (figure 1.4).[2] In other words, on average, not only do ECA countries have only about 60 percent of the human and physical capital per worker as in the United States, but the efficacy of workers' use of those factors is only 62 percent of that in the United States. The high susceptibility of both human and physical capital to changes in efficiency means that both capital gaps and efficiency gaps contribute to the overall productivity gap. To close the efficiency gap with the United States, ECA countries need to improve both factor allocation and factor efficiency.

FIGURE 1.4 For ECA countries, efficiency gaps with the United States are larger than capital gaps, 2022

a. Relative capital and relative efficiency, by ECA country group



b. Actual versus counterfactural GDP per worker, by ECA country group



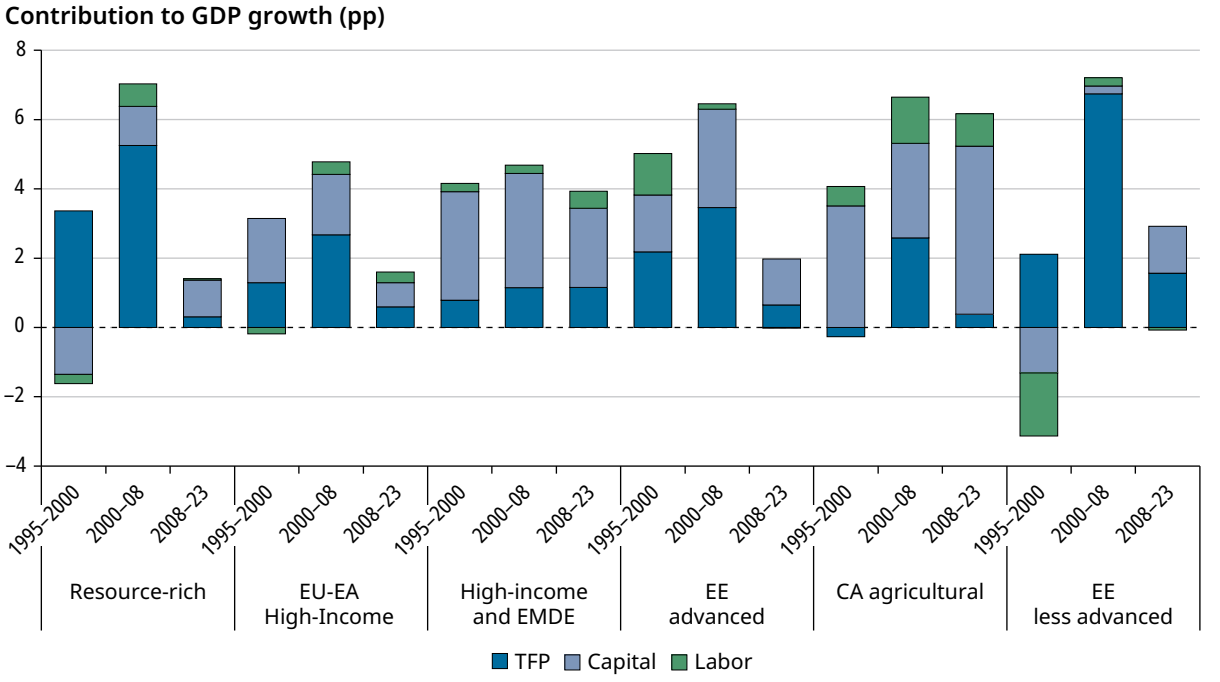
Source: Estimates based on data from Programme for International Student Assessment and World Bank, World Development Indicators, using the estimation methodology in Caselli 2016.

Note: In panel a, the dark blue bars represent capital per worker in the identified country group relative to capital per worker in the United States (relative capital). This shows each country's counterfactual income relative to the United States as in panel b; the light blue bars represent relative efficiency under the given relative capital per worker. The horizontal lines indicate the unweighted means for all countries excluding the EU-EA high-income countries. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. CA = Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; EU-EA = European Union and euro area; GDP = gross domestic product.

Slower growth in productivity—rather than in factor accumulation—is the key reason for the slower growth in ECA countries in the post-GFC period. A Solow decomposition analysis of growth finds that the contribution of total factor productivity (TFP) to growth has declined since the GFC for most country groups in the ECA region (figure 1.5). Meanwhile, contributions from factor accumulation—capital, labor, and human capital combined—have remained constant or have increased over time. About 91 percent of the decline in GDP growth is attributable to the decline in TFP growth during the post-GFC period.

FIGURE 1.5 The contribution of TFP growth to GDP growth has declined since the global financial crisis in ECA countries

Contribution of TFP growth to GDP growth, by ECA country group, 1995–2023



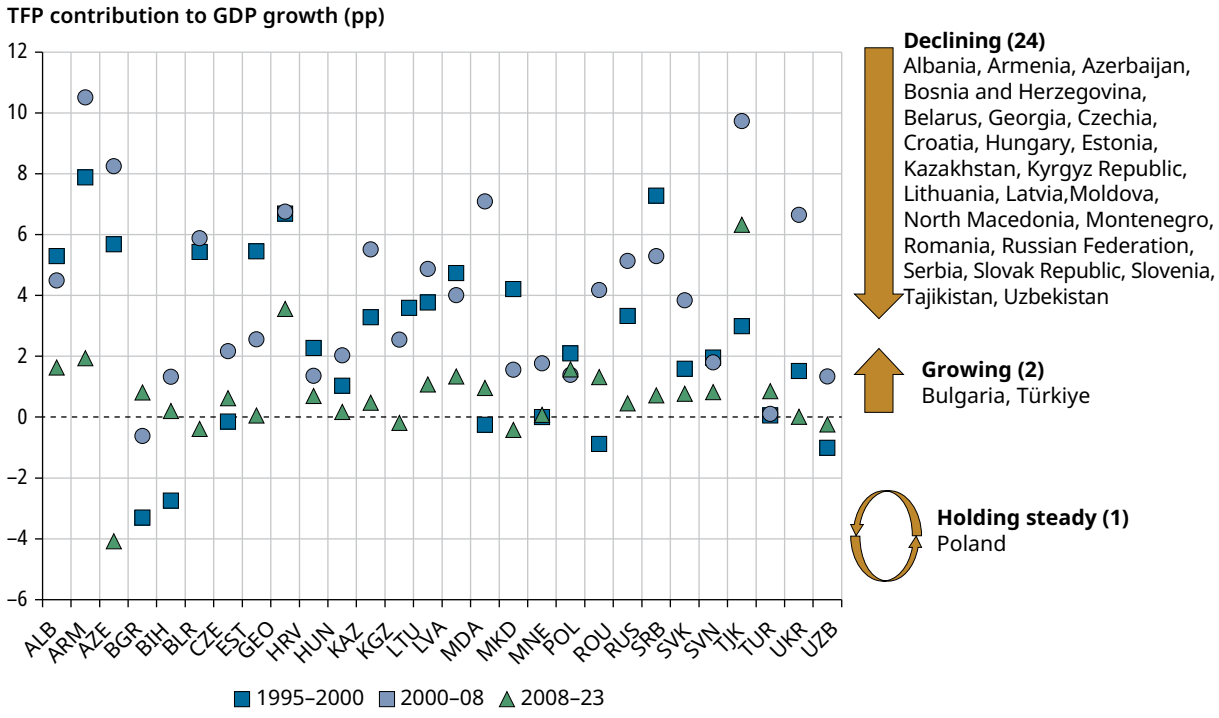
Source: Estimates based on data from World Bank, World Development Indicators and Penn World Table 10.01 (Feenstra, Inklaar, and Timmer 2015); World Bank 2024a.

Note: CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; EU-EA high income comprises Czechia, Estonia, Hungary, Latvia, Lithuania, Slovak Republic, and Slovenia; high income and emerging markets and economies comprises Croatia, Poland, Romania, and Türkiye; and resource-rich comprises Azerbaijan, Kazakhstan, and the Russian Federation. CA = Central Asia; ECA = Europe and Central Asia; EMDE = emerging markets and developing economies; EE = Eastern Europe; EU-EA = European Union and euro area; GDP = gross domestic product; pp = percentage point; TFP = total factor productivity.

Most countries in ECA experienced rapid declines in TFP growth after the GFC and did not bounce back before the pandemic (figure 1.6). Only two economies, Bulgaria and Türkiye, have managed to boost their TFP growth levels since the GFC. Adjusting for capital utilization has lowered TFP even more during the post-GFC period.

FIGURE 1.6 TFP growth dynamics in ECA countries changed after the global financial crisis

Average TFP growth (in pp over indicated period), by country, 1995–2023



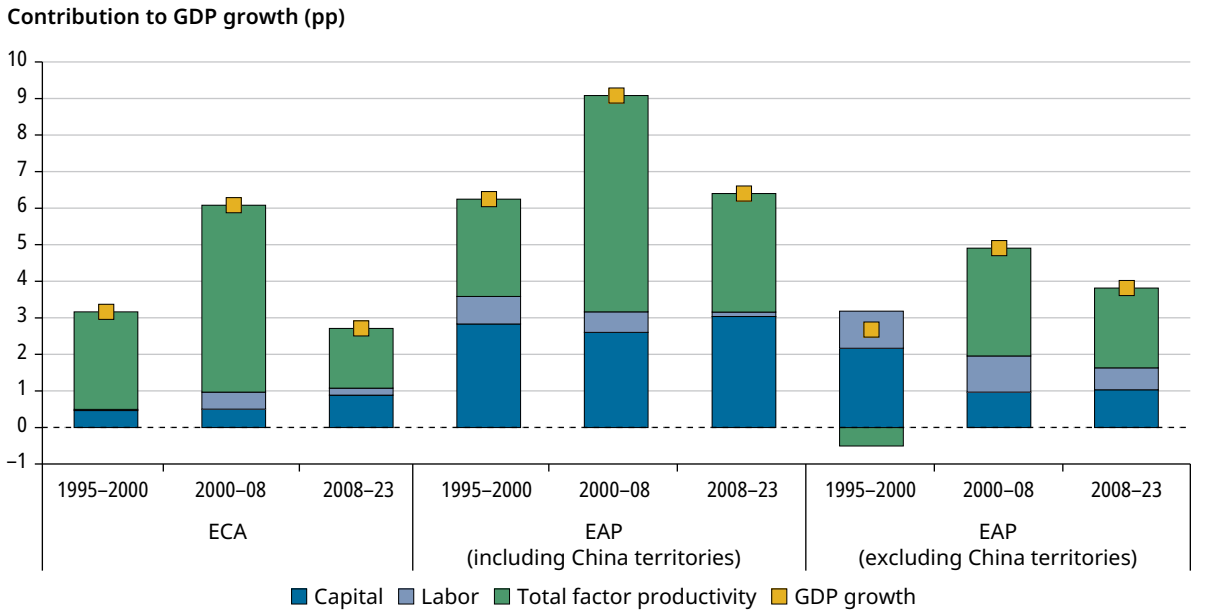
Source: Estimates based on data from World Bank, World Development Indicators and Penn World Table 10.01 (Feenstra, Inklaar, and Timmer 2015); World Bank 2024a.

Note: For a list of country codes, refer to https://www.iso.org/obp/ui/#search. GDP = gross domestic product; pp = percentage point; TFP = total factor productivity.

The large contraction in TFP contributions to growth in ECA in the post-GFC period explains the region's weaker growth performance relative to the East Asia and Pacific (EAP) region (figure 1.7). Whereas the combined contribution of capital and labor to economic growth in ECA remained constant between 2000–08 and 2008–23, the contribution of TFP to growth fell by half. Over the same periods, EAP countries excluding China maintained roughly similar levels of capital, labor, and TFP contributions to their growth. Including data for China makes the contribution of TFP to EAP GDP growth proportionally less pronounced, but not to the extent of the contraction seen in the ECA region. Had the ECA region maintained the same level of TFP growth after the GFC as before, its growth performance in the later period would have been comparable to that of the EAP region including China and stronger than that of the EAP region excluding China.

FIGURE 1.7 The contribution of TFP growth to GDP growth contracted sharply in ECA compared with EAP (with and without China) after the global financial crisis

Contributions to GDP growth, ECA versus EAP, 1995–2023



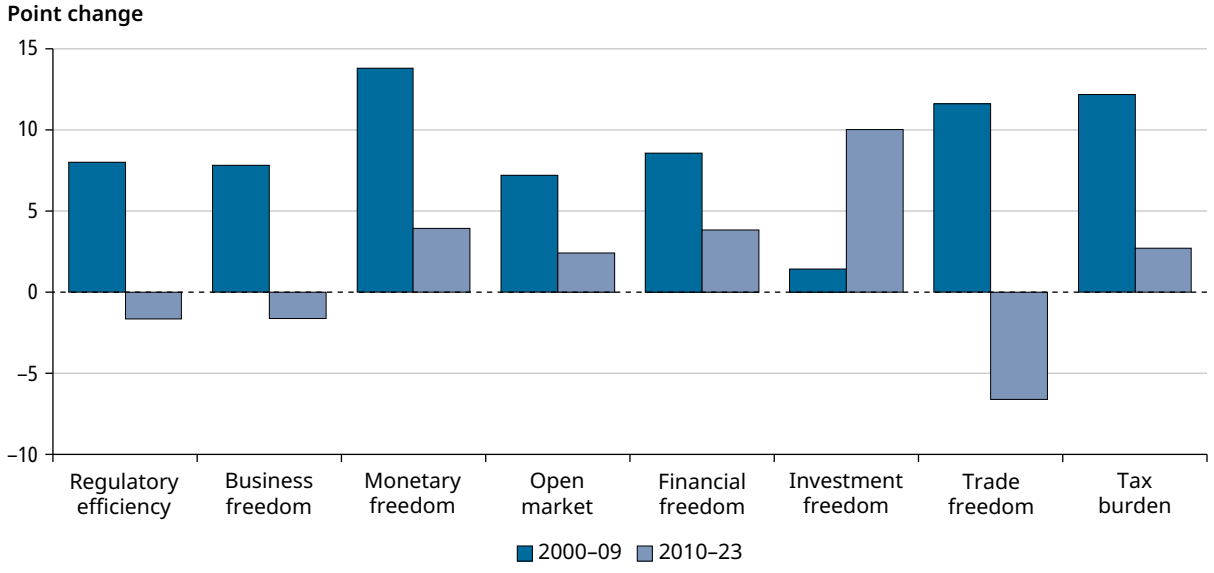
Source: Estimates based on data from Penn World Table 10.01 (Feenstra, Inklaar, and Timmer 2015) and the World Bank.

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; GDP = gross domestic product; pp = percentage point; TFP = total factor productivity.

The large contraction in TFP contributions to growth coincided with a slowdown—and some reversals—in reforms across ECA. Much of the momentum toward market-oriented reform faltered in the wake of the GFC. With the exception of greater investment freedom, reforms have stalled or retreated (figure 1.8). Regulatory efficiency reforms have been reversed. The heavy regulatory burden on firms creates a drag on business productivity and profitability, whether by interfering with market operations (price setting) or by increasing the cost of production. The slowing pace of financial sector reforms means that financial sectors across ECA still cannot efficiently allocate credit to more productive firms, and pervasive state involvement in banking distorts competition and reduces transparency. These reform slowdowns and setbacks, together with lagging monetary system reforms to increase monetary freedom, have created a market environment that distorts prices and misallocates resources.

FIGURE 1.8 Reform momentum has stalled since 2010

Changes in economic freedom scores, by indicator, 2000–23



Source: Analysis based on Heritage Foundation, Economic Freedom database.

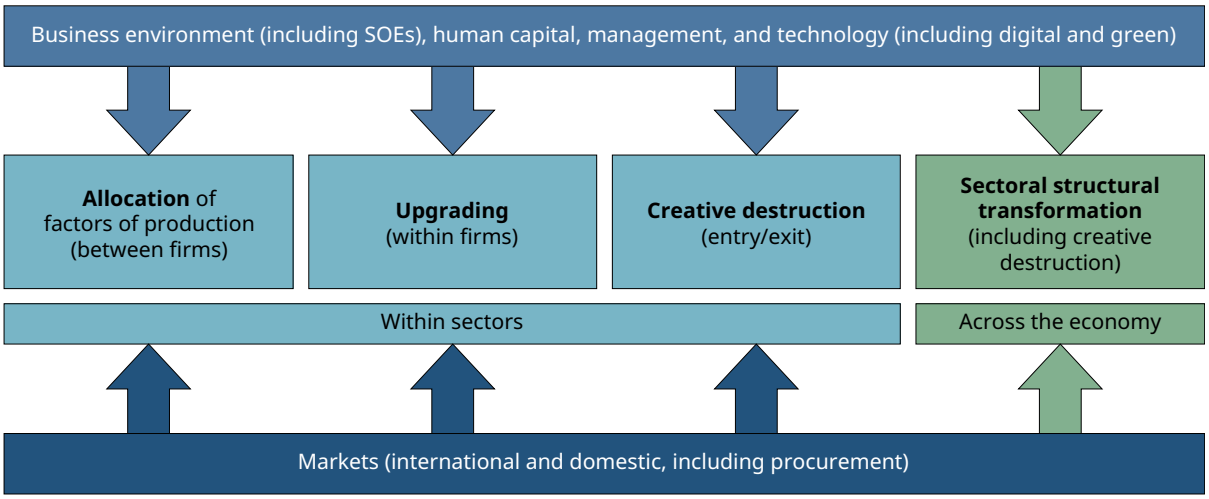
Note: Data show the unweighted average change in scores across all countries in Europe and Central Asia for indicators under the two market-oriented pillars of the four pillars of the economic freedom score: open markets (trade freedom, investment freedom, financial freedom) and regulatory efficiency (business freedom, monetary freedom). The figure also shows tax burden, an indicator under the government size pillar.

Pathways to Productivity Growth: Structural Transformation, Within-Sector Allocation, Creative Destruction, and Firm Upgrading

Four complementary pathways can drive aggregate productivity growth: structural transformation, reallocation between incumbent firms, creative destruction, and firm upgrading. Figure 1.9 depicts the four mechanisms by which markets and the business environment affect aggregate productivity growth, either within sectors or between sectors. Within sectors, three channels can induce productivity growth. The first is market reallocation, which can occur through shifts in market shares of incumbents toward more productive firms. The second pathway is within-firm upgrading, referring to changes in a firm's productivity level over time, which could be induced through efficiency- or quality-improving investments in technology, organization, or skills. The third is firm selection, through the entry of more productive and the exit of less productive firms, often referred to as creative destruction. Finally, aggregate productivity can grow through a fourth mechanism: structural transformation. Structural changes of the economy (movements of employment between sectors) lead to higher aggregate productivity if more resources are allocated to sectors with higher levels of productivity.

FIGURE 1.9 Markets and the business environment affect productivity growth in several ways

Four mechanisms of the business environment's and markets' effect on productivity growth



Source: World Bank.

Note: SOE = state-owned enterprise.

The four pathways do not operate in isolation but interact with each other. Greater misallocation in sectors can negatively affect entry and exit of firms, as distortions affect which firms survive. Furthermore, misallocation reduces the returns to investment in upgrading, which lowers the incentives for firms to invest in new skills or technologies (Bloom et al. 2022). The following sections delve deeper into the effects of each of the four drivers on aggregate productivity and assess how misallocation has negatively affected further productivity growth in ECA.

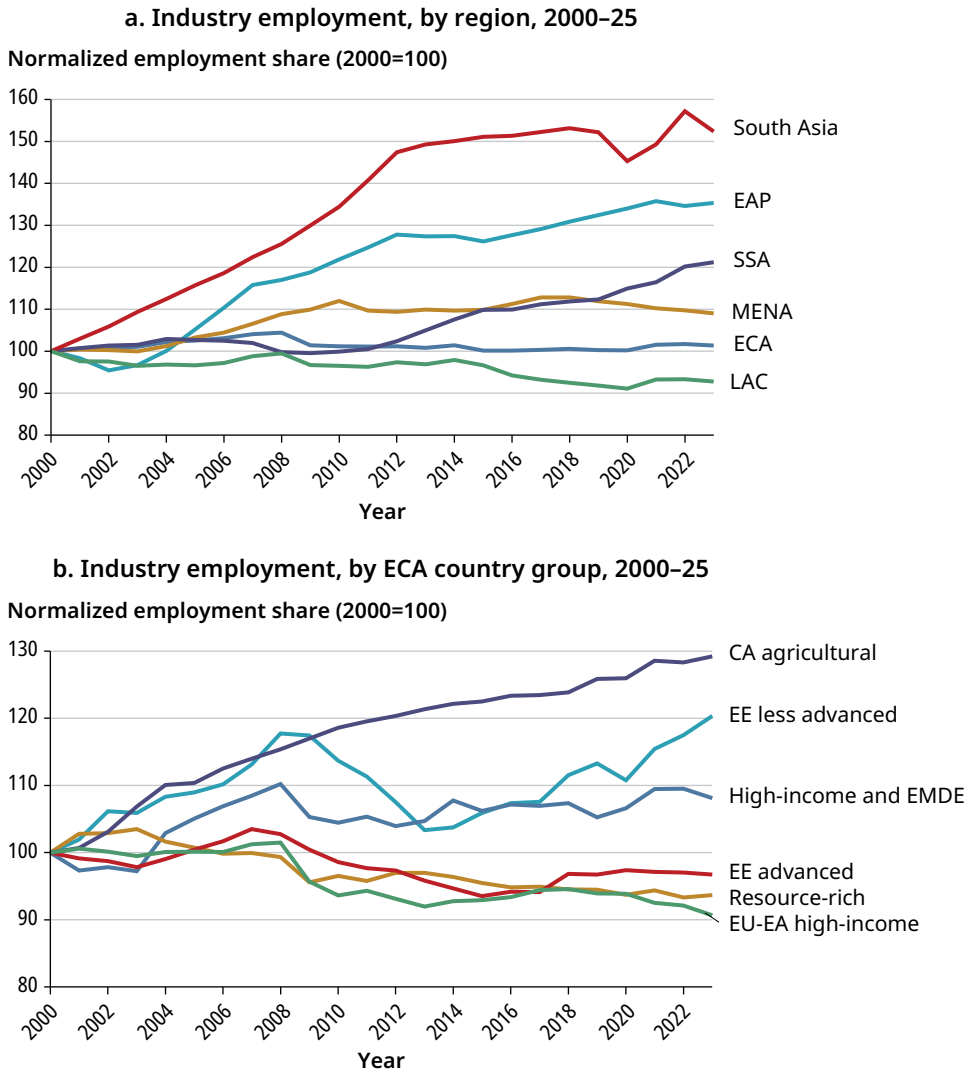
Structural Change in Europe and Central Asia

In the early 1990s, as many ECA countries began to transition from central planning to a market economy, the sectoral structure of their economies changed. For the first 10 years of the transition, the employment and output shares of industry, the largest employment sector in most ECA countries, declined, whereas the shares of services expanded. Over the next 10 years, services' shares in employment continued to expand relative to industry's, although at a slower pace (figures 1.10a and 1.11a), and agriculture's shares shrank gradually. Most ECA country groups have experienced the same falling-industry dynamic, except for the agricultural and less advanced Eastern European country groups (figure 1.10b), and a concurrent rise in the labor share of services, except for the less advanced Eastern European group (figure 1.11b). However, the pace of the shift to services has varied across country groups. Across global regions, employment shares of industry have declined in ECA and in Latin America and the Caribbean but increased in EAP, South Asia, and, more recently, Sub-Saharan Africa (refer to figure 1.10a).

The role of structural change in improving productivity

Structural change has played a positive but limited role in driving productivity growth across both the formal and the informal sectors. A decomposition of labor productivity growth found that productivity growth within sectors accounted for most of the growth in overall labor productivity (GDP per worker) in ECA, whereas the effects of labor shifts between sectors (structural change) contributed only minor shares (figure 1.12a).[3] Structural change has had a larger effect on labor productivity growth in EAP than in ECA, and the difference has widened in recent years (figure 1.12b).

FIGURE 1.10 The employment share of industry has declined in ECA since 2000

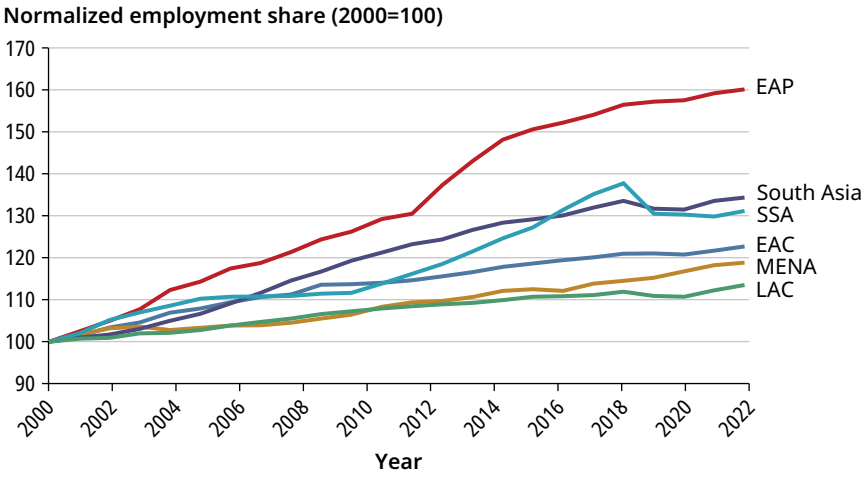


Source: Estimates based on data from World Bank, World Development Indicators.

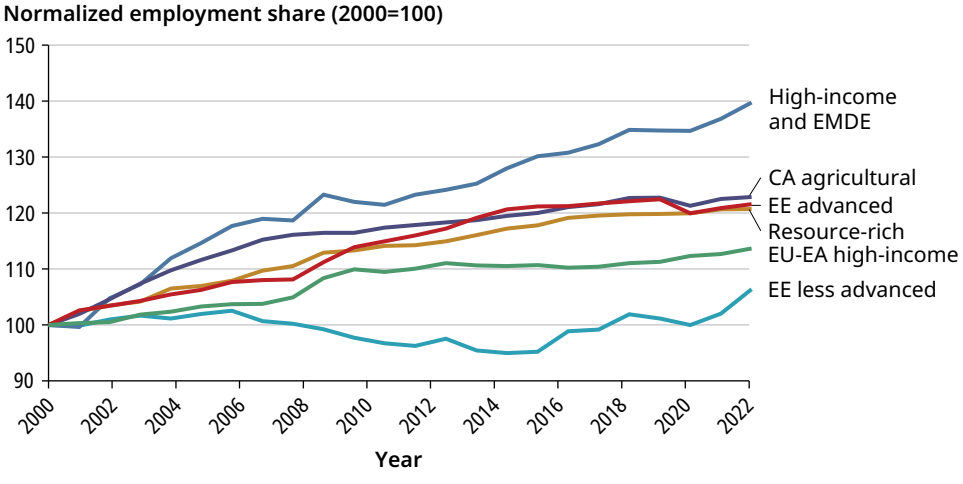
Note: In panel b, CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; EU-EA high income comprises Czechia, Estonia, Hungary, Latvia, Lithuania, Slovak Republic, and Slovenia; high-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; and resource-rich comprises Azerbaijan, Kazakhstan, and the Russian Federation. CA = Central Asia; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; EU-EA = European Union and euro area; LAC = Latin America and the Caribbean; SSA = Sub-Saharan Africa.

FIGURE 1.11 The employment share of services has increased in ECA since 2000

a. Services employment, by global region, 2000–25



b. Services employment, by ECA country group, 2000–25

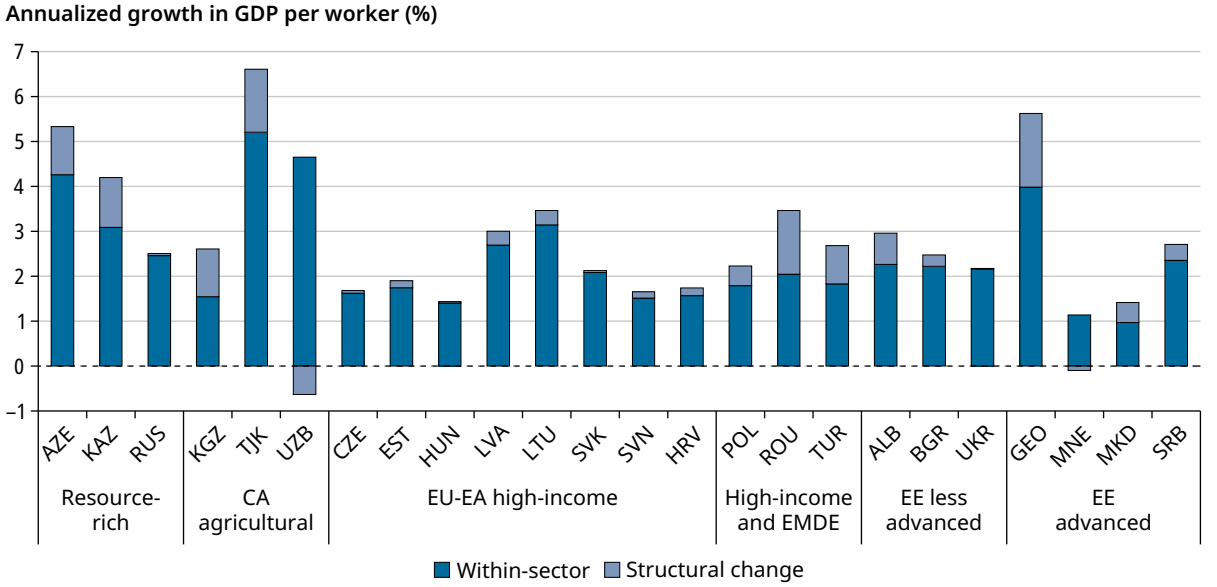


Source: Estimates based on data from World Bank, World Development Indicators.

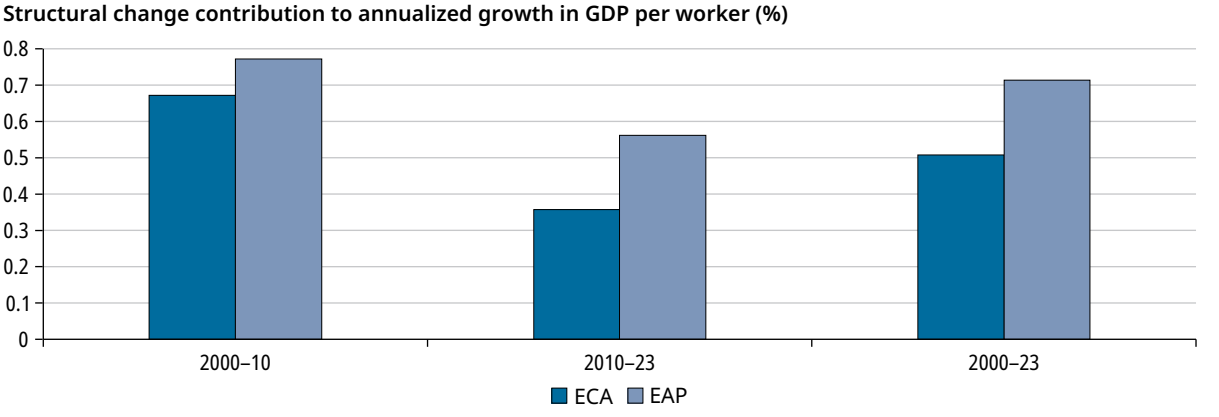
Note: In panel b, CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; EU-EA high income comprises Czechia, Estonia, Hungary, Latvia, Lithuania, Slovak Republic, and Slovenia; high-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; and resource-rich comprises Azerbaijan, Kazakhstan, and the Russian Federation. CA = Central Asia; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; EU-EA = European Union and euro area; LAC = Latin America and the Caribbean; SSA = Sub-Saharan Africa.

FIGURE 1.12 ECA has seen positive but limited productivity gains from structural change since 2000

a. Labor productivity decomposition, by ECA country group, 2000–23



b. Size of structural change effect in labor productivity change, by period, ECA versus EAP, 2000–23



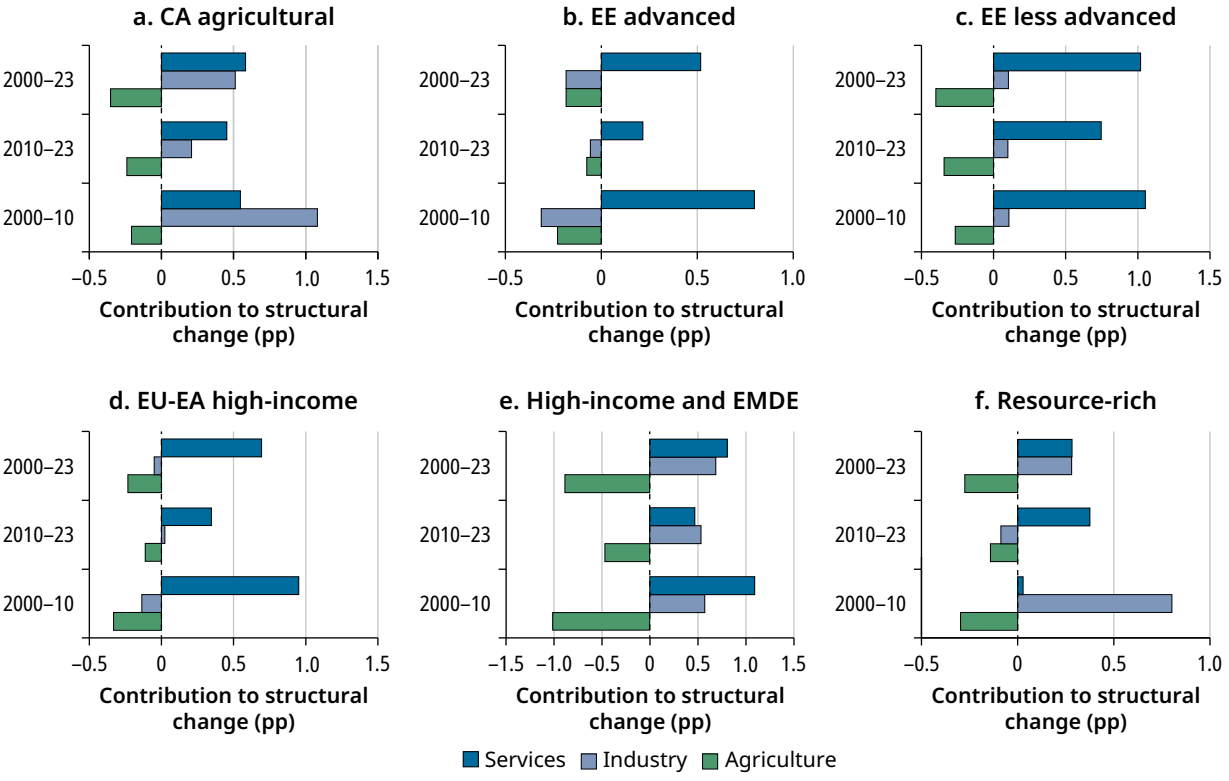
Source: Estimations based on data from World Bank, World Development Indicators.

Note: For a list of country codes, refer to https://www.iso.org/obp/ui/#search. CA = Central Asia; EAP = East Asia and Pacific; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; EU-EA = European Union and euro area; GDP = gross domestic product.

The services sector has led structural transformation across ECA, driving both labor productivity and wage growth. For all ECA country groups, the services sector has been the main driver of structural change (figure 1.13) and, thus, the main reason for the contribution of structural change to labor productivity growth (figure 1.14). However, the services sector encompasses subsectors with heterogeneous skill requirements: firm-level data show that within services, low-skill services have driven the growth in labor productivity, and high-skill services have driven wage growth. Thus, the labor shifts that underpin structural change are dominated by employment shifts to low-skill services, stunting the productivity potential of the services sector and its contribution to the overall labor productivity gains from structural change.

FIGURE 1.13 The services sector has made the main sectoral contribution to structural change since 2000

Contribution to structural change (pp), by sector and ECA country group, 2000–23

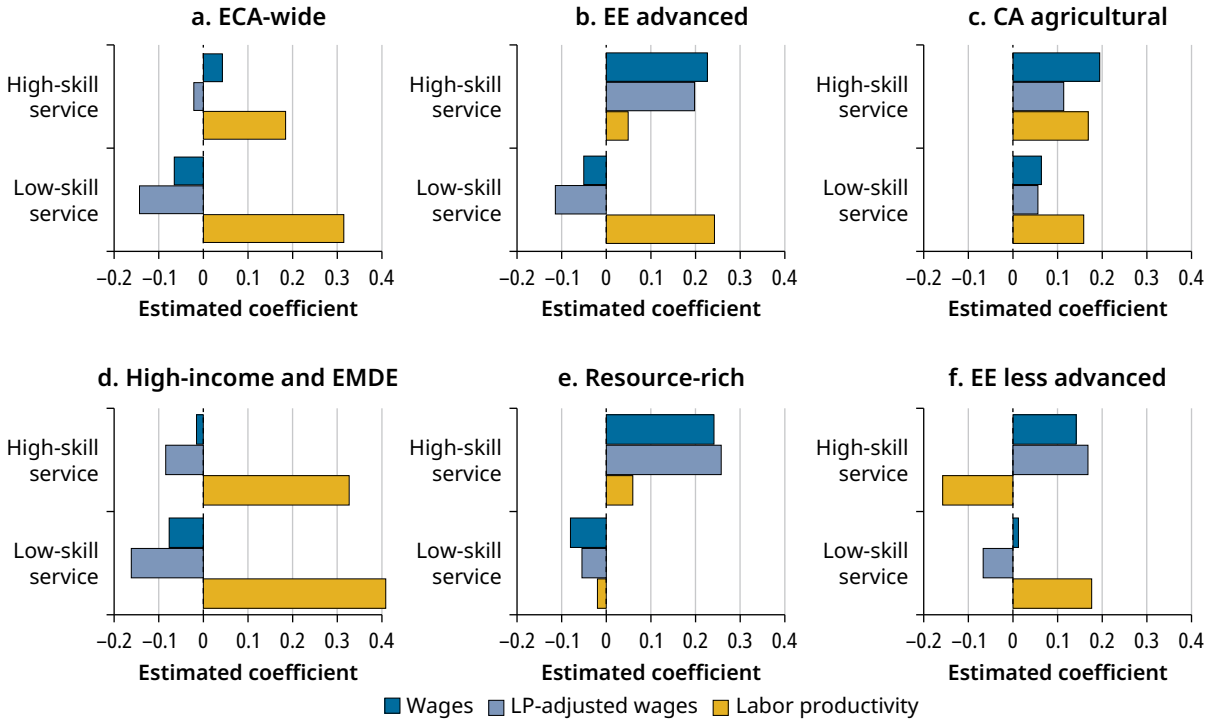


Source: Estimates based on data from World Bank, World Development Indicators.

Note: CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; EU-EA high income comprises Czechia, Estonia, Hungary, Latvia, Lithuania, Slovak Republic, and Slovenia; high-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; and resource-rich comprises Azerbaijan, Kazakhstan, and the Russian Federation. CA = Central Asia; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; EU-EA = European Union and euro area; pp = percentage point.

FIGURE 1.14 The services sector accounts for most of the contribution of structural change to overall labor productivity gains

Contribution of services to structural change (pp), by ECA country group and worker skill level, 2006–24



Source: Estimates based on firm-level data from national statistical offices and Orbis.

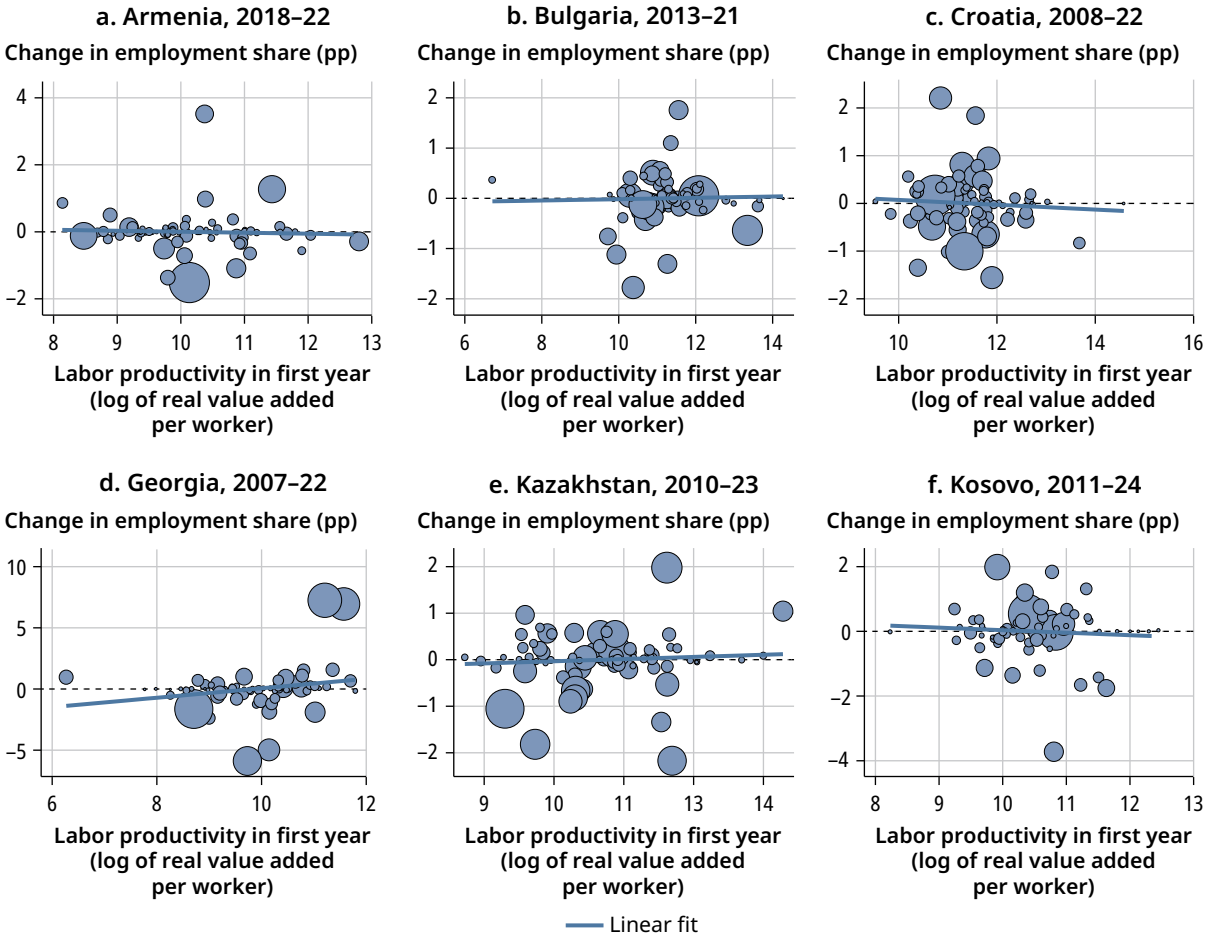
Note: Estimated at the Nomenclature of Territorial Units for Statistics (NUTS) level 2. EE advanced comprises Bulgaria, Georgia, Montenegro, North Macedonia, Kosovo, and Serbia; CA agricultural includes the Kyrgyz Republic and Tajikistan; high-income and EMDE includes Croatia, Poland, Romania, and Türkiye; resource-rich includes Kazakhstan; EE less advanced comprises Armenia, Moldova, and Ukraine. Each specification regresses the outcome variable (log wages and labor productivity) on the type of sector (industry as baseline and high- and low-skill services), including size and age class effects plus country-year and region (NUTS2-equivalent) fixed effects. LP-adjusted wages regresses the log wages on labor productivity and the variables mentioned previously. Each cluster is regressed separately. CA = Central Asia; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; pp = percentage point.

A more granular sectoral analysis of the formal economy based on firm-level data reveals a consistent story of limited contribution of structural change to productivity growth. The analysis observes the minor role of sectoral shifts in driving productivity growth across ECA countries not only at the broad sectoral level but also at a more granular level (at the two-digit level of the Statistical Classification of Economic Activities in the European Community, or NACE). The correlation between sectoral labor share changes and initial value added per worker in the post-GFC period, though positive in many countries, is weak

and close to zero, implying a limited contribution for the reallocation of labor between sectors (structural change) to productivity growth (figure 1.15).[4] This is the case for Bulgaria, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Montenegro, North Macedonia, Poland, Serbia, and Ukraine. Montenegro, Romania, and Türkiye show a shift in labor share allocation from higher-productivity activities to lower-productivity activities, but the relationship is also weak and small.

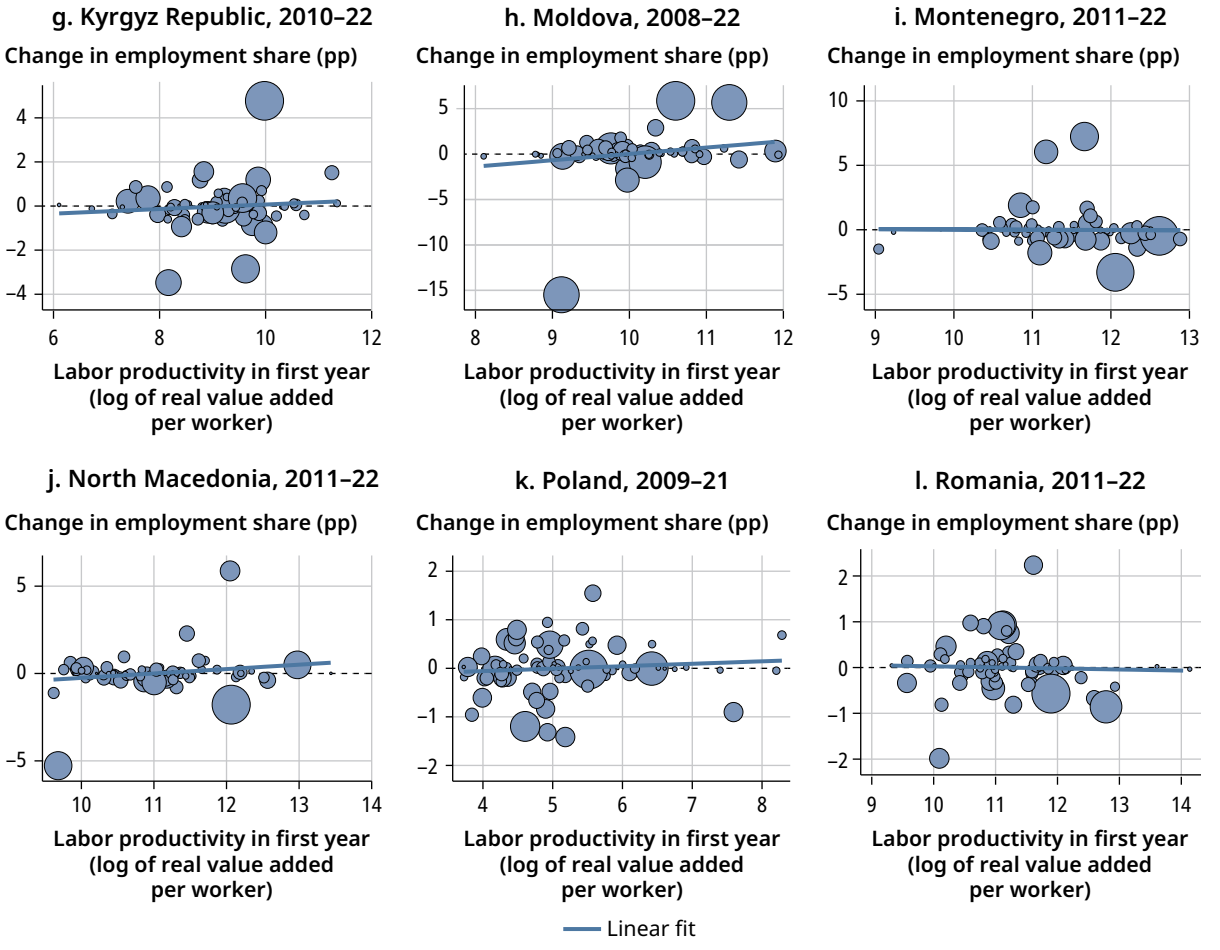
FIGURE 1.15 ECA countries have had limited productivity-enhancing structural change since the global financial crisis

Labor shifts and productivity, by country, various year ranges



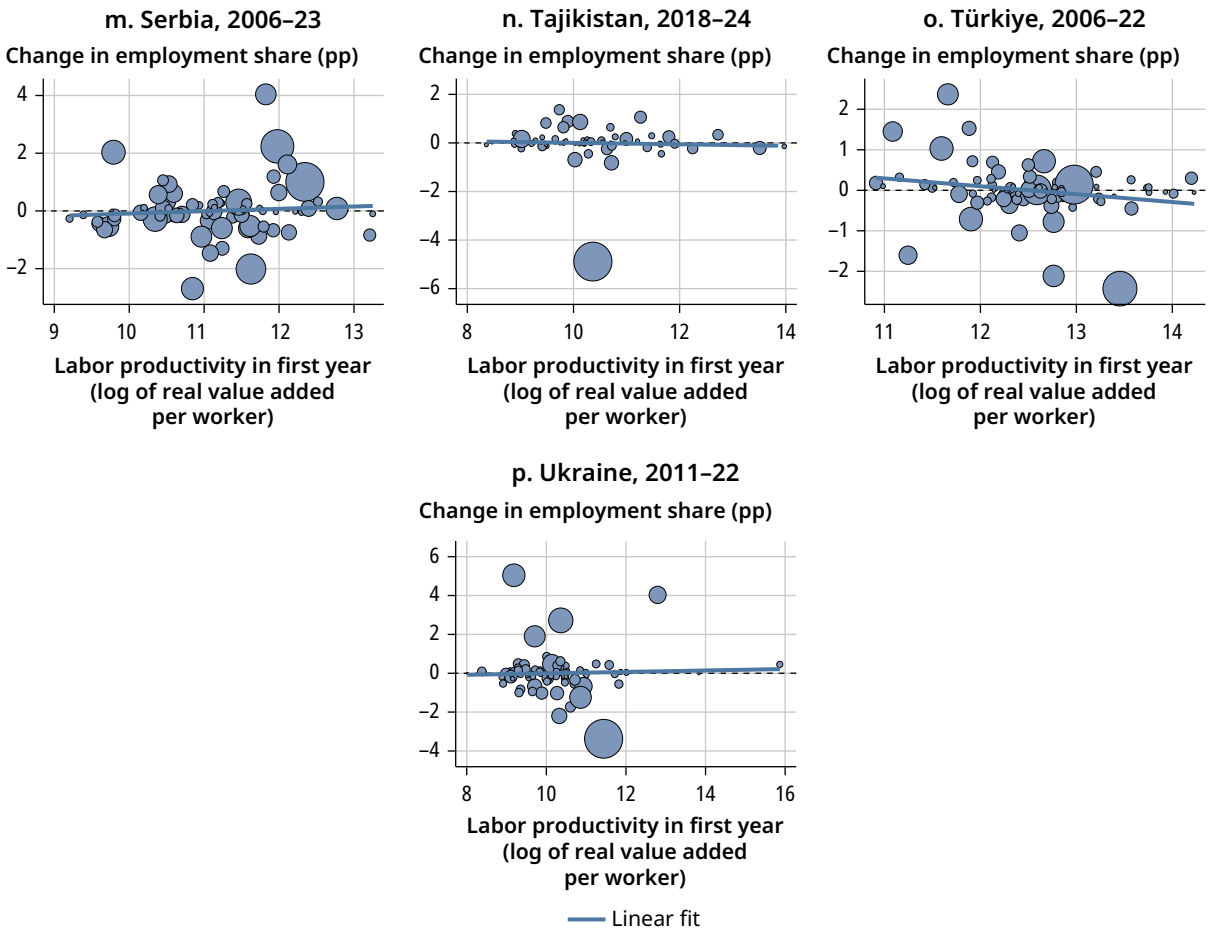
Continued

FIGURE 1.15 ECA countries have had limited productivity-enhancing structural change since the global financial crisis *(Continued)*



Continued

FIGURE 1.15 ECA countries have had limited productivity-enhancing structural change since the global financial crisis *(Continued)*



Source: Estimates based on firm-level data from national statistical offices and Orbis.

Note: Refer to table 1A.1 in online annex 1A for data date ranges and national sources. Labor share changes are calculated at the two-digit level of the Statistical Classification of Economic Activities in the European Community in each country between the first and last year of the sample. Initial labor productivity is the weighted value added per worker in the first year of the sample. Only sections from B to N, P, Q, R, and S of NACE Rev. 2 are considered. ECA = Europe and Central Asia; pp = percentage point.

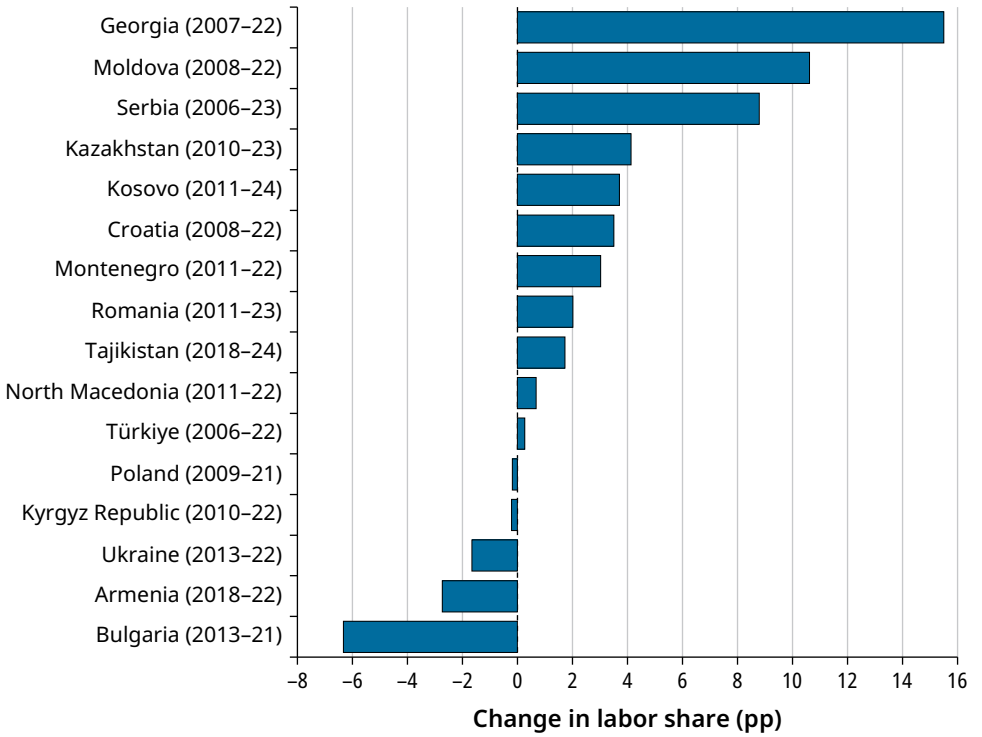
The influence of distortions, trade, and technology on the productivity impacts of structural change

Economic distortions can reduce the productivity growth arising from structural change by letting economies deindustrialize prematurely. Two factors could account for the contraction found in industry's shares of employment and output: the natural forces of structural transformation as resources shift from industry to services and policy distortions that disproportionately burden industrial firms and workers. In some ECA countries, policy distortions have resulted in premature deindustrialization, a finding in line with evidence from other emerging market developing economies (Fattal 2023).

The expansion in low-skill services in ECA induced by technological change, combined with the contraction of the industrial sector, could suggest that the structural shift to services is not completely productivity inducing. In most ECA countries, the share of labor in low-skill services increased in the period after the GFC (figure 1.16). On average, technological change, specifically digitalization, has augmented labor for both high- and low-skilled workers; however, it has been biased toward high-skilled workers in the manufacturing sector and low-skilled workers in the services sector (Cusolito et al. 2022). Technological change has resulted in higher wages in the manufacturing sector, reducing demand for labor and resulting in a reallocation of labor to the services sector.

FIGURE 1.16 The share of labor in low-skill services has risen in most ECA economies since the global financial crisis

Change in labor share of low-skill services (pp), by country, various years



Source: Estimates based on firm-level data from national statistical offices and Orbis.

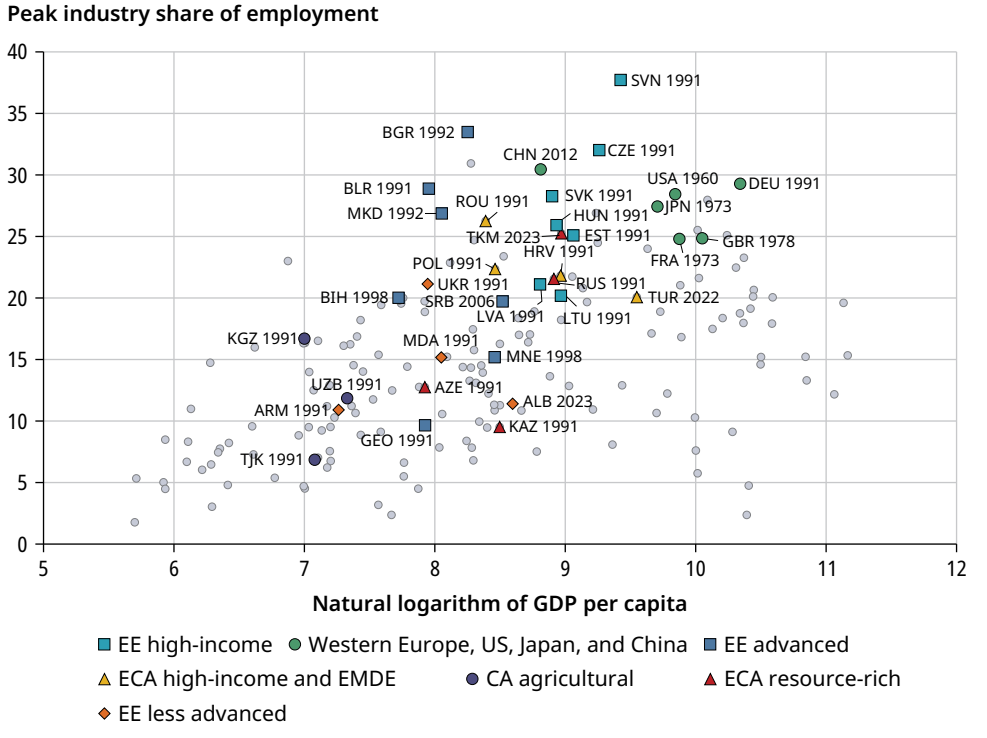
Note: For each country, the figure shows the change in labor share of low-skill services between the first and last year of available data. Low-skill services include vehicles (division 45 of the Statistical Classification of Economic Activities Rev. 2); wholesale (46) and retail (47) trade; land (49), water (50), and air (51) transportation; transport support (52); courier services (53); accommodation (55); food and beverage services (56); buying and selling real estate, leasing (68); rental and leasing (77); employment activities and agencies (78); travel agencies and tour operators (79); security services (80); building support and landscaping (81); office support services (82); arts and creation of art (90); museums, libraries, and zoos (91); gambling (92); theme parks (93); repair of computers and household goods (95); and personal services (96). ECA = Europe and Central Asia; pp = percentage point.

Patterns of trade integration also affect structural change in different ways. Trade liberalization and China's entry into global markets could also induce deindustrialization by increasing import competition (Sposi, Yi, and Zhang 2024) or reindustrialization, which, by lowering the manufacturing wage, affects the peak of industrialization (Krugman 1988). Countries with large imports from China could have deindustrialized more than countries that import less. Countries, particularly those in the Western Baltics, that trade mainly within the ECA region have been partly shielded from the deindustrialization brought on by import competition from China. This situation has enabled those countries to achieve higher peaks of industrialization than those observed for advanced economies when they deindustrialized (figure 1.17). The high level of "missing trade" with countries outside the ECA region (figure 1.18) implies an efficiency loss resulting from trade patterns biased toward intraregional trade (refer to chapter 2).

Countries in the ECA region still have scope to enhance productivity from structural change. They can do so by addressing economic distortions, achieving more balanced trade integration with global and regional economies, and upgrading technology.

FIGURE 1.17 Industrialization peaks are high for some ECA economies that deindustrialized

Peak share of industry employment and GDP per capita, by income, various years

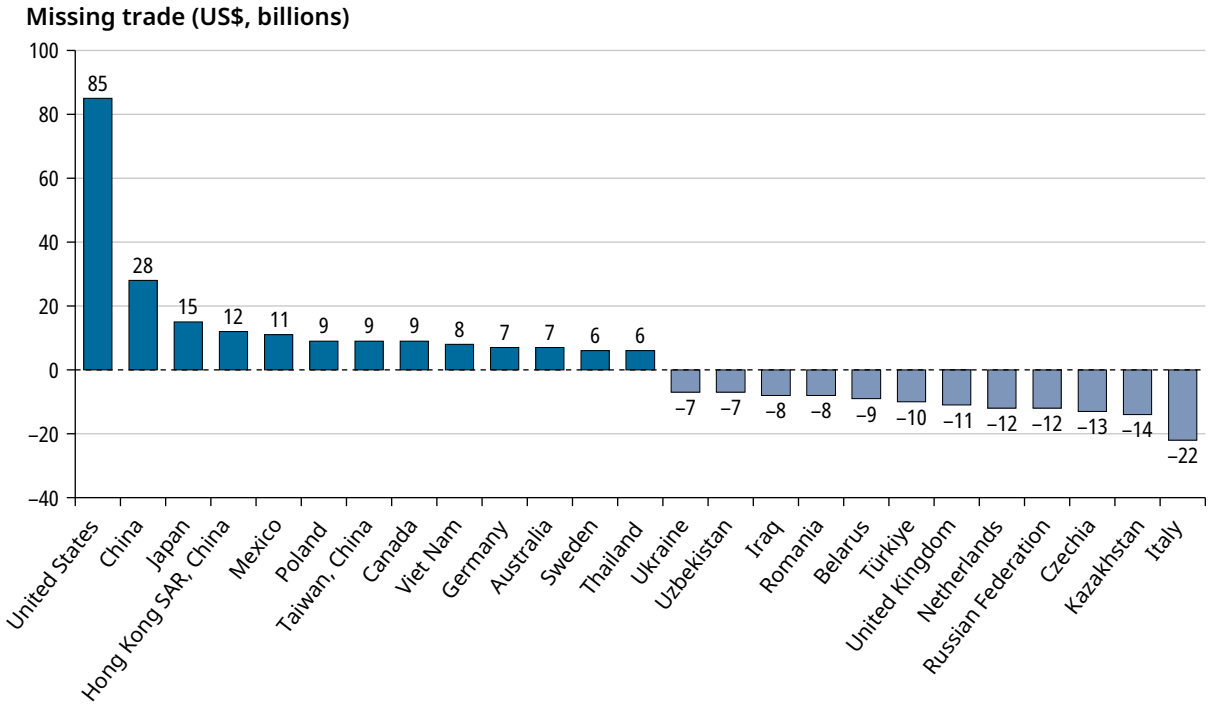


Source: Estimates based on data from World Bank, World Development Indicators.

Note: For a list of country codes, refer to https://www.iso.org/obp/ui/#search. CA = Central Asia ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies; GDP = gross domestic product.

FIGURE 1.18 ECA countries have high levels of "missing trade" with countries and economies outside the region

Average missing trade of ECA countries, by trading partner, 2020–22



Source: Estimates based on data from Comtrade 2024.

Note: For methodology, refer to chapter 2. "Missing trade" refers to the situation in which actual exports to a given country are lower than the exports predicted by a gravity model. ECA = Europe and Central Asia.

Productivity, Distortions, and Misallocation Within Sectors

Improving allocative efficiency by addressing misallocation between firms within sectors is another important channel for strengthening productivity gains. Recalling the four drivers of productivity growth described in figure 1.9, this section focuses on the resource reallocation between firms in the same sector. It first identifies the potential gains from reversing within-sector misallocation of resources. Subsequently, it delves deeper into the drivers of misallocation, looking particularly at state-owned enterprises (SOEs) and distortions in competition, credit allocation, employment, and procurement.

Policies and institutions can generate distortions that affect factor allocation across firms in multiple ways. In the banking sector, subsidized interest rates or loans based on noneconomic factors can misallocate credit to firms with lower returns instead of to more productive firms (Banerjee and Duflo 2005; Banerjee and Munshi 2004). Policies that subsidize or give regulatory advantages to SOEs, that create favorable market conditions for them, or that distort relative prices lead to resource misallocation by favoring market access for public companies over more productive private companies (Restuccia and Roggerson 2008). Public procurement policies that favor specific firms or activities without an economic rationale also misallocate resources. Product and labor regulations, trade restrictions, and many other policies that favor market concentration and hinder competition also distort the allocation of resources across firms. Research on the factors driving firm-level productivity finds that firms are less productive in more concentrated industries and in sectors with high informality and are more efficient when access to credit is greater (Correa, Cusolito, and Pena 2019).

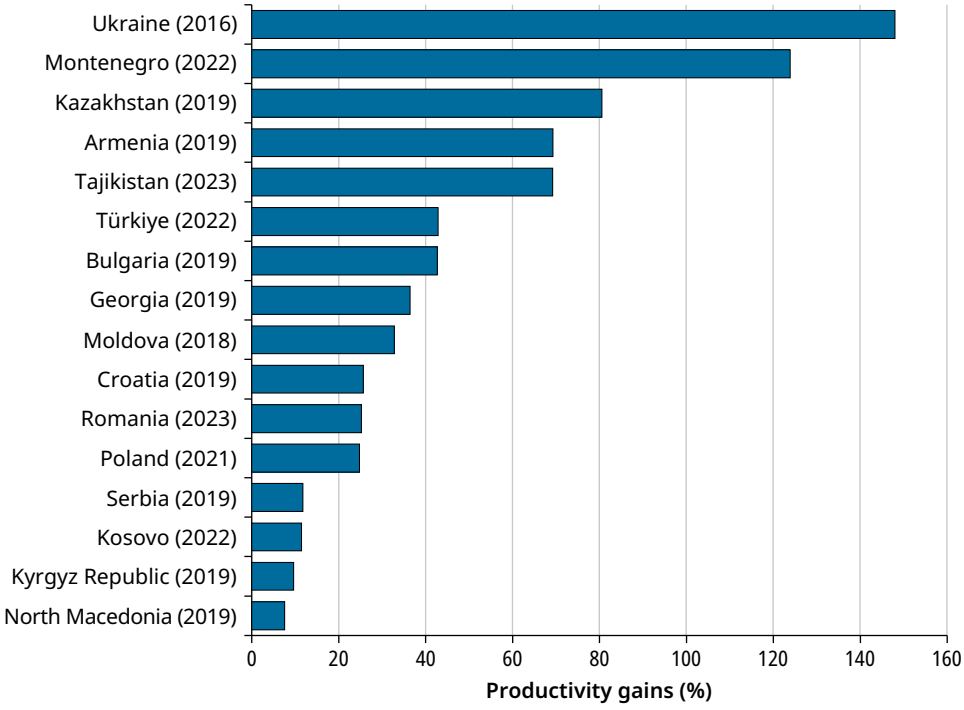
Potential productivity gains from reversing misallocation

Removing misallocations in labor and capital markets could achieve the largest gains in economic growth in ECA. Eliminating distortions in the industrial and services sectors is the quickest way to increase the value of the marginal product of workers and capital without increasing labor and capital costs. Other policies to pave the way for pro-competitive effects from global integration may be less effective in ECA in the short and medium terms because of the dominance of intraregional trade over international trade. In ECA, "moving to the European Union (EU) and US efficiency" level in labor and capital markets could increase TFP by 10–70 percent in most ECA countries,[5] in line with previous findings (Hsieh and Klenow 2009) (figure 1.19). Ukraine and other ECA countries at earlier stages of development could increase productivity considerably more than in EU accession countries. Countries in the Caucasus and Central Asia, including Armenia, Georgia, Kazakhstan, and Tajikistan, could increase productivity by 35–80 percent. For reallocation gains over time, refer to figure 1A.2 in online annex 1A.

The greater prevalence of distortions in less advanced ECA economies implies higher gains from better reallocation of resources in those countries. Productivity-dependent distortions, proxied by the correlation between revenue-based TFP and quantity-based TFP,[6] are higher in less advanced economies than in more advanced economies (figure 1.20a and figure 1A.2 in online annex 1A). A high TFPR-TFPQ correlation means that the more capable firms are confronting higher distortions, misallocating resources away from them toward less capable producers. Thus, the potential productivity growth arising from reducing misallocation would be larger in less advanced ECA economies.

FIGURE 1.19 Large productivity gains result from reallocating labor and capital to EU and United States efficiency levels

Productivity gains in the manufacturing sector from removing resource misallocation to average efficiency levels observed in advanced EU economies and the United States, latest data available

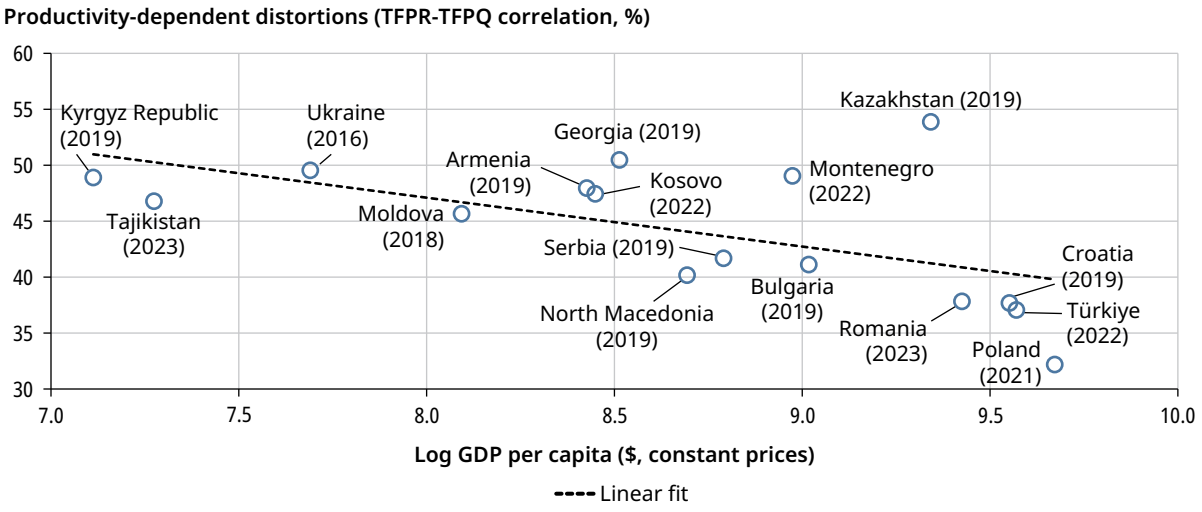


Sources: Estimates based on firm-level data from national statistical offices, ministries of finance, and Orbis.

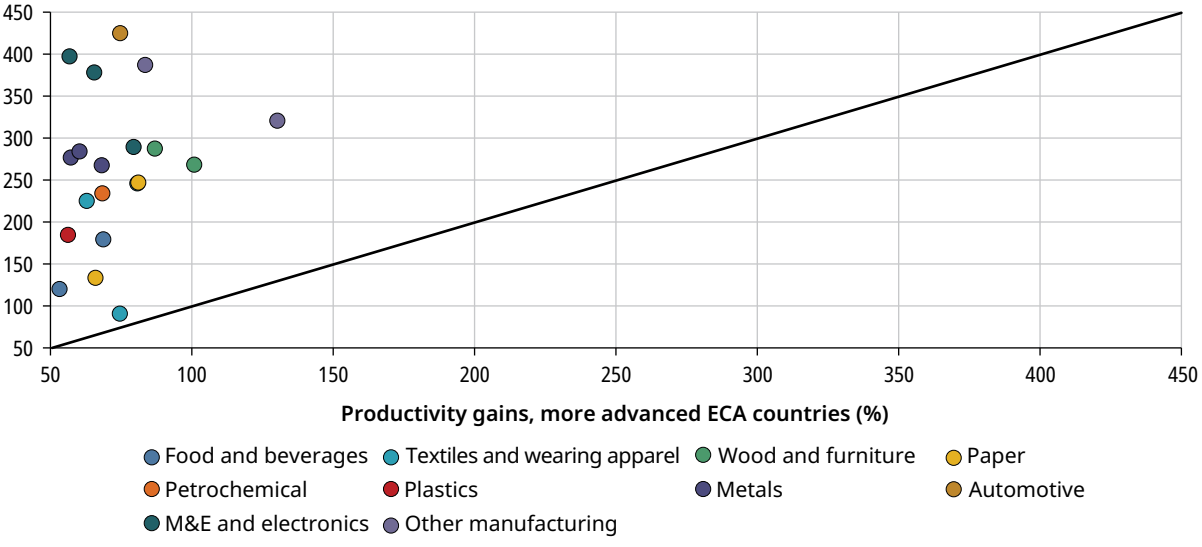
Note: Productivity gains for manufacturing firms only are reported relative to selected EU advanced economies and the United States, based on Hsieh and Klenow (2009) and Cusolito, Fattal-Jaef, Mare, and Singh (2024). Relative productivity gains are calculated as the ratio between the country-year gains $\left(\frac{Y_E^c}{Y^c}\right)$ and the EU and US average $\left(\frac{\overline{Y_E}}{Y}\right)$ as follows: relative gain $= \frac{Y_E^c / Y^c}{\overline{Y^E} / Y} \times 100$, where Y_E^c is the output value under efficiency. Included advanced EU economies are Austria, Estonia, France, Finland, Germany, Italy, Norway, and Spain. For data date ranges and national sources, refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788. The analysis includes firms with at least 10 employees. ECA = Europe and Central Asia; EU = European Union.

FIGURE 1.20 Misallocation and potential productivity gains in the manufacturing sector are larger in less advanced than in more advanced ECA economies

a. Level of misallocation and per capita income, by country, latest data available



b. Estimated productivity gains, by sector and country's level of development



Source: Estimates based on firm-level data from national statistical offices and Orbis.

Note: Refer to table A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. The analysis includes manufacturing firms with at least 10 employees and sectors with at least 10 companies. The 45-degree lines indicate same productivity gains for less advanced and more advanced ECA countries. More advanced ECA countries comprise high-income and EMDE (Croatia, Poland, Romania, and Türkiye), and EE and Caucasus advanced countries (Bulgaria, Georgia, Kosovo, Montenegro, North Macedonia, and Serbia). Less advanced ECA countries comprise CA agricultural (the Kyrgyz Republic and Tajikistan), resource-rich (Kazakhstan), and EE less advanced countries (Armenia, Moldova, and Ukraine). CA = Central Asia; EE = Eastern Europe; ECA = Europe and Central Asia; EMDE = emerging markets and developing economies; TFPQ = quantity-based total factor productivity; TFPR = revenue-based total factor productivity.

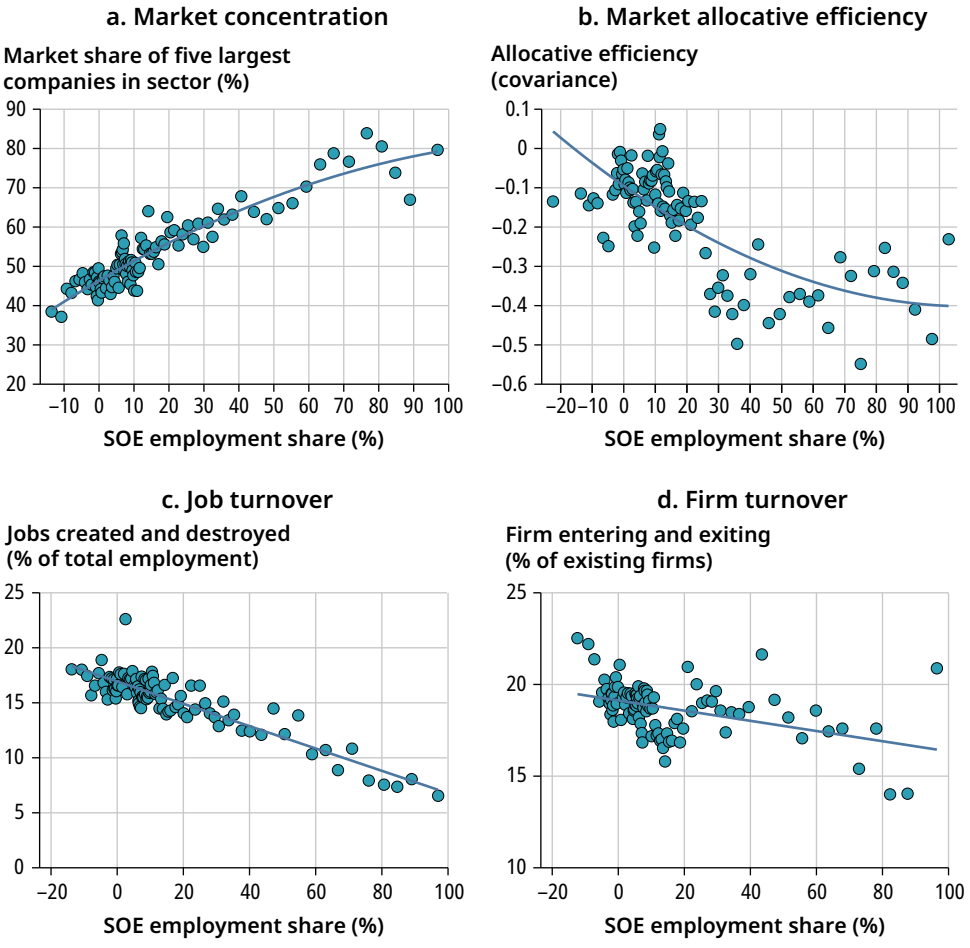
Misallocation through distortions created by the presence of state-owned enterprises

Removing distortions, especially those related to the state's footprint in the economy, is key to fostering regional productivity growth. Although ECA countries started shifting from planned economies to market economies in the early 1990s, a prominent state presence remains in many countries. This incomplete market transition affects productivity growth today. Three developments have recently reignited the debate about the distortionary effect of SOEs. First is the large and nondecreasing state presence in competitive sectors for which state economic involvement has no economic rationale (World Bank 2023). Second is the need to rebuild fiscal buffers in several emerging market developing economies that have limited fiscal space or are in debt distress (IMF 2023). Third is the emerging evidence that SOEs underperform private enterprises on average (Dollar and Wei 2007; Harrison et al. 2019; Wei, Xie, and Zhang 2017).

The SOE presence weakens market forces and is associated with less efficient resource allocation and lower entrepreneurial dynamism. Among sectors with at least some SOE presence (at least 1 percent of market share), higher presence is associated with higher market concentration (figure 1.21a) and lower market allocative efficiency (figure 1.21b), suggesting that sectors in which SOEs are more prominent are less competitive and less efficient. Although such associations could be driven by a sector's nature as a natural monopoly or a partially contestable sector—that is, SOEs may have more prominence because of existing market failures or for economic reasons—the results are similar for competitive industries.[7] These results imply that a strong state presence in a market where there is no economic rationale impedes the ability of market forces to allocate resources efficiently or to create a business environment conducive to competition and enhanced entrepreneurial dynamism, with subsequent negative effects on productivity and economic growth.

FIGURE 1.21 Markets are less efficient when they are more exposed to state-owned enterprises

Correlation between SOE presence and market dynamism, 2006–24



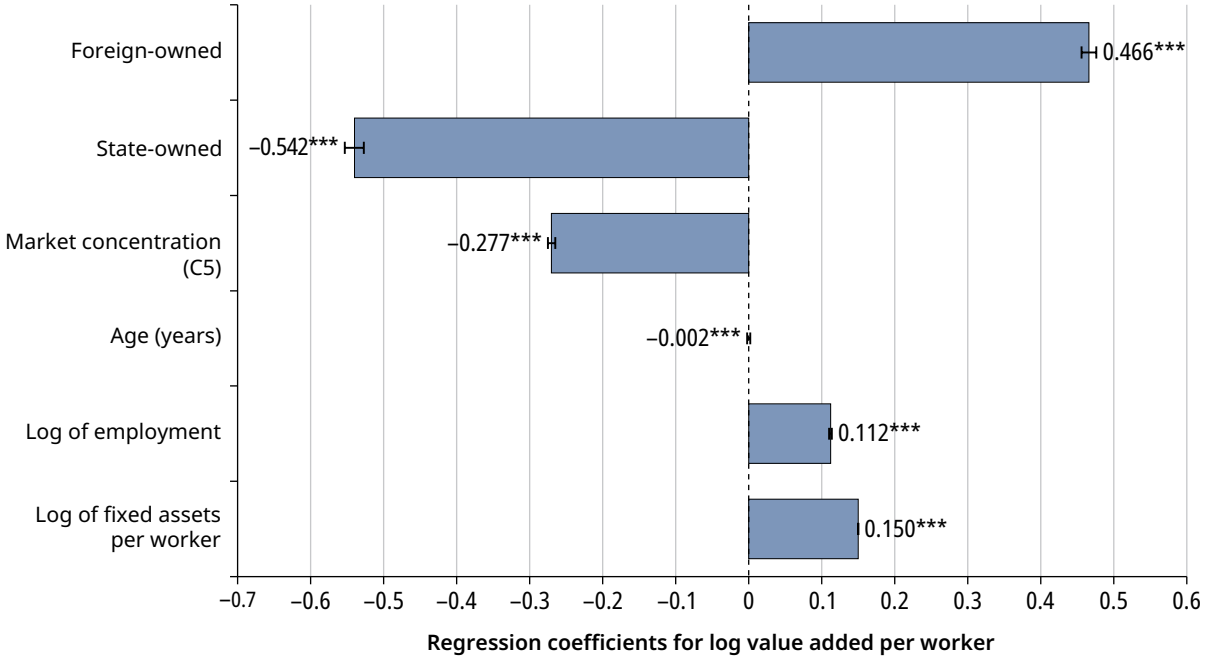
Sources: Estimates based on firm-level data from national statistical offices, Orbis, and the Business of the State data set.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. The binned scatter points show the correlation between four metrics of market dynamism and SOE exposure, all considered at the sector level (three-digit Statistical Classification of Economic Activities Rev. 2) by country and year, as measured by SOEs' share of labor: (a) market concentration, defined as the market share of the five largest companies in the sector; (b) allocative efficiency, measured as the covariance term of the Olley-Pakes static decomposition (difference between the weighted and unweighted value added per worker); (c) job turnover, measured as job creation and job destruction relative to total employment; and (d) firm turnover, measured as the share of firms entering and exiting a market relative to the number of existing firms. The specification controls for country-year fixed effects. Negative SOE exposure is due to the algorithm computing residuals after including control variables, although the underlying SOE exposure data are positive. Only sectors with at least 10 firms and positive SOE exposure are considered. Because the data are from surveys, Georgia, Kazakhstan, and Moldova are excluded when panel data are required (job and firm turnover). SOE = state-owned enterprise.

Not only does the presence of SOEs reduce market dynamism, but SOEs themselves are less productive than private companies. On average, a worker in a SOE produces only about 60 percent of the value added produced by the same employee working in a domestic private company even when the firms operate in the same sector and region, are the same size and age class, and display a similar level of capital intensity, or capital per worker (figure 1.22). The differential is even greater for foreign-owned firms, which are nearly 60 percent more efficient than domestic firms. Market concentration, a proxy for weak competition and measured as the combined market share of the five largest companies in each sector (at the three-digit level), negatively correlates with the labor productivity of firms. Therefore, in addition to the negative association between SOE presence and market dynamism, SOEs are less productive than their private counterparts even when considering only more competitive sectors.

FIGURE 1.22 State-owned enterprises are less productive than their private counterparts

Correlates of value added per worker at the firm level, 2006–24



Sources: Estimates based on firm-level data from national statistical offices, Orbis, and the Business of the State data set.

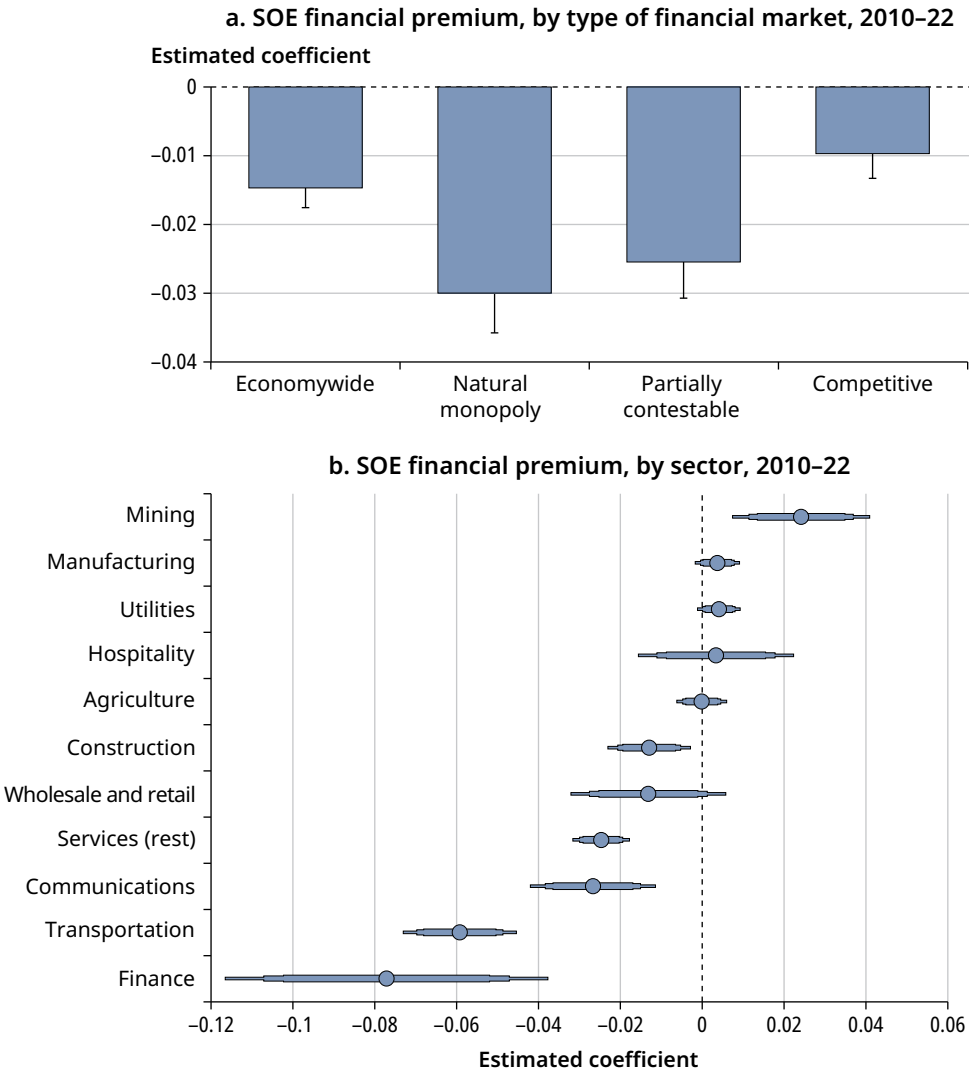
Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. The baseline category is private-owned domestic firms. Controls include fixed effects for sector (three-digit Statistical Classification of Economic Activities level), region (Nomenclature of Territorial Units for Statistics equivalent), and country-year. C5 = the market share of the five largest companies in the sector. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

State-owned enterprises and credit misallocation

One way SOEs affect the allocation of resources is through their preferential and subsidized access to real and financial resources. Studies analyzing trends in Europe find that a 10-percentage-point increase in government direct shareholding reduces the average cost of production through the financial channel (debt and equity) by 0.7 percent and through the real channel (labor and capital) by 0.5 percent (Cusolito et al 2024). New evidence replicating the analysis for preferential access to financial resources for 12 ECA countries corroborates these findings (figure 1.23a). SOEs in sectors where there is less competition receive higher subsidies, but subsidies are still considerable in competitive sectors. For instance, SOEs have a cost of production through the financial channel that is 1.5 percent lower than their private counterparts, an advantage that doubles in sectors that are natural monopolies.[8] SOEs in sectors that are the greatest facilitators of the economy, including finance, transportation, and communications, receive the largest subsidies, as high as 5–10 percent in the case of finance (figure 1.23b). These subsidies, though often justified for political and social reasons rather than economic ones, introduce substantial distortions in the allocation of financial resources. Cross-subsidies, whereby SOEs borrow from state-owned financial institutions, create even worse distortions. This practice also creates macrofinancial risks, affecting the domestic investment climate and private sector investor confidence. Firms' access to credit is lower in less advanced parts of ECA (refer to figure 1A.3 and figure 1.A.4 in online annex 1A).

SOEs' subsidized access to financial resources creates distortions in credit markets, reducing the financing available to more productive private firms and limiting their opportunities to invest and grow. In efficient credit markets, the most profitable or productive firms would have the greatest access to finance. In ECA countries, however, very productive firms do not always have greater access to finance than middle- or middle-low-productivity firms (figure 1.24).[9] A large overlap also exists in the productivity distribution of firms that report debt (a proxy for financial access) and firms that do not (figure 1.25). The misallocation of finance means that unrealized productivity gains could be achieved by redirecting credit flows to more productive firms. Banks in ECA appear effective at screening out the most unprofitable projects but struggle to identify the most promising ones. These results are consistent with the results of other studies for the region that find productivity gains of 20–80 percent from correcting finance misallocation (Cusolito et al 2025; Iacovone, Muñoz Moreno, Olaberria, and Pereira López 2022).

FIGURE 1.23 SOEs are subsidized in financial markets, especially in less competitive markets and in sectors that are the greatest facilitators of the economy

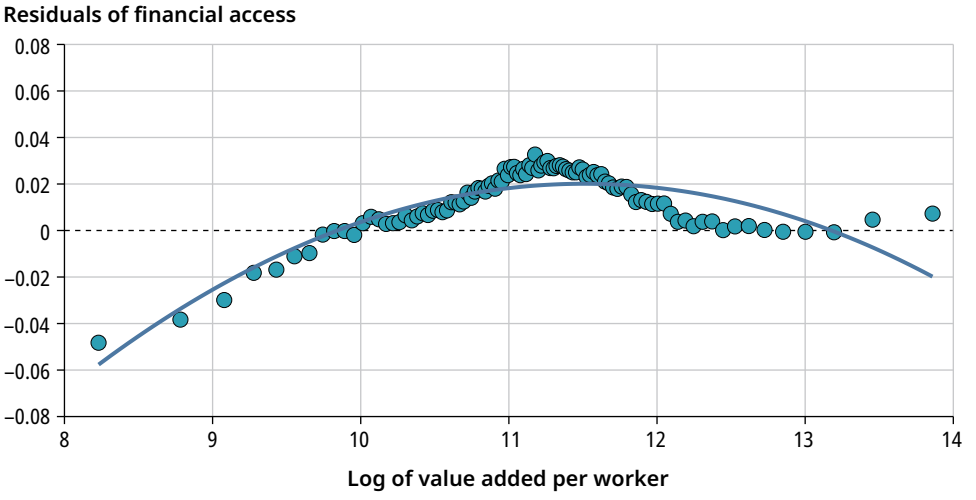


Source: Estimates based on firm-level data from Orbis and the Business of the State data set.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. Both panels show the estimated coefficient for the SOE dummy variable from regressing the marginal cost of firms (in logs) on an SOE time-invariant dummy variable and age, fixed assets (log), and quantity-based total factor productivity. Sector-year and country fixed effects are controlled for. Countries in the analysis are those for which financial information is available after cleaning the data following the methodology of Cusolito, Fattal-Jaef, Patiño Peña, and Singh 2024 plus 10 benchmark countries: Bulgaria, Bosnia and Herzegovina, North Macedonia, Montenegro, Poland, Romania, and Serbia in ECA and Estonia, Slovenia, and Spain outside ECA. ECA = Europe and Central Asia; SOE = state-owned enterprise.

FIGURE 1.24 Some high-productivity firms get less access to finance than some less productive firms

Access to finance and labor productivity, 2001–22

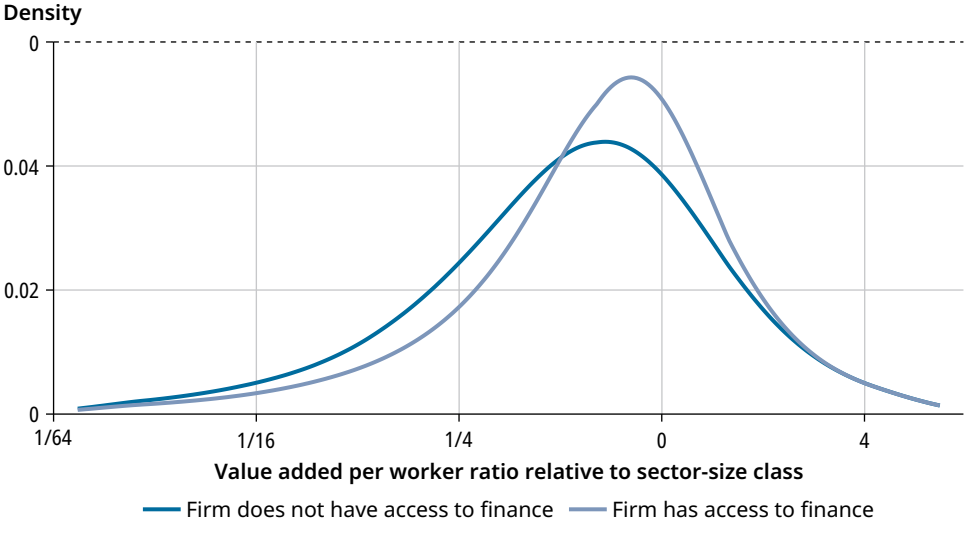


Source: Estimates based on firm-level data from Orbis.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. The relationship between labor productivity and access to finance is assessed after controlling for log of fixed assets (a proxy for collateral), size class, and country-year and sector (four-digit) fixed effects.

FIGURE 1.25 Slight productivity differences exist between firms with debt and those without debt

Labor productivity distribution by access to finance, 2001–22



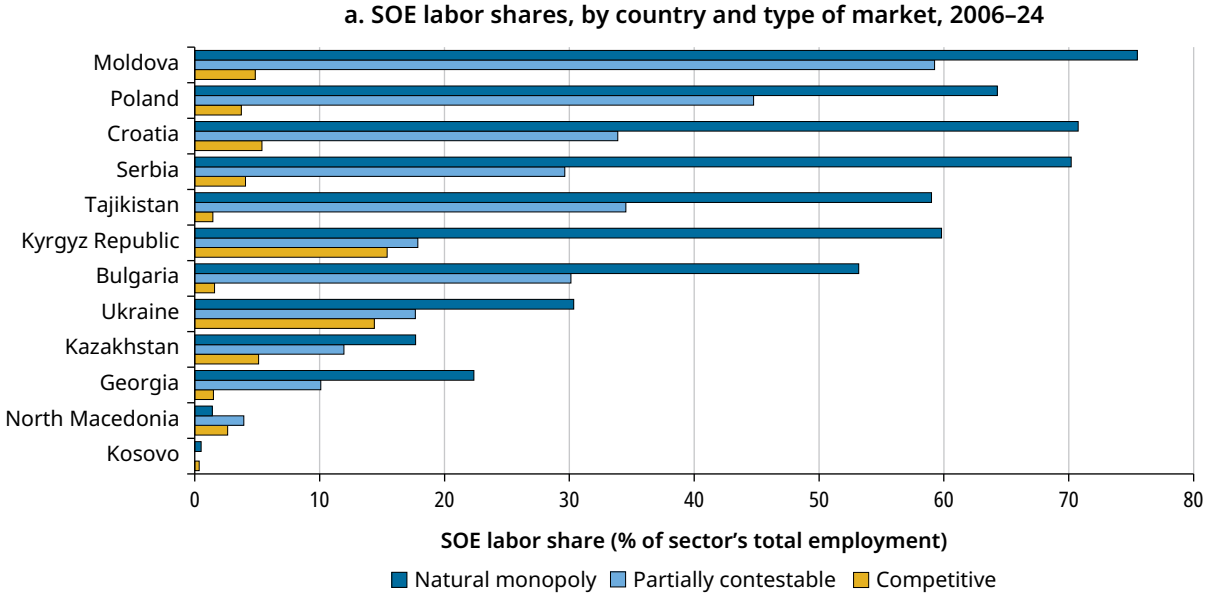
Source: Estimates based on firm-level data from Orbis.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. Value added per worker is normalized to the sector-size class average (set to 0). Financial access is measured through firm debt reports.

Large and persistent presence of state-owned enterprises

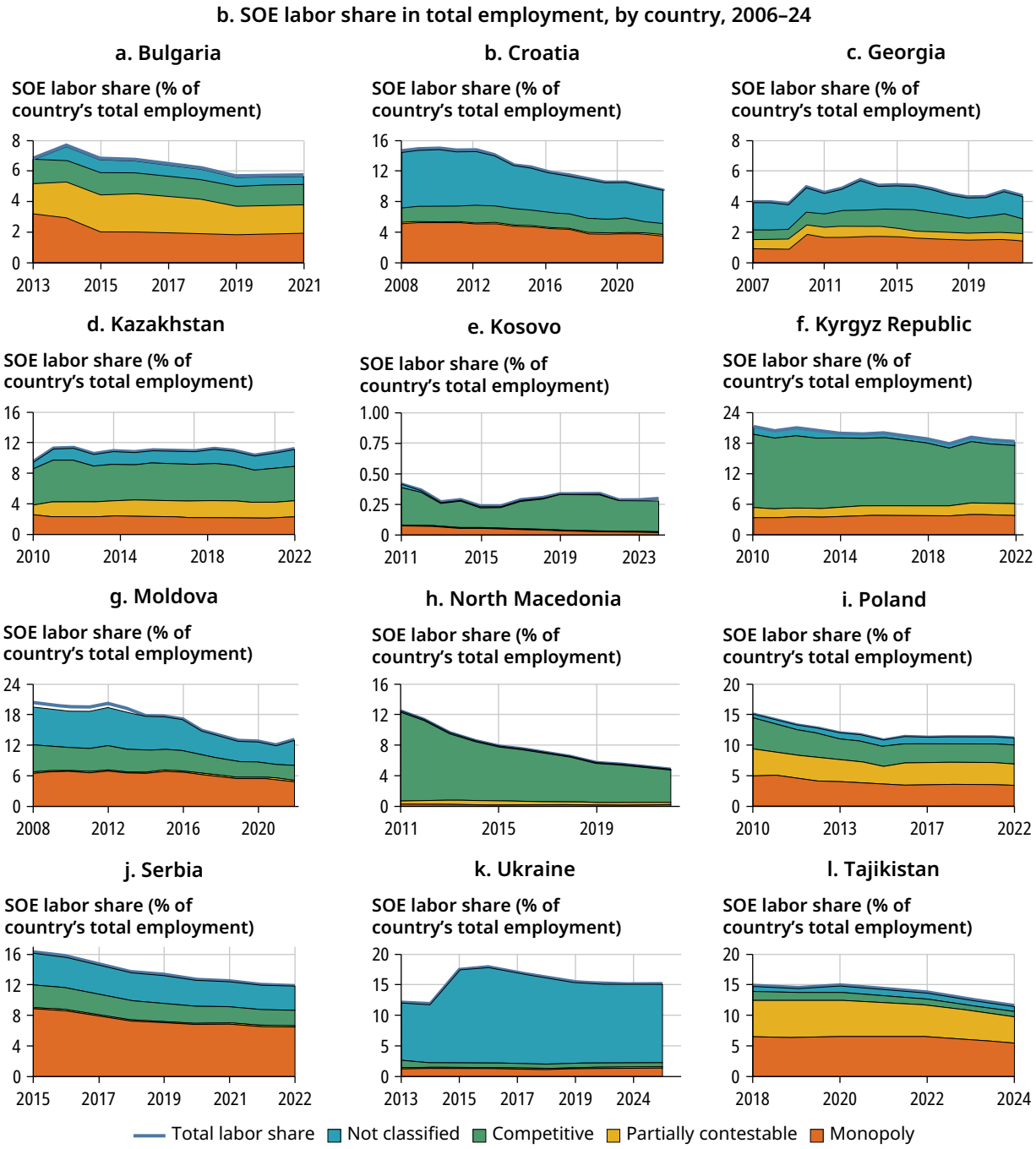
The pervasive presence of SOEs in ECA countries, particularly in less competitive sectors and in sectors that facilitate the functioning of the economy, is deleterious to efficient markets. SOEs often have policy goals that do not fully align with maximizing economic benefits. Thus, they have a stronger presence in less competitive sectors, typically those with large entry costs and economies of scale, such as public services, and in sectors that facilitate the functioning of the economy, such as transportation. The five sectors with the largest SOE presence (by market share or employment) are electricity, gas and steam and air conditioning provision, water provision and waste management, air and land transportation, and postal courier activities. The market share of SOEs in natural monopoly industries ranges from 25 percent to 60 percent in most ECA countries. It is significantly lower, but still substantial, in partially contestable sectors such as transportation (figure 1.26a). Despite a smaller presence in competitive sectors, with labor shares of 3–10 percent, SOEs still have a strong effect on the economy because of the importance of competitive sectors in the overall economic structure (figure 1.26b)[10] and because little economic rationale exists for them in competitive sectors.

FIGURE 1.26 SOEs have a stronger presence in noncompetitive sectors, but their presence remains large economywide



Continued

FIGURE 1.26 SOEs have a stronger presence in noncompetitive sectors, but their presence remains large economywide *(Continued)*



Source: Estimates based on firm-level data from national statistical offices, Orbis, and the Business of the State data set.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. ECA = Europe and Central Asia; SOE = state-owned enterprise.

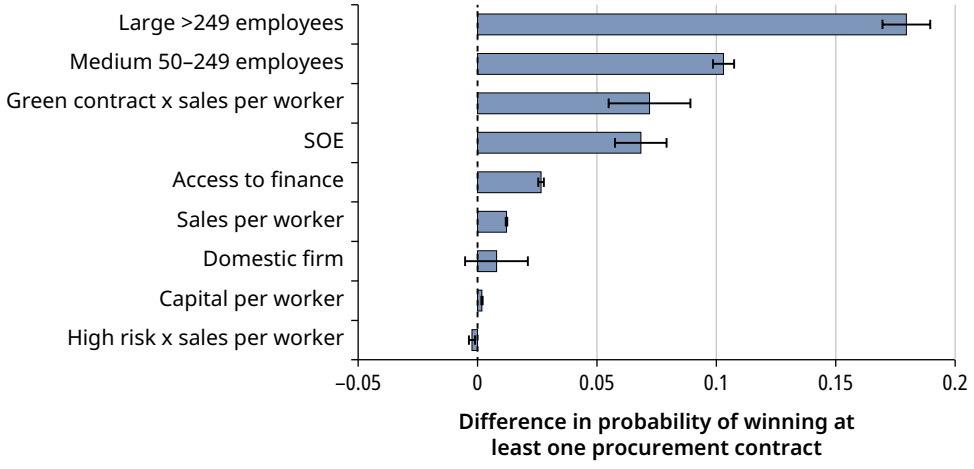
State-owned enterprises and distortions through public procurement

Public procurement is another channel through which SOEs distort market dynamics. SOEs can distort public procurement and allocative efficiency in two ways. One is noncompetitive selection mechanisms in public procurement that favor SOEs. Another is preferential treatment of SOEs in real and financial markets, which confers a competitive advantage even in a fully competitive and transparent procurement process.

Public procurement favors SOEs, which are more likely to win contracts under such noncompetitive mechanisms as single bidder, restrictive procedures, and tenders with unpublished documents. Analysis of a data set covering 2.2 million public procurement contracts in six ECA countries over 2007–22 reveals the factors that predict whether a firm wins a public tender (figure 1.27).[11] Although firms that win public procurement contracts are, on average, more productive than other firms in the same sector, country, and size class, this association is weaker for firms with a high Corruption Risk Indicator score (high corruption risk times sales per worker; figure 1.28). SOEs are about 7 percent more likely to win procurement contracts than private firms, a significant differential considering that only 3.2 percent of firms in the sample won a procurement contract.[12]

FIGURE 1.27 Firms that win public procurement contracts tend to be more productive, but that relationship weakens under corrupt practices

Probability of winning a procurement, by firm and sector characteristics

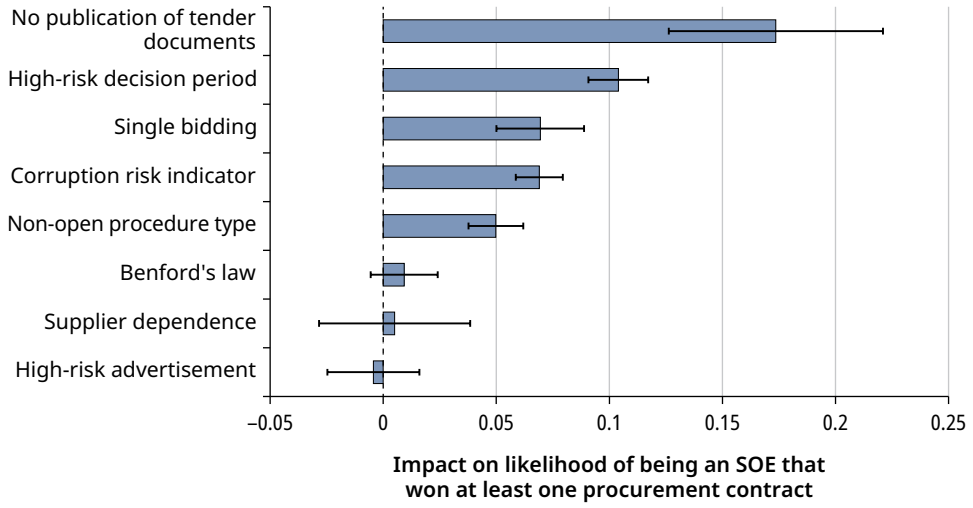


Sources: Estimates based on Global Public Procurement Dataset (GPPD) from Fazekas et al. 2024; firm-level data from Orbis.

Note: Data cover Bulgaria, Croatia, Kazakhstan, Romania, Serbia, and Ukraine and range from 2007 to 2022, but periods vary by country. The figure shows the results of a linear probability model that predicts the probability of winning at least one public procurement contract in a given year. The regression controls for country-year and sector (four digits) fixed effects.

FIGURE 1.28 State-owned enterprises benefit from a higher share of noncompetitive practices in public procurement

SOE status and tender characteristics, overall and by component



Sources: Estimates based on Global Public Procurement Dataset (GPPD) from Fazekas et al. 2024; firm-level data from Orbis.

Note: Data covers Bulgaria, Croatia, Kazakhstan, Romania, Serbia, and Ukraine and ranges from 2007 to 2022, but periods vary by country. The figure shows the results of a linear probability model that predicts the probability of being an SOE that won at least one procurement contract in a given year based on the characteristics of the procurement. The regression controls for country-year and sector (four digits) fixed effects. High corruption risk is a dummy variable that takes a value of 1 if the median Corruption Risk Index (CRI) of all procurements a firm won in a specific year was above 0.5 (68 percent of firms win only one procurement a year). The CRI measures the share of six competition-reducing practices, with a minimum value of 0 and maximum value of 1.

SOEs win more contracts and larger ones under less competitive circumstances. SOEs win a higher than expected share of public procurement contracts in the markets in which they participate considering the size of firms and sector, country, and year fixed effects. SOEs also win higher average contract values, meaning that they also benefit more financially. On average, they face 18 percent fewer competitors. Moreover, the average corruption risk indicator for bids won by SOEs is 18 percent higher than the baseline mean, reflecting that the average SOE procurement displays half of the six criteria of uncompetitive bidding: more tenders with single bidders, unpublished documents, and restrictive procedures, such as entry restrictions (figure 1.28).

Though not as pervasive as before, uncompetitive bidding persists in ECA countries. Nearly 40 percent of bidders continue to win public procurement contracts under uncompetitive conditions in the six countries analyzed (refer to figure 1A.9 in online annex 1A). Competitive public procurement can enhance productivity (refer to box 1.1), whereas uncompetitive procurement, often favoring SOEs, has productivity-distorting effects.

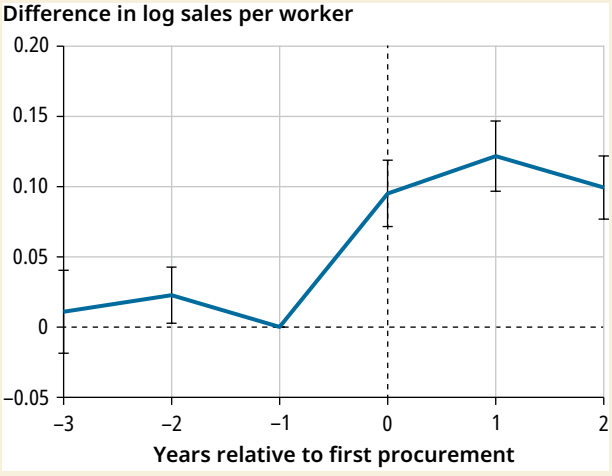
BOX 1.1 Public procurement and productivity

Public procurement represents a significant portion of gross domestic product and can function as a productivity accelerator or distorter, depending on how it is conducted. Public contracts represent about 14.0 percent of gross domestic product in the European Union and 12.8 percent in Organisation for Economic Co-operation and Development countries (di Giovanni et al. 2022). Winning a government contract can help firms that face constraints in their access to finance due to lack of collateral or earnings history overcome those constraints. This effect of public procurement is particularly important in industries with large economies of scale. This constraint tends to affect new and small firms more than others, which is why institutions like the European Commission promote the participation of small and medium firms through specific regulations.[a] The data confirm that small and medium enterprises win fewer procurement contracts than large firms, controlling for other characteristics (figure B1.1.1). Additional analysis, using large procurement data sets for six Europe and Central Asia countries, sought to determine the potential productivity gains from participating in procurement and whether they vary by type of firm.[b]

Firms that win a public procurement contract have an approximately 10 percent gain in productivity (as measured by sales per worker) in the year of contract award and in the two following years. Although no significant productivity differences occur between procurement winners and a comparable control group before the award, productivity is about 10–12 percent higher for procurement contract winners after contract award. This impact is robust and of similar magnitude across all six ECA countries.

FIGURE B1.1.1 Accessing a public procurement contract increases productivity

Public procurement and productivity, by time from contract



Source: Global Public Procurement Dataset (GPPD), Fazekas et al. (2024).

Note: Awarded firms are matched to control firms through nearest neighbor propensity score matching. The unmatched sample exhibits the same trajectory, but confidence intervals are slightly larger.

Continued

BOX 1.1 Public procurement and productivity *(Continued)*

The impact is significant only among small and medium enterprises and extends to employment and revenue. Dividing the sample by size groups shows that the productivity gain differs by firm size. Micro and small firms exhibit the largest gains, whereas large firms (more than 249 full-time equivalent workers) do not see a significant postaward impact. Firms that win public procurement awards also gain a significant boost in employment (15 percent) and an even larger gain in revenues (30 percent), with the same size-related differences.

a. European Union, Directive 2014/24/EU of the European Parliament and of the Council on 26 February 2014 on public procurement and repealing Directive 2004/18/EC," https://eur-lex.europa.eu/eli/dir/2014/24/oj/eng.
b. Firm-level data come from Fazekas et al. (2024) and Orbis.

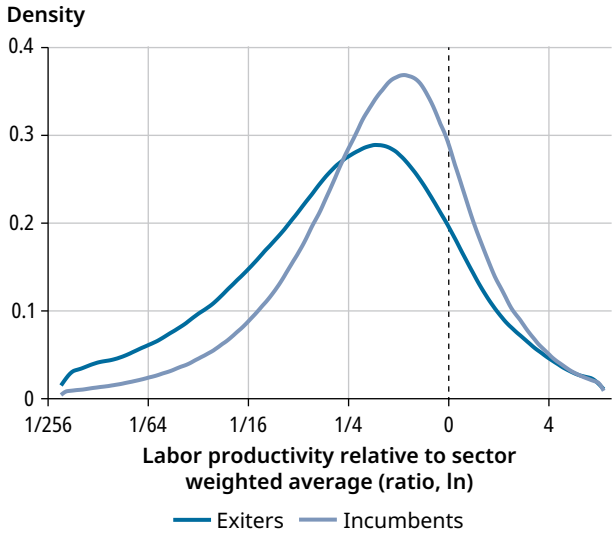
Misallocation Through Enterprise Creation, Survival, and Destruction

This section looks at how misallocation affects aggregate productivity through selection—entry and exit market dynamics and the business dynamism associated with selection.

Inefficiency in the allocation of resources can lead highly productive firms to fail and less productive firms to survive. Productivity dispersion in ECA is large, with many unproductive firms coexisting with a few high-productivity firms. In efficient markets, productive firms survive and grow, while unproductive firms (firms with very low productivity compared to average sector efficiency) shrink and exit. Ultimately, this process implies a rightward shift (figure 1.29) in the productivity distribution of incumbents relative to the productivity distribution of exiting companies (stochastic dominance). The data for ECA, however, reveal a different story. A large proportion of exiting firms have higher productivity than survivor firms that continue to operate in the same sector, many of which have low productivity levels for their industry (figure 1.29). The coexistence of low-productivity survivors and high-productivity exiters suggests that markets are not performing their function of selecting enterprises with high efficiency levels and strong growth prospects. These findings imply that ECA countries can increase their aggregate productivity by improving conditions for more efficient entry and exit market dynamics.

FIGURE 1.29 Many survivor firms in ECA display lower productivity levels than exiting firms

Productivity distribution of exiting and surviving firms, 2006–24



Source: Estimates based on firm-level data from national statistical offices and Orbis.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. Productivity (value added per worker) distributions are depicted relative to the sector median at the three-digit level.

As firms in ECA mature, they do not become more productive (refer to figure 1A.7 in online annex 1A). In competitive, well-functioning markets, selection mechanisms coupled with learning should make survivor firms increasingly productive, following an up-or-out dynamic (either they expand and remain in the market or they exit) as less productive firms exit. In highly competitive sectors, businesses innovate and upgrade to beat the competition, reducing marginal costs relative to noninnovative firms (Ericson and Pakes 1995). However, the average productivity of firms tends to decline faster in older cohorts in less advanced ECA economies, compared to a less pronounced decline in more advanced ECA economies (refer to figure 1A.8 in online annex 1A). This tendency suggests that incumbent firms in ECA, especially in less advanced economies, have problems growing and boosting their productivity as they mature.

Start-ups' uncertainty about their true productivity can lead to high productivity dispersion among younger cohorts, but these productivity differences may decrease as firms experiment and learn about their efficiency. Firms enter the market without complete knowledge of their relative productivity and profitability or their productivity performance over time because they are subject to idiosyncratic sources of uncertainty (Ericson and Pakes 1995; Foster, Haltiwanger, and Syverson 2008; Jovanovic 1982; Pakes and Ericson 1998).

They gain this knowledge through operating experience. In well-functioning markets, less productive firms close and more productive ones grow through investments and capability upgrading due to competition forces. If they have limited success (profits and efficiency are below expectations), firms can abandon the industry. A study of these selection dynamics in a developing and a developed country (Colombia and the United States) reveals that firm growth rates are highly skewed and differ considerably across cohorts, with start-ups and young firms exhibiting an up-or-out dynamic (Eslava, Haltiwanger, and Pinzon 2022). This selection mechanism is weaker in less advanced economies. Consequently, many underperforming young firms remain in the market and coexist with a few high-productivity firms, increasing productivity dispersion.

Productivity differences are larger for younger cohorts and shrink only slowly as firms age, supporting the idea that selection mechanisms can increase resource misallocation. In more advanced ECA economies, especially high-income economies, a negative relationship exists between productivity dispersion and age, but this pattern does not hold in less advanced ECA economies (except the Kyrgyz Republic, where the relationship is negative and initial dispersion high). Productivity dispersion typically declines during the first five years of a firm's life, then flattens. Patterns in productivity dispersion (refer to figure 1A.8 in online annex 1A) suggest that market selection mechanisms and expected postentry growth of incumbents do not work to benefit more productive firms. In other words, misallocation seems to be dampening aggregate productivity growth in ECA.

Within-Firm Upgrading as a Complementary Channel to Reallocation

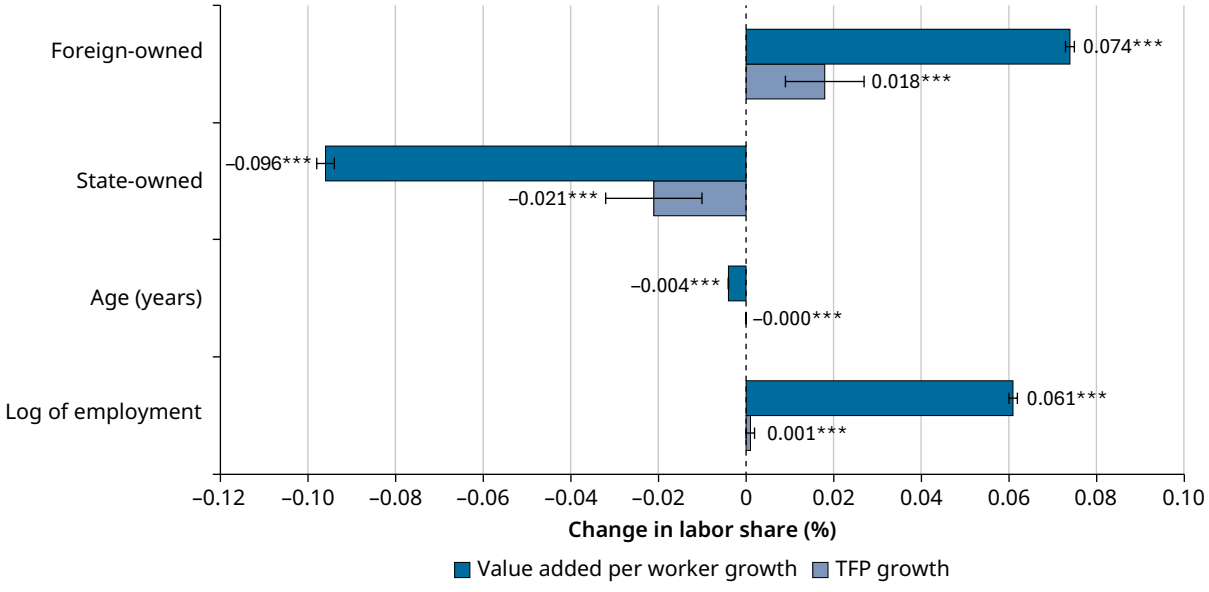
ECA will also need to promote more firm upgrading, whose productivity gains often complement the reduction of misallocation. Recent evidence on ECA shows that within-firm upgrading is also important for productivity growth, particularly in the middle-income parts of ECA where very little within-firm productivity gains have occurred (Iacovone et al. 2025). Whereas the previous section shows the great potential for productivity gains from improving market allocation, past evidence[13] suggests that the success of such policies also crucially depends on firms' ability to meet the increased competition through investments in their managerial or technical capabilities.

Within-firm upgrading is predominately driven by foreign-owned, younger firms and larger companies in ECA. Figure 1.30 depicts how different firm characteristics correlate with labor productivity (value added per worker) and TFP changes over a five-year time horizon. First, younger firms show higher levels of productivity growth in ECA, because age is negatively correlated with productivity growth.

This difference is significant across four out of the five ECA clusters and more pronounced in less advanced parts of ECA (refer to figure 1A1.10 in online annex 1A), showing that firms do not become more productive as they mature in ECA, especially in less advanced economies. Second, larger companies exhibit more productivity growth. Moreover, foreign investment emerges as another driver of within-firm upgrading. Foreign-owned companies exhibit higher productivity growth rates compared to private domestic companies, which underlines the gains of foreign direct investment (discussed in more detail in the next chapter). Consistent with the findings from the previous sections, the productivity of SOEs grows considerably less than that of private firms, and the negative growth gap is even larger than the positive gap of foreign-owned firms.

FIGURE 1.30 Young firms display more within-firm productivity growth across ECA

Within-firm productivity growth, by firm characteristics, 2006–24



Source: Estimates based on data from national statistical offices.

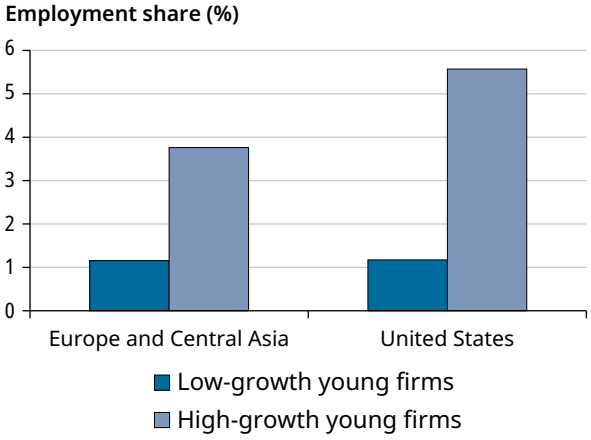
Note: The reference category is private domestic firms. The specification regresses the five-year normalized labor productivity and TFP change on firm attributes and the initial productivity of the firm (the productivity value when it is first observed in the data). Controls include country-sector-year fixed effects. The normalized productivity change is calculated as follows: $g_{i,t} = \frac{prod_{i,t} - prod_{i,t-5}}{\frac{1}{2} \times \left(prod_{i,t} + prod_{i,t+5} \right)}$. Value added per worker and TFP enter the calculation in levels.

The regression was run at firm level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. TFP = total factor productivity.

Despite the importance of young firms for productivity growth, they lack a strong presence in ECA countries, limiting the economywide gains from firm upgrading. Young firms drive firm upgrading and thus productivity growth overall, but they often account for only a small share of total firms in most countries in the region, compared with in high-income countries such as the United States and those in the European Union. Although the employment share of low-growth young firms (those with the lowest 10 percent of productivity growth) is similar in the United States and ECA, high-growth young firms (those with the highest 10 percent of productivity growth) employ about 6 percent of the workforce in the United States but only 4 percent in ECA (figure 1.31). Furthermore, the share of high-growth firms among total firms tends to be lower in most of ECA, except Georgia, Kazakhstan, and Moldova, than in Western Europe (figure 1.32).

FIGURE 1.31 High-growth young firms have a lower employment share in ECA than in the United States

Employment share of young firms, by level of productivity growth, ECA and the United States, 2006–24

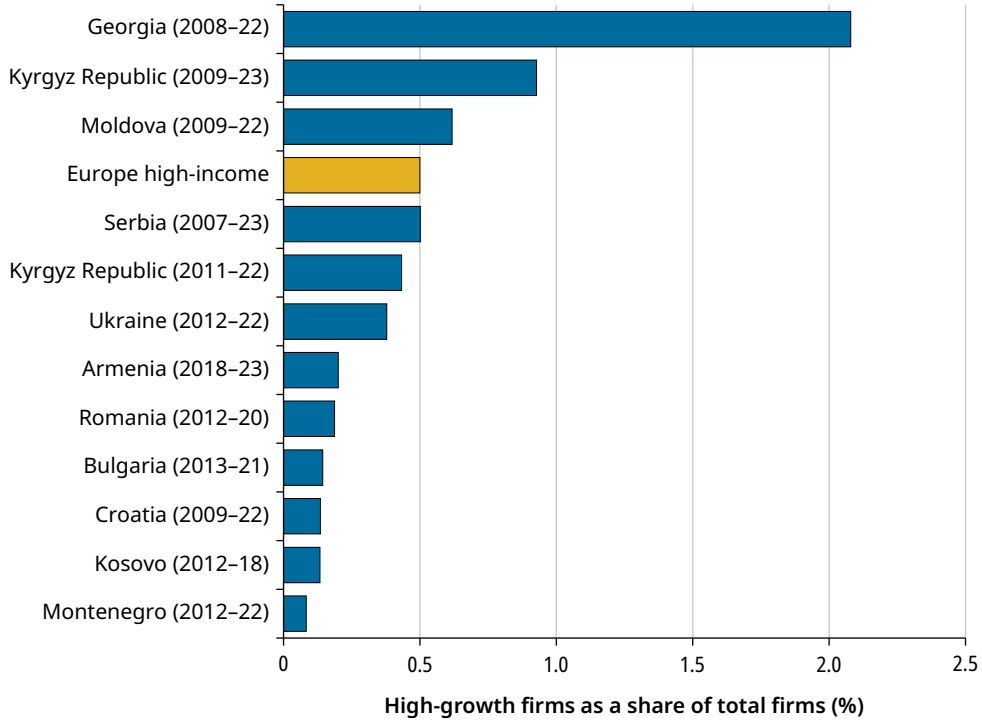


Source: Estimates based on data from national statistical offices.

Note: Low-growth young firms are those ages 0–4 years with the lowest 10 percent of productivity growth. High-growth young firms are those ages 0–4 years with the highest 10 percent of productivity growth. ECA = Europe and Central Asia.

FIGURE 1.32 The share of high-growth firms among total firms tends to be lower in most of ECA, except Georgia, Kazakhstan, and Moldova, than in Western Europe

High-growth firms as a share of total firms, by country, various year ranges



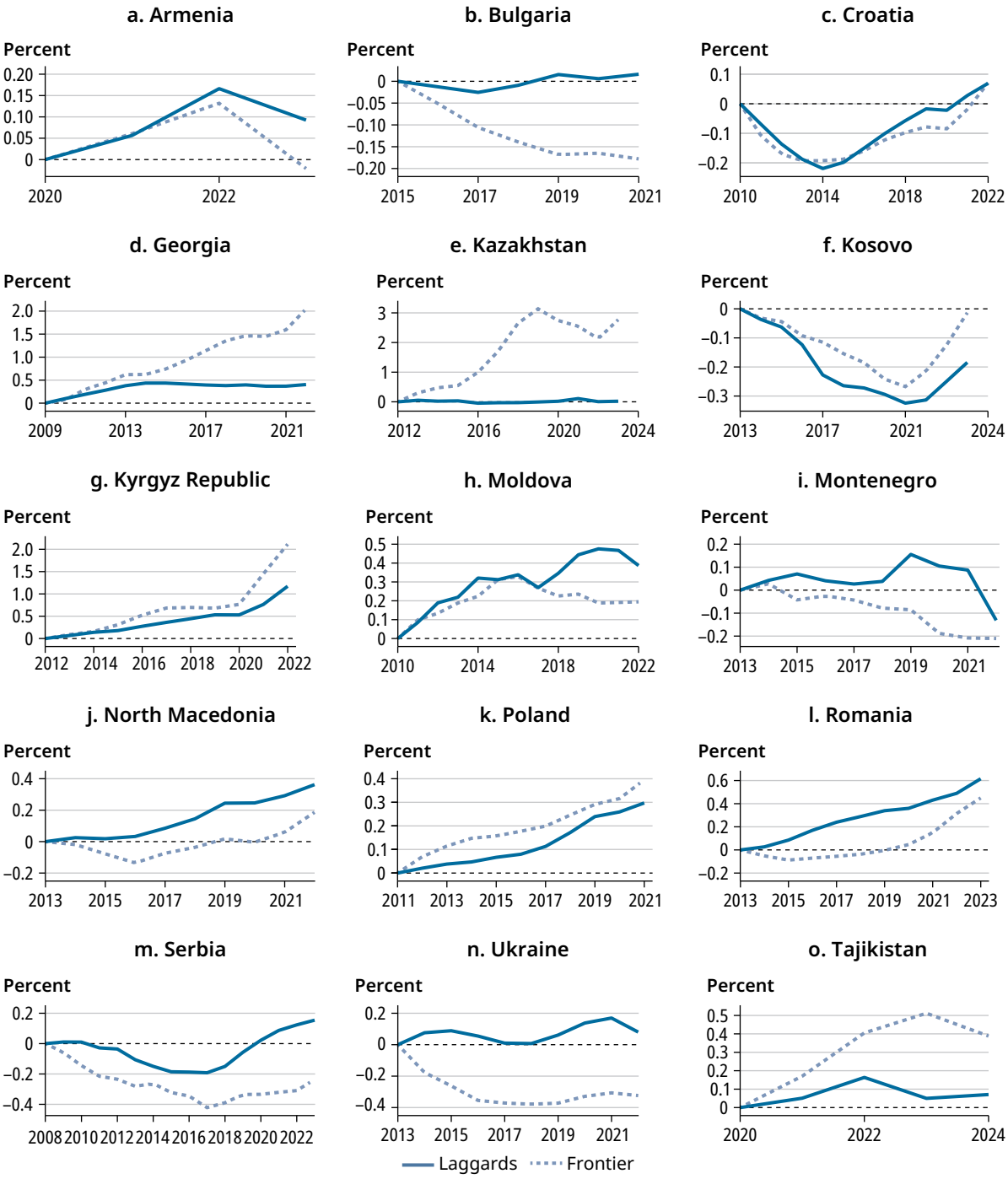
Source: Estimates based on data from national statistical offices and Orbis.

Note: High-growth firms are those that have experienced at least one three-year period of annualized growth in deflated sales of 20 percent or more in their first 10 years of operation and have more than 100 employees (Adilbish et al. 2025).

Many ECA countries also face a productivity challenge at the frontier, with productivity growth of top firms occurring more slowly than among laggard firms. Figure 1.33 shows the cumulative productivity growth of the top 10 percent of firms with the highest productivity (red) and of the remaining 90 percent, referred to as laggards, over time. In 9 out of 15 countries, the frontier firms have had lower productivity growth than the laggards have; in several countries, such as Bulgaria and the Balkan countries, growth over the past decade has been either stagnant or negative. Thus, productivity convergence in many countries results at least partially from bad performance at the frontier. Overall, these results underline the significant potential for productivity gains from firm upgrading, both at the frontier and among laggard firms.

FIGURE 1.33 Frontier firms do not exhibit higher productivity growth than laggards in most of ECA

Cumulative growth of frontier and laggard firms, by country, various year ranges



Source: Estimates based on data from national statistical offices.

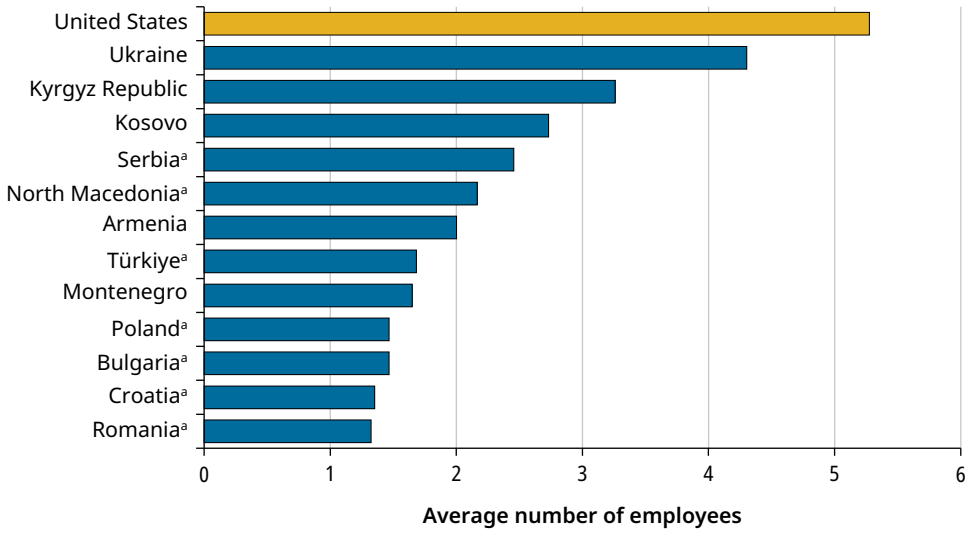
Note: Frontier firms are the top10 percent of firms with the highest productivity; laggards are the remaining 90 percent of firms.

Productivity and Jobs

Start-ups and other new firms enter the market at a small scale in ECA, with new firms in ECA entering at less than half the size of new firms in the United States (figure 1.34). Although smaller entry size may suggest lower barriers to entry, new firm creation often results from necessity rather than opportunity. Evidence from the Global Entrepreneurship Monitor on the subset of ECA firms with fewer than five workers and employers with less than college education shows that approximately 40 percent of new businesses in ECA were motivated by opportunity and 30 percent by necessity; the remaining 30 percent were motivated by a combination of necessity and opportunity.[14] Although considerable, the percentage of new businesses that open in ECA because of necessity does not differ much from that observed in Organisation for Economic Co-operation and Development (OECD) countries.[15] OECD countries have a higher percentage of new businesses driven by opportunity (48 percent), but the share driven purely by necessity is similar to the share in ECA (30 percent), meaning that 22 percent have a mixed motivation to start a business (refer to table 1A.2 in online annex 1A). Creating an enabling business environment that rewards productive firms and investment by improving credit access and increasing trade integration is therefore key to improving opportunities for entrepreneurs and encouraging the creation of larger, capital-intensive, and innovative companies.

FIGURE 1.34 New firms in ECA countries are smaller than those in the United States

Firm size at entry, selected ECA countries and the United States, latest data available for 2006–24



Sources: Estimates based on firm-level data from national statistical offices, Orbis, and Eurostat.

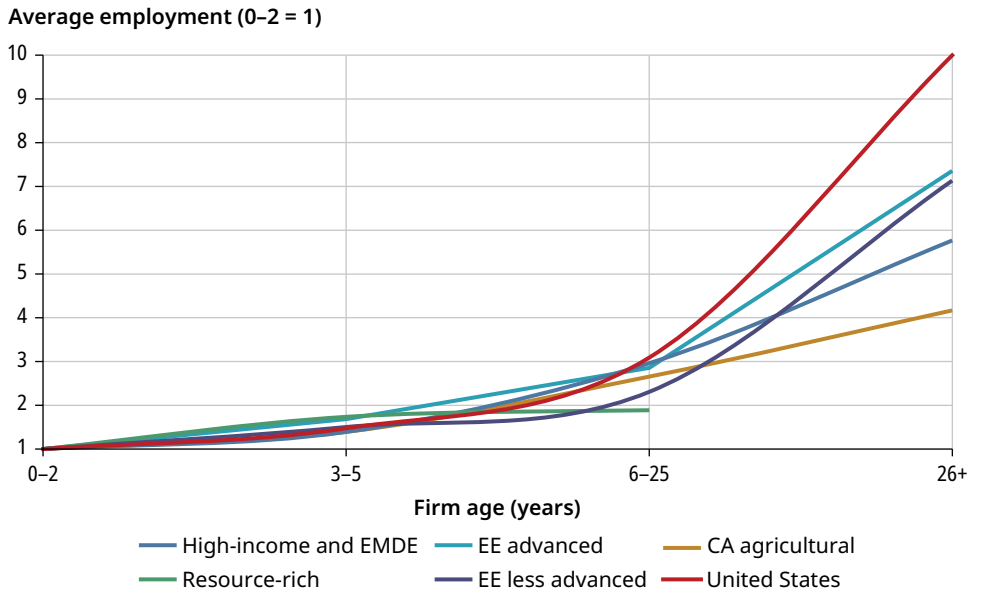
Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources.

a. Data from Eurostat.

In addition to entering the market at a smaller size, new firms in ECA have sluggish employment growth as they mature. When new businesses open, they face substantial uncertainty about demand and their own productivity (Hopenhayn 1992). In well-functioning markets, as noted earlier, the selection process ensures that more productive firms survive and grow, whereas less efficient ones shrink and eventually exit. New firms in ECA countries show weaker employment growth as they mature than do new firms in developed economies like the United States, especially firms in less advanced ECA countries. Plotting average employment of firms at each age bin shows similar employment growth trajectories for ECA and the United States up to the first 25 years but diverging trajectories afterward in less advanced ECA countries (figure 1.35). Thus, most mature US companies (older than 25 years) are substantially larger than younger US companies (6–25 years old), whereas the differential is much less pronounced in ECA countries.

FIGURE 1.35 Older firms in ECA countries have more sluggish employment growth compared with similarly aged firms in the United States

Average employment of firms, ECA and United States, by ECA country group and firm age, 2006–24



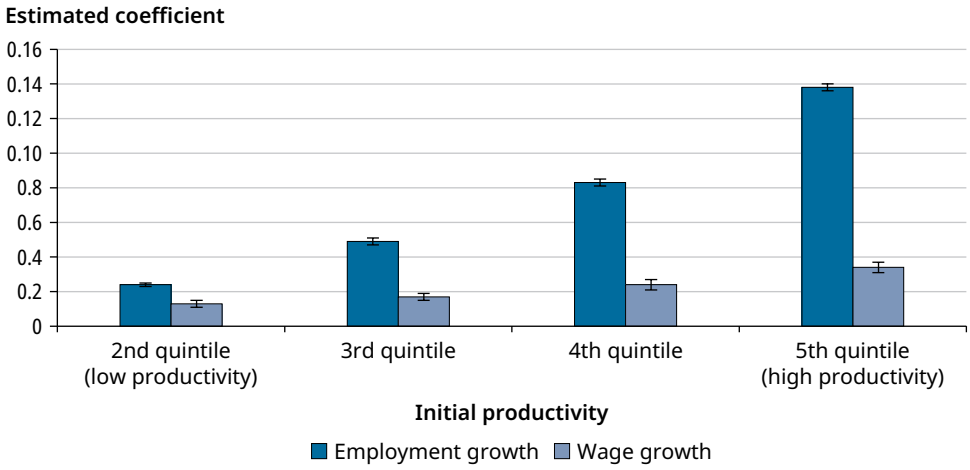
Sources: Estimates based on firm-level data from national statistical agencies, Orbis, and US Census Bureau.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. CA agricultural includes the Kyrgyz Republic and Tajikistan; EE advanced comprises Bulgaria, Georgia, Kosovo, Montenegro, North Macedonia, and Serbia; high-income and EMDE includes Croatia, Poland, Romania, and Türkiye; EE less advanced comprises Armenia, Moldova, and Ukraine; resource-rich includes Kazakhstan. The figure shows average employment at each age class bin relative to firms ages 0–2 years (normalized to 1). CA = Central Asia; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies.

Boosting productivity matters for job creation and job quality. In a context free of distortions, friction, and adjustment costs, employment creation is greater in higher-productivity firms than in lower-productivity firms. A regression analysis finds that the average five-year employment growth rate has a strong positive association with the initial productivity of a firm (figure 1.36). For instance, a firm whose productivity at market entry (or the first value observed) was within the first quintile of the distribution displays a substantially lower average employment growth rate than that of firms in higher-productivity quintiles. Frontier companies (those in the fifth quintile) exhibit an average employment growth 2 times higher than that of firms in the fourth quintile and 10 times higher than that of firms in the first quintile. Promoting the entry of innovative, more capital-intensive firms is good for economic growth and employment creation. Similarly, wages rise faster in frontier firms than in lower-productivity firms, although the relationship is weaker than for job creation (refer to box 1.2).

FIGURE 1.36 High-productivity firms create more jobs and increase wages more than low-productivity firms

Employment and wage growth, by firm's initial productivity quintile, 2006–24



Sources: Estimates based on the methodology in Calligaris et al. 2023 and firm-level data from national statistical offices, Orbis, and the US Census Bureau.

Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. The figure displays the relationship between the initial productivity of the firms (first value added per worker grouped into quintiles) and the normalized employment growth rate over a five-year period, controlling for the initial employment of the firm and country-sector-year fixed effects; thus, the results should be interpreted as the growth rate relative to differences across productivity quintiles.

BOX 1.2 Factors associated with higher wages

In addition to creating more jobs, more productive firms pay higher wages. For instance, wages are 80 percent higher in the most productive 20 percent of firms than in the second-least productive 20 percent of firms in Europe and Central Asia. One explanation is that more efficient employees work in more efficient firms; thus, if employees are paid according to their marginal productivity, wages should be higher in firms where an identical worker produces more with the same inputs. A complementary explanation is that workers in more productive firms are more skilled and that differences in wages therefore reflect differences in underlying capabilities. Although that hypothesis could not be assessed, differences in underlying skills likely play a role, highlighting the importance of having more productive firms to attract high-skilled workers.

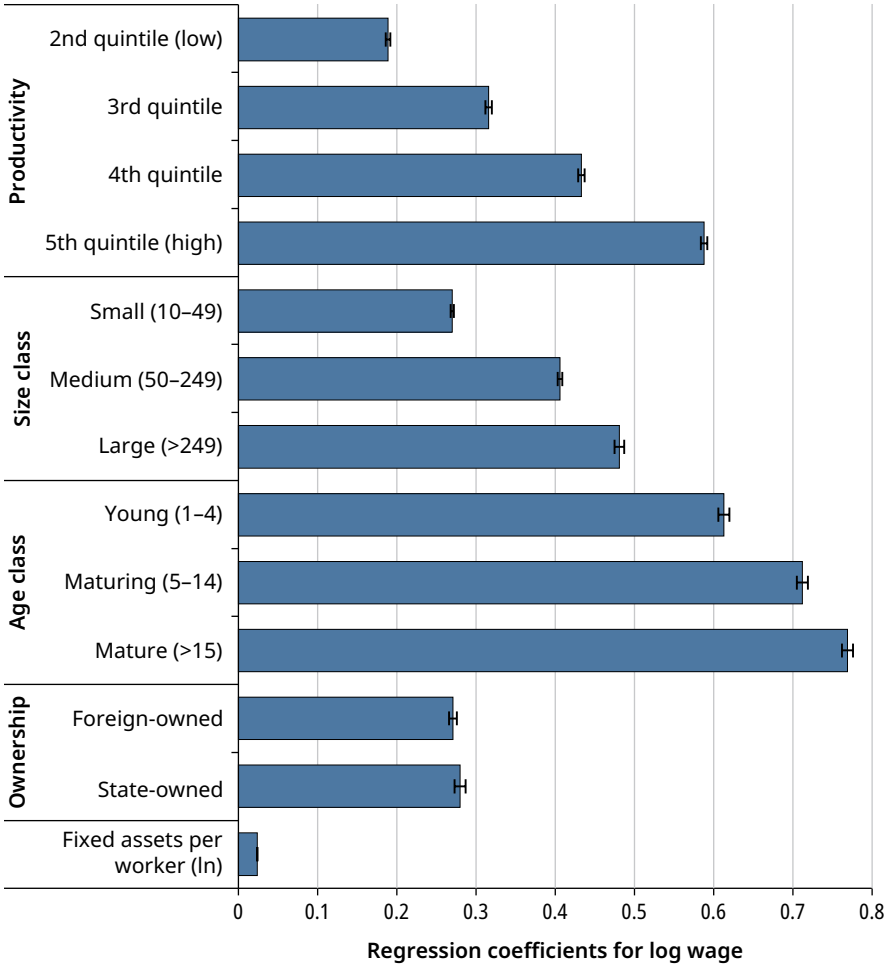
Foreign- and state-owned enterprises in Europe and Central Asia also pay higher wages. Once productivity is accounted for, wages in foreign companies are about 30 percent higher than in domestic private companies, on average. In addition to bringing product diversification, integration to global value chains, exports, technology infusion, and better managerial practices, foreign direct investment could also contribute to higher wages. Even when they have lower productivity than that of their private counterparts in the same industry, state-owned enterprises also pay higher wages (figure B1.2.1). State-owned enterprises have a productivity disadvantage relative to private companies (meaning they are less efficient), but they still reward workers above the industry average wage. This higher pay likely results in lower profits or preferential access to markets, in the form of subsidies or protective regulations.

Continued

BOX 1.2 Factors associated with higher wages *(Continued)*

FIGURE B1.2.1 Productivity, size, age, ownership, and capital intensity help explain wage differences across firms

Correlates of average wages in ECA countries, by firm characteristics



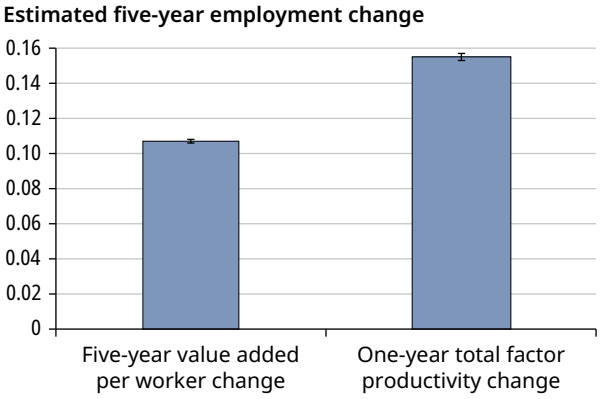
Sources: Estimates based on firm-level data from national statistical offices and Orbis.

Note: The baseline is micro, private domestic firms. Specification controls include country and sector-year fixed effects. ECA = Europe and Central Asia.

Productivity growth drives job creation, with this link stronger among high-productivity firms. Productivity growth can be labor reducing if firms achieve efficiency through the adoption of labor-saving technologies and if this effect dominates labor expansions driven by a scaling up of firm demand (Calligaris et al. 2023). Overall, however, a positive association exists between productivity growth and employment creation at the firm level in ECA countries (figure 1.37). Firms with larger productivity gains tend to have larger employment growth in the long term (over five years), irrespective of whether the analysis uses labor productivity or multifactor productivity. Although the results could be interpreted as smaller firms making larger efficiency improvements and employment changes, these job growth patterns are robust to the initial employment of the firm and its position in the productivity distribution. These results corroborate the findings of an average positive effect of similar magnitude in nine OECD countries (Calligaris et al. 2023)[16] and a positive effect of TFP gains on employment growth for the United States (Decker et al. 2020).

FIGURE 1.37 Job growth is associated with productivity growth in ECA

Association between employment creation and productivity, 2006–24

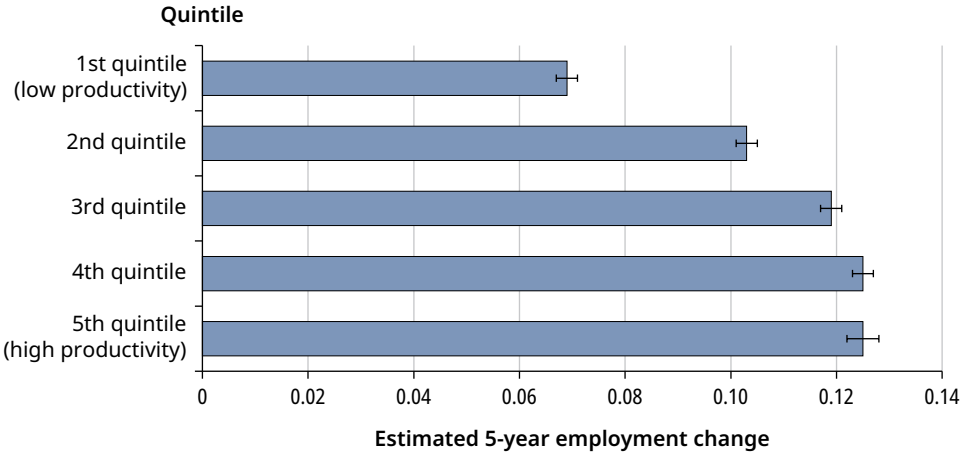


Sources: Estimates based on the methodology in Calligaris et al. 2023 and firm-level data from national statistical offices, Orbis, and the US Census Bureau.

Note: The figure shows the results of regressing the change in employment over five years on a one-year productivity growth, considering the initial position of the firm in the productivity distribution, the one-year employment growth, and the initial firm size. The specification controls for country-sector-year effects. Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. ECA = Europe and Central Asia.

FIGURE 1.38 Job growth is more responsive to productivity growth among higher-productivity firms in ECA

Association between employment growth and initial productivity, by quintile, 2006–24



Sources: Estimates based on the methodology in Calligaris et al. 2023 and firm-level data from national statistical offices, Orbis, and the US Census Bureau.

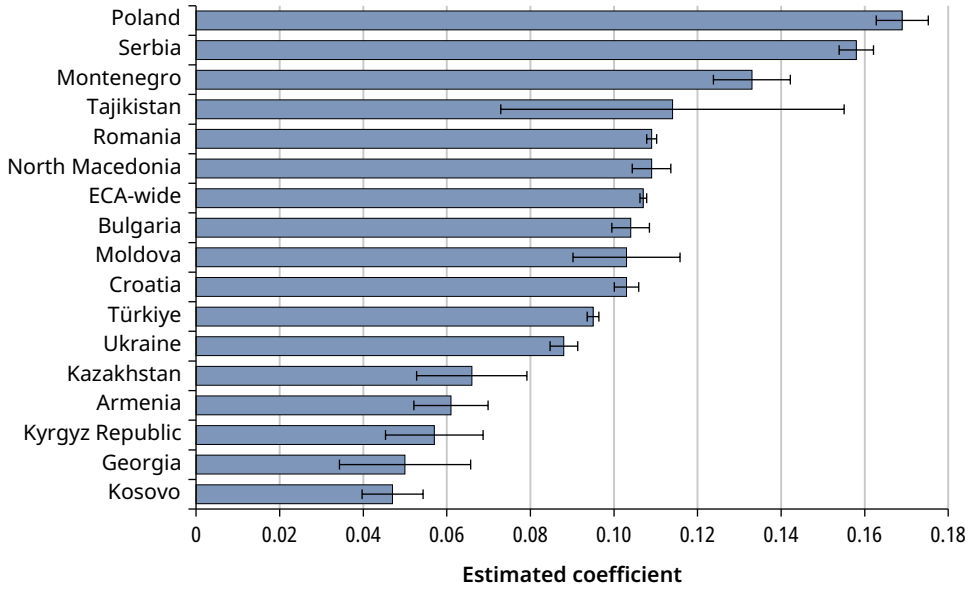
Note: Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources. The figure shows the results of regressing the five-year employment change on the interaction between one-year productivity change and the initial productivity quintile of the firm. The specification controls for the initial productivity quintile, initial employment, and the one-year employment change. Country-sector-year fixed effects are also included.

The same increase in productivity boosts employment growth twice as much for firms in the top quintile of initial productivity as for firms in the bottom quintile (figure 1.38). In other words, frontier firms have larger employment responsiveness to productivity growth than do laggard firms. Thus, having more productive firms is important not only because of the boost to job growth but also because productivity-enhancing policies can have a stronger long-term impact on job creation if the business environment attracts innovative entrepreneurs.

The link between productivity growth and job creation holds across the ECA region. Although the magnitude of the effect varies across countries, the effect is economically and statistically significant in the 15 ECA countries with firm-level data that were analyzed for this report (figure 1.39). Less advanced ECA economies display lower employment growth responsiveness to productivity gains, which could be explained by less competitive markets and less conducive business environments than in more advanced ECA economies. If firms that become more efficient can benefit from their productivity gains by increasing their market share, they will create more jobs as they expand output (if the demand effect is larger than the displacement and efficiency effects, as noted earlier). However, this expansion can happen only with a competitive market and an enabling business environment.

FIGURE 1.39 Job creation responds to productivity growth across ECA countries

Association between productivity growth and job creation, selected ECA countries, 2006–24



Sources: Estimates based on the methodology in Calligaris et al. 2023 and firm-level data from national statistical offices, Orbis, and the US Census Bureau.

Note: The figure shows the results of regressing the change in employment over five years on a one-year productivity growth, considering the initial position of the firm in the productivity distribution, the one-year employment growth, and the initial firm size. The specification controls for sector-year effects. Regressions are run separately for each country. Refer to table 1A.1 in online annex 1A, available at https://hdl.handle.net/10986/43788, for data date ranges and national sources.
ECA = Europe and Central Asia.

Conclusion and Policy Recommendations

The analysis in this chapter emphasizes the need for ECA countries to complete the transition to a market economy and address the misallocation of resources between and within sectors. Removing frictions and distortions in labor and financial markets will facilitate the reallocation of economic resources to more productive firms and increase productivity. In labor markets, governments should increase the flexibility of labor market regulations by ending preferential treatment for SOEs; eliminating contractual restrictions in hiring, including restrictions related to type of contract, minimum number of hours, fixed-term and temporary positions, and layoffs in response to shocks; fostering responses to global trends such as digitalization, technological change, and climate change; and encouraging organizational changes. Reducing the cost, time, and number of procedures required to fire a worker can accelerate labor reallocation to more productive activities and firms. In financial markets, governments should remove preferential treatment for SOEs and any type of preference not based on

fundamentals, such as size-based subsidies. Modernizing insolvency regimes can expedite the reallocation of resources to the most productive firms and activities. In addition to removing preferential treatment of SOEs in real and financial markets, governments should guarantee competitive neutrality and pave the way for greater private participation in the economy. Welcoming foreign direct investment—both public and private—that brings know-how and expertise in key upstream sectors can increase aggregate productivity.

Policy priorities

The following policy priorities are based on the analysis in this chapter.[17] Table 1.1 indicates how these policy priorities can be tailored to countries within each country group.

Priority 1: Mainstream the productivity agenda in countrywide growth strategies underpinned by robust statistical data and analytics

All ECA countries have some type of national development strategy based on their vision for promoting sustained growth, reducing poverty, and improving welfare. In many countries, these strategies are articulated in multiyear development plans and linked to the government's public investment programs and policy reform programs. Because productivity is central to enhancing growth and accelerating income convergence in the ECA region, national development strategies should address ways to boost productivity and identify country-specific reforms for institutional building.

Robust statistical data and analytics should guide attention to productivity in countries' growth strategies. Countries need strong national statistical systems that are transparent and accessible and that collect and analyze firm-level data. According to the World Bank Statistical Performance Index, most countries in the region perform above the world average on statistical data and analytics, but several countries are in the bottom 20 percent of the global distribution, particularly in data services such as quality of data releases, richness and openness of online access, effectiveness of statistical advisory and analytical services, and availability and use of data services.

Priority 2: Foster investments in upgrading and technology adoption through incentives

Fostering technology adoption is important for drawing greater productivity gains from structural change by enabling the expansion of technology-intensive sectors. Firms will invest in upgrading and technology only if they can reap the benefits from those investments. Therefore, eliminating distortions and reducing misallocation can generate incentives for investing in firm upgrading

(Akcigit 2021; Bloom et al. 2022; Iacovone et al. 2022). Chapter 3 will discuss in more detail priority reforms pertaining to trade, foreign direct investment, and technology spillovers.

Priority 3: Foster market competition by removing regulatory distortions

Building competitive domestic markets is fundamental to reducing misallocation between firms within sectors. Each country needs a competition policy framework to ensure market contestability—allowing productive and innovative firms to enter and unproductive firms to exit. Although a competition law is an important part of such a policy framework, competition policy covers a broader set of tools, including sector regulations, licensing and certification requirements, investment laws, investment incentives, trade policies, procurement policies, and public-private partnership frameworks (World Bank 2023). Specific reforms under the competition policy framework should be identified using robust market diagnostics supported by a strong statistical system, the identification of government interventions that distort market dynamics, and the design of the least restrictive policy alternatives.

Priority 4: Reduce the footprint of state-owned enterprises

The incomplete market transition and continuing prevalence of economic SOEs impede the promotion of domestic market competition in ECA countries. SOEs not only act as a fiscal drain and a source of contingent liabilities for governments but also reduce market contestability, distort the allocation of resources, and crowd out private enterprises. ECA countries need to reduce SOEs' participation in commercial activities by removing subsidies and distortive arrangements, including preferential access to resources.

Priority 5: Develop sound domestic financial markets and financial institutions

Although ECA countries, on average, have well developed domestic financial markets that are integrated in the global financial system, some countries have significant gaps in their financial system. Mechanisms are needed to prevent credit misallocation. One measure would be to promote alternative credit scoring models and enhance the capacity of financial institutions to assess the potential of innovative firms. Addressing information asymmetries that impede investment in technology upgrading and firm growth will require improving credit registry systems.

Priority 6: Strengthen the institutional framework for public procurement to limit uncompetitive procurement practices

Public procurement emerged as another important source for misallocation in ECA and there are a variety of measures that can make public procurement more competitive. First, make open, competitive tendering the norm and hardwire it through an end-to-end e-procurement platform that discloses plans, tenders, awards, contracts, and implementation milestones. A second reform area could be to establish an independent, time-bound complaints review mechanism, to require conflict-of-interest and beneficial-ownership disclosures, and to adopt a robust sanctions/debarment regime applied consistently across procuring entities. Third, avenues that could lead to potential favoritism to SOEs should be closed by codifying level-playing-field rules (same qualification, pricing, and contract management standards as private firms) and using competitive procedures whenever procuring from SOEs, except for narrowly justified monopolies. This will address a source of misallocation highlighted in the analysis. Finally, tracking and publishing key performance indicators—such as the share of competitively awarded contracts, single-bid rates, average bidders per tender, SOE award share, and complaint resolution times—can be a way to flag collusion risk using data analytics. While the suitability of each measure varies across countries and may need to be adapted to the specific context, these reform options can help curb single-source awards, increase effective competition, and reduce allocative distortions—supporting productivity growth.

In terms of sequencing, it is important that policies and programs that foster the capabilities of firms (Priority 2) accompany competition reforms (Priority 3) and other efforts to reduce misallocation.[18] This sequencing will enable domestic firms to better respond to increased competition by upgrading their products or entering new markets.

Considerations for using industrial policy to promote productivity

Countries have increasingly deployed industrial policies to promote competitiveness, but effective implementation is difficult and requires meeting a broad set of preconditions. The recent surge in industrial policies poses the question of whether they offer an adequate response to also promote productivity in specific sectors. Unless implemented under the right institutional conditions, industrial policies may worsen the misallocation in the economy. Industrial policy instruments need to be selected carefully to fit the market failure they aim to address (refer to box 1.3 for details). Finally, industrial policies like production or innovation subsidies are very costly and need to be provided over longer periods of time to materialize. Given that most ECA countries have limited fiscal space, they should carefully weigh the use of scarce public resources for industrial policy against alternative uses that might promote productivity more directly, such as promoting foundational and managerial skills or competition.

TABLE 1.1 Priority level for policy recommendations, by country group

Recommendation	EU members	EU candidates	Türkiye	Central Asia and South Caucasus
Mainstream the productivity agenda in countrywide growth strategies underpinned by robust statistical data and analytics	Medium	High	Medium	High
Foster technology adoption	Medium	Medium	High	High
Foster market competition by removing regulatory distortions	Medium	High	Medium	High
Reduce footprint of state-owned enterprises	Medium	Medium	Low	High
Develop sound domestic financial markets and financial institutions	Medium	Medium	Low	High
Strengthen the institutional framework for public procurement to limit uncompetitive procurement practices	Low	Medium	Medium	High

Source: World Bank.

Note: Low, medium, and high indicate priority level. ECA = Europe and Central Asia; EU = European Union.

BOX 1.3 Industrial policy

Over the past years, the number of industrial policies has grown significantly (Juhasz et al. 2025). Many industrial policies have been motivated not only by concerns of economic security due to geopolitical tensions but also by competitiveness concerns in sectors considered "strategic," such as semiconductors or batteries. Although often rebranded as "industrial strategies," these policies do not differ much from traditional industrial policies, indicating that similar principles for their effectiveness apply (Rajan 2024).

Principles for industrial policies

Evidence from past case studies provides insights about the conditions under which industrial policies tend to work best. First, in terms of focus, industrial policies are best applied to support activities rather than sectors and should focus on new activities to support the costs of discovery. Ideally, these are activities that have potential for spillovers in terms of information or crowding in private investment. Second, effective

Continued

BOX 1.3 Industrial policy *(Continued)*

implementation requires the leadership of high-capacity agencies that communicate actively with the private sector but maintain their autonomy to avoid regulatory capture (embedded autonomy). Third, policies need to have clear criteria for success and failure and sunset clauses that phase out support if criteria are not met. Finally, a high level of accountability and transparency through monitoring and evaluation systems is required to facilitate institutional learning and to ensure public scrutiny.

Different tools for different contexts and market failures

Policy instruments can be categorized into first-best and second-best by whether they address market failures directly or indirectly, with the latter imposing additional costs. Industry-tailored public goods such as industrial parks or shared infrastructure can address coordination failures and are first-best when they provide access before most market interventions can. Innovation and production subsidies work as first-best in the presence of positive externalities in sectors with incomplete risk and financial markets, but they impose high costs and are therefore less suitable for fiscally constrained governments. Among trade-related instruments, tariffs are considered second-best because they harm consumers and downstream industries, if applied to intermediate inputs. Some evidence shows that commodity export bans and local content requirements can generate growth in large domestic markets but with lower effects on productivity and wages. Ultimately, gains from industrial policies may take very long to materialize (for example, in the Republic of Korea) and require support over extended period of times. Countries should therefore carefully weigh spending scarce public resources on such policy interventions against alternative policies and alternative uses.

Sources: The section on principles for industrial policies is based on Juhász, Lane, and Rodrik 2024 and Rodrik 2009. The section on different tools is based on Fernandes and Reed, forthcoming.

Notes

1. For the purpose of this report, ECA economies were classified into five groups using k-means clustering based on a variety of economic, geographic, and institutional factors (GDP share of agriculture, natural resource rents [percent of GDP], trade openness, distance to the geographic center of the European Union, and Bertelsmann Stiftung's Transformation Index): (a) high-income and emerging markets and developing economies (Croatia, Poland, Romania, and Türkiye), (b) Eastern Europe advanced economies (Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Montenegro, North Macedonia, and Serbia), (c) Eastern Europe less advanced economies (Albania, Armenia, Moldova, and Ukraine), (d) resource–rich economies (Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan), and (e) agricultural Central Asia economies (the Kyrgyz Republic, Tajikistan, and Uzbekistan). However, completeness of groups may vary due to data availability. Notes below figures list the exact countries used from each group.
2. The estimation builds on the methodology developed by Caselli (2016).

3. Even when sectoral productivity remains constant over time, aggregate productivity can increase or decrease because of the reallocation of workers from low- to high-productivity sectors or vice versa.
4. The analysis yields similar results when using TFP in place of value added.
5. The counterfactual analysis performed in this chapter replicates previous work by Cusolito, Fattal-Jaef, Mare, and Singh (2024). The analysis examines how real and financial misallocation contribute to aggregate productivity losses. Real misallocation is quantified by comparing the observed marginal revenue of capital and labor across firms within sectors. In efficient markets, marginal products should be equalized across firms in the same industry, so dispersion suggests the existence of inefficiencies. These results are used in a counterfactual exercise that simulates what would happen to aggregate productivity if labor and capital constraints were removed (if marginal products were equalized because of production factors reallocating efficiently). Because productivity gains are model-dependent, they are reported compared to the gains observed in advanced economies for which data are available. This scenario is referred to as "hypothetically moving to the EU and US efficiency" level.
6. Under conditions of no resource misallocation, TFPR should be equal across firms, so a higher TFPR–TFPQ correlation reflects larger TFPR dispersion and thus less allocative efficiency.
7. The sector taxonomy based on the degree of competition in the sector follows Dall'Ollio et al. (2022).
8. For further details on this taxonomy, refer to Dall'Ollio et al. (2022).
9. The exercise controls for firm size and age class, fixed assets (ln), four-digit sector (NACE Rev. 2), and year.
10. Despite SOEs' low market share in competitive sectors, their contribution to the economywide share is relevant because they account for 85 percent of total output.
11. The analysis includes information on 2,206,758 contracts in six ECA countries (Bulgaria, Croatia, Kazakhstan, Romania, Serbia, and Ukraine) from 2007 to 2022. The coverage period, however, varies by country.
12. The sample consists of all firms present in for the time frame with available procurement data. SOEs represent 0.3 percent of all observations in the nonprocurement sample but 2.3 percent of all observations in the sample of firms that win procurement.
13. Refer to past World Bank reports *Productivity Revisited: Shifting Paradigms in Analysis and Policy* (Cusolito and Maloney 2018) and *The Innovation Paradox: Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up* (Cirera and Maloney 2017) for detailed discussions of firm capabilities and their effect on productivity.
14. Based on 2018 data from the Global Entrepreneurship Monitor (https://www.google.com/search?client=safari&rls=en&q=global+entrepreneurship+monitor&ie=UTF-8&oe=UTF-8). ECA countries included are Bulgaria, Croatia, Poland, the Russian Federation, and Türkiye based on data availability.
15. OECD countries include Austria, Canada, France, Germany, Greece, Ireland, Israel, Italy, Japan, the Republic of Korea, Luxembourg, New Zealand, Slovenia, Spain, Sweden, Switzerland, the United Kingdom and the United States.
16. The countries are Belgium, Croatia, Hungary, Italy, Japan, Latvia, the Netherlands, Portugal, and Sweden.
17. Other priorities such as fostering regional and global integration, as well as promoting technology adoption— although crucial for spurring productivity growth—are not discussed in this chapter but in the following chapters.
18. For more details, refer to Cusolito and Maloney (2018).

References

Akcigit, U., H. Alp, and M. Peters. 2021. "Lack of Selection and Limits to Delegation: Firm Dynamics in Developing Countries." *American Economic Review* 111 (1): 231–75. https://www.jstor.org/stable/27027255.

Adilbish, O., D. Cerdeiro, R. Duval, et al. 2025. "Europe's Productivity Weakness: Firm-Level Roots and Remedies" IMF Working Paper No. 2025/040. Washington, DC: International Monetary Fund. https://doi.org/10.3386/w14060.

Banerjee, A., and E. Duflo. 2005. "Growth Theory through the Lens of Development Economics." In *Handbook of Economic Growth*, volume 1A, edited by P. Aghion and S. N. Durlauf, 473–552. Amsterdam, The Netherlands: Elsevier. https://doi.org/10.1016/S1574-0684(05)01007-5.

Banerjee, A., and K. Munshi. 2004. "How Efficiently Is Capital Allocated? Evidence from the Knitted Garment Industry in Tirupur." *Review of Economic Studies* 71 (1): 19–42. https://www.jstor.org/stable/3700709.

Bloom, N., L. Iacovone, M. Pereira-Lopez, and J. Van Reenen. 2022. "Management and Misallocation in Mexico." Working Paper 29717, National Bureau of Economic Research, Cambridge, MA.

Calligaris, S., F. Calvino, M. Reinhard, and R. Verlhac. 2023. "Is There a Trade-Off between Productivity and Employment? A Cross-Country Micro-to-Macro Study." OECD Science, Technology and Industry Policy Papers No. 157, Organisation for Economic Co-operation and Development, Paris. https://doi.org/10.1787/99bede51-en.

Caselli, F. 2016. "Accounting for Cross-Country Income Differences: Ten Years Later." Background paper for *World Development Report 2017: Governance and the Law.* World Bank, Washington, DC.

Cirera, X., and W. F. Maloney. 2017. *The Innovation Paradox: Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up.* Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1160-9.

Comtrade. 2024. *UN Comtrade Database.* New York: United Nations Statistics Division (accessed October 30, 2024), https://comtrade.un.org/.

Correa, P. G., A. P. Cusolito, and J. Pena. 2019. *Business Environment Distortions and Firm-Level Productivity: Global Evidence.* Washington, DC: World Bank.

Cusolito, A., and W. F. Maloney. 2018. *Productivity Revisited: Shifting Paradigms in Analysis and Policy.* Washington, DC: World Bank. http://hdl.handle.net/10986/30588.

Cusolito, A., C. Gévaudan, D. Lederman, and C. Wood. 2022. *The Upside of Digital for the Middle East and North Africa: How Digital Technology Adoption Can Accelerate Growth and Create Jobs.* Washington, DC: World Bank. http://hdl.handle.net/10986/37058.

Cusolito, A., R. Fattal-Jaef, D. Mare, and A. Singh. 2024. "The Role of Financial (Mis)allocation on Real (Mis)allocation: Firm-Level Evidence from European Countries." Policy Research Working Paper 10811, World Bank, Washington, DC. http://hdl.handle.net/10986/41744.

Cusolito, A., R. Fattal-Jaef, F. Patiño Peña, and A. Singh. 2024. "The Financial Premium and Real Cost of Bureaucrats in Businesses." Policy Research Working Paper 10929, World Bank, Washington, DC. http://hdl.handle.net/10986/42205.

Dall'Olio, A., T. Goodwin, M. Martinez Licetti, et al. 2022. "Are All State-Owned Enterprises Equal? A Taxonomy of Economic Activities to Assess SOE Presence in the Economy." Policy Research Working Paper 10262, World Bank, Washington, DC.

Decker, R., J. Haltiwanger, R. Jarmin, and J. Miranda. 2020. "Changing Business Dynamism and Productivity." *American Economic Review* 110 (12): 3952–90. https://www.jstor.org/stable/10.2307/26966485.

di Giovanni, J., M. García-Santana, P. Jeenas, E. Moral-Benito, and J. Pijoan-Mas. 2022. "Buy Big or Buy Small? Procurement Policies, Firms' Financing, and the Macroeconomy." FRB of New York Staff Report No. 1006. http://dx.doi.org/10.2139/ssrn.4047178.

Dollar, D., and S.-J. Wei. 2007. "Das (Wasted) Kapital: Firm Ownership and Investment Efficiency in China." Working Paper No. w13103, National Bureau of Economic Research, Cambridge, MA. https://ssrn.com/abstract=986953.

Ericson, R., and A. Pakes. 1995. "Markov-Perfect Industry Dynamics: A Framework for Empirical Work." *Review of Economic Studies* 62 (1): 53–82. https://doi.org/10.2307/2297841.

Eslava, M., J. Haltiwanger, and A. Pinzon. 2022. "Job Creation in Colombia Versus the USA: 'Up-or-Out Dynamics' Meet 'the Life Cycle of Plans.'" *Economica* 89: 511–39.

Fattal-Jaef, R. 2022. "Entry Barriers, Idiosyncratic Distortions, and the Firm Size Distribution." *American Economic Journal: Macroeconomics* 14 (2): 416–68. https://doi.org/10.1257/mac.20200234.

Fattal-Jaef, R. 2023. "On the Welfare Costs of Premature Deindustrialization." Policy Research Working Paper 10344. World Bank, Washington, DC. http://hdl.handle.net/10986/39519.

Fazekas, M., B. Tóth, A. Abdou, and A. Al-Shaibani. 2024. "Global Contract-Level Public Procurement Dataset" *Data in Brief* 54: 110412.

Fazekas, M., V. Poltoratskaya, M. Schiffbauer, and B. Tóth. 2025. "Procuring Low Growth: The Impact of Political Favoritism on Public Procurement and Firm Performance in Bulgaria." Policy Research Working Paper 11085, World Bank, Washington, DC. http://hdl.handle.net/10986/42949.

Feenstra, R. C., R. Inklaar, and M. P. Timmer. 2015. "The Next Generation of the Penn World Table" *American Economic Review* 105 (10): 3150–82. https://www.rug.nl/ggdc/productivity/pwt/.

Fernandes, A., and T. Reed. Forthcoming. *Industrial Policy for Development*. Washington, DC: World Bank.

Foster, L., J. Haltiwanger, and C. Syverson. 2008. "Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?" *American Economic Review* 98 (1): 394–425. https://www.jstor.org/stable/29729976.

Hopenhayn, H. 1992. "Entry, Exit, and Firm Dynamics in Long Run Equilibrium." *Econometrica* 60 (5): 1127–50. https://www.jstor.org/stable/2951541.

Hsieh, C., and P. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics* 124 (4): 1403–48. https://doi.org/10.1162/qjec.2009.124.4.1403.

Iacovone, L., I. Izvorski, C. Kostopoulos, et al. 2025. *Greater Heights: Growing to High Income in Europe and Central Asia*. Europe and Central Asia Studies. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-2206-3.

Iacovone, L., W. F. Maloney, and N. Tsivanidis, N. 2019. "Family Firms and Contractual Institutions." World Bank Policy Research Working Paper 8803. Washington, DC: World Bank. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/683401554304716994/family-firms-and-contractual-institutions.

Iacovone, L., W. Maloney, and D. McKenzie. 2022. "Improving Management with Individual and Group-Based Consulting: Results from a Randomized Experiment in Colombia." *Review of Economic Studies* 89 (1): 346–71. https://doi.org/10.1093/restud/rdab005.

Iacovone, L., R. Munoz Moreno, E. Olaberria, and M. Pereira Lopez. 2022. *Productivity Growth in Mexico: Understanding Main Dynamics and Key Drivers*. Washington, DC: World Bank. http://hdl.handle.net/10986/37190.

IMF (International Monetary Fund). 2023. *Fiscal Monitor: On the Path to Policy Normalization*. Washington, DC: International Monetary Fund.

Jovanovic, B. 1982. "Selection and the Evolution of Industry." *Econometrica* 50 (3): 649–70. https://doi.org/10.2307/1912606.

Juhász, R., N. Lane, E. Oehlsen, and V. Pérez. 2025. "Measuring Industrial Policy: A Text-Based Approach." http://dx.doi.org/10.2139/ssrn.5262841.

Juhász, R., N. Lane, and D. Rodrik. 2024. "The New Economics of Industrial Policy." *Annual Review of Economics* 16: 213–42.

Krugman, P. 1988. "Target Zones and Exchange Rate Dynamics." Working Paper 2481, National Bureau of Economic Research, Cambridge, MA. http://www.nber.org/papers/w2481.pdf.

Rajan, R. 2024. "Industrial Policy's Deceptive New Clothes." *Project Syndicate*, September 9, 2024. https://www.project-syndicate.org/commentary/industrial-policy-subsidies-tariffs-regulations-will-add-costs-harm-innovation-by-raghuram-g-rajan-2024-09.

Restuccia, D., and R. Rogerson. 2008. "Policy Distortions and Aggregate Productivity with Heterogeneous Establishments." *Review of Economic Dynamics* 11: 707–20. https://doi.org/10.1016/j.red.2008.05.002.

Restuccia, D., and R. Rogerson. 2017. "The Causes and Costs of Misallocation." *Journal of Economic Perspectives* 31 (3): 151–74.

Rodrik, D. 2009. "Industrial Policy: Don't Ask Why, Ask How." *Middle East Development Journal* 1 (1): 1–29.

Pakes, A., and R. Ericson. 1998. "Empirical Implications of Alternative Models of Firm Dynamics." *Journal of Economic Theory* 79: 1-45. http://dx.doi.org/10.1006/jeth.1997.2358.

Sposi, M., K. Yi, and J. Zhang. 2024. "Deindustrialization and Industry Polarization." Globalization Institute Working Paper 428, Federal Reserve Bank of Dallas, TX. http://dx.doi.org/10.24149/gwp428.

Wei, S., Z. Xie, and X. Zhang. 2017. "From 'Made in China' to 'Innovated in China': Necessity, Prospect, and Challenges." *Journal of Economic Perspectives* 31 (1): 49–70. https://doi.org/10.1257/jep.31.1.49.

World Bank. 2023. *The Markets and Competition Policy Assessment Toolkit.* Washington, DC: World Bank. http://hdl.handle.net/10986/42649.

World Bank. 2024a. *The Changing Wealth of Nations 2024: Revisiting the Measurement of Comprehensive Wealth.* Washington, DC: World Bank. http://documents.worldbank.org/curated/en/099100824155021548.

2

Integration Unfulfilled: The Untapped Productivity Potential of Trade and Foreign Direct Investment

Introduction

Greater integration with global markets has historically been a powerful catalyst for productivity growth. By expanding a firm's customer base and exposing the firm to international competition, trade can incentivize innovation and efficiency, while foreign direct investment (FDI) can bring new technologies and know-how. In addition, integration with the global economy through greater competition and market size leads to a shift of resources across sectors and firms to more productive ones (Harrison and Rodríguez-Clare 2010; Syverson 2011). For Europe and Central Asia (ECA), a region of many small and medium-sized economies, tapping into global markets is crucial. Domestic markets are often too small to drive the scale of innovation and productivity gains needed for sustained growth. However, the productivity boost from trade and FDI depends on domestic policy and institutions. An enabling business environment, skilled labor, and good governance amplify positive effects (Freund and Bolaky 2008; Teignier 2018). Despite recent geopolitical and protectionist challenges, the fundamental link between openness and productivity remains an important one.



Online annexes for this report are available at https://hdl.handle.net/10986/43788.

Trade and FDI enhance productivity through the four intertwined pathways defined in chapter 1. First, structural transformation shifts resources to higher-productivity sectors based on comparative advantage (Harrison and Rodríguez-Clare 2010). Second, within-sector reallocation moves market share to more efficient producers through competitive pressure, allowing productive firms to expand while inefficient ones shrink—the "selection effect" (Melitz 2003; Melitz and Ottaviano 2008), which is a driver of aggregate productivity gains (Fernandes 2007; Pavcnik 2002). Third, creative destruction accelerates firm turnover as new, more productive entrants replace less competitive incumbents (Foster, Haltiwanger, and Krizan 2001) and trade and FDI liberalization force inefficient firms to improve or exit (Bloom, Draca, and Van Reenen 2016; Javorcik 2004). Fourth, incumbent firm upgrading occurs through "learning by exporting" (De Loecker 2007) and "learning by importing" (Amiti and Konings 2007; Goldberg et al. 2010; Halpern, Koren, and Szeidl 2015), where firms gain access to new technologies, better inputs, and larger markets that justify productivity-enhancing investments (Acemoglu and Linn 2004). Empirical evidence supports the relevance of these upgrading effects across various countries and mechanisms. However, these benefits are not automatic and often require complementary firm investments and well-functioning local markets. This can lead to productivity dispersion across firms, but aggregate productivity could still rise as leading firms advance.

This chapter presents four key findings that emphasize that ECA countries are currently missing productivity-enhancing integration opportunities. First, the region exhibits "missing trade," with misaligned patterns as exports remain insufficiently diversified and tilted toward lower-complexity products and nearer markets rather than dynamic global markets. Second, exceptional exporters represent a narrow engine of growth, as the few ECA firms that export are far more productive than others and drive regional improvements, yet their success has not broadened the exporting base. Third, evolving FDI patterns have shown declining inflows and fewer new (greenfield) investments over the past decade, with reinvested earnings now constituting a larger share, although geopolitical shifts present nearshoring opportunities. Fourth, FDI spillovers remain conditional on absorptive capacity and the business environment. Countries with strong skills, competitive markets, and multinational-local linkages see greater benefits, while weak fundamentals leave FDI potential untapped.

Trade Integration, Untapped Opportunities, and Productivity

Missing trade, or the shortfall of an ECA country's exports relative to the expected level of exports for a typical upper-middle-income economy, is

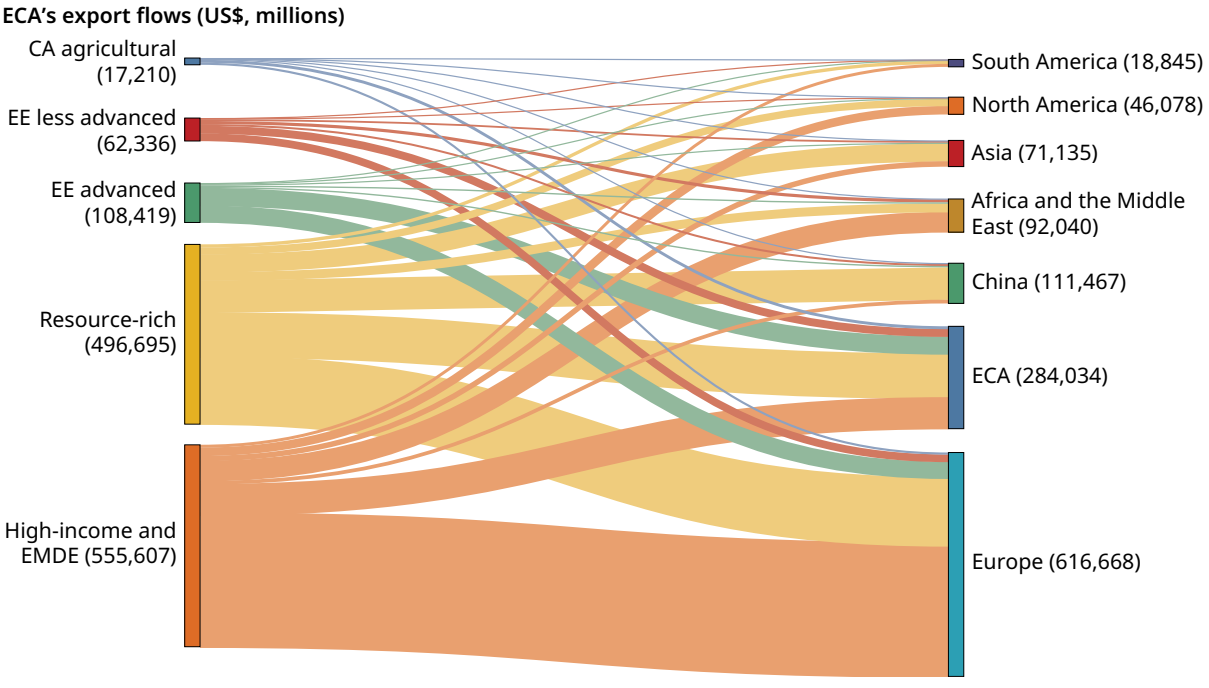
pervasive in ECA and linked to the challenges of firm integration into the global economy. As in many countries, exporters in ECA represent a small, high-performing segment of all firms. They contribute disproportionately to value added, employment, salaries, and fixed assets and are key drivers of growth. However, in many ECA countries (particularly in lower-income countries), exporters constitute a below-median share of firms compared to EU countries, indicating missed growth opportunities through trade. Low survival rates rather than product life cycles, with older products giving way to newer ones, result in significant churning among ECA exporters and their products (especially in products with comparative disadvantage and exports to non–Organisation for Economic Co-operation and Development [OECD] destinations). Consequently, export growth in ECA countries is driven predominantly by incumbent exporters expanding their existing product lines and penetrating existing destinations, with new products and destinations contributing only in a limited way.

The lack of growth in new exporters, new products, and new destinations suggests that the pathways from trade to development are underexploited. All four pathways seem to be too narrow, reflecting untapped potential for growth-promoting, trade-induced structural transformation, within-sector reallocation, creative destruction, and incumbent firm upgrading. All the pathways are actionable, however, and should be widened, as discussed at the end of the chapter.

Trade patterns in ECA

Export patterns differ substantially across ECA country groups.[1] Over 2018–22, average annual goods exports from ECA countries totaled $1.2 trillion (figure 2.1). The most important destinations were Europe (absorbing about 50 percent of ECA's exports), followed by ECA countries (23 percent) and China (9 percent). The top export origins in ECA were high-income countries (45 percent), resource–rich countries (40 percent), and advanced countries in Eastern Europe (9 percent). Manufactured goods dominated exports from the following groups in ECA: high-income and emerging markets and developing economies (EMDE) countries (89 percent of exports were manufactured goods), Eastern Europe advanced countries (80 percent), and Central Asia agricultural countries (77 percent), with considerably smaller shares among Eastern Europe less advanced countries (55 percent) and resource-rich countries (33 percent) (figure 2.2).

FIGURE 2.1 Europe is the leading export destination for much of ECA, 2018–22



Source: Estimates based on data from Comtrade 2024.

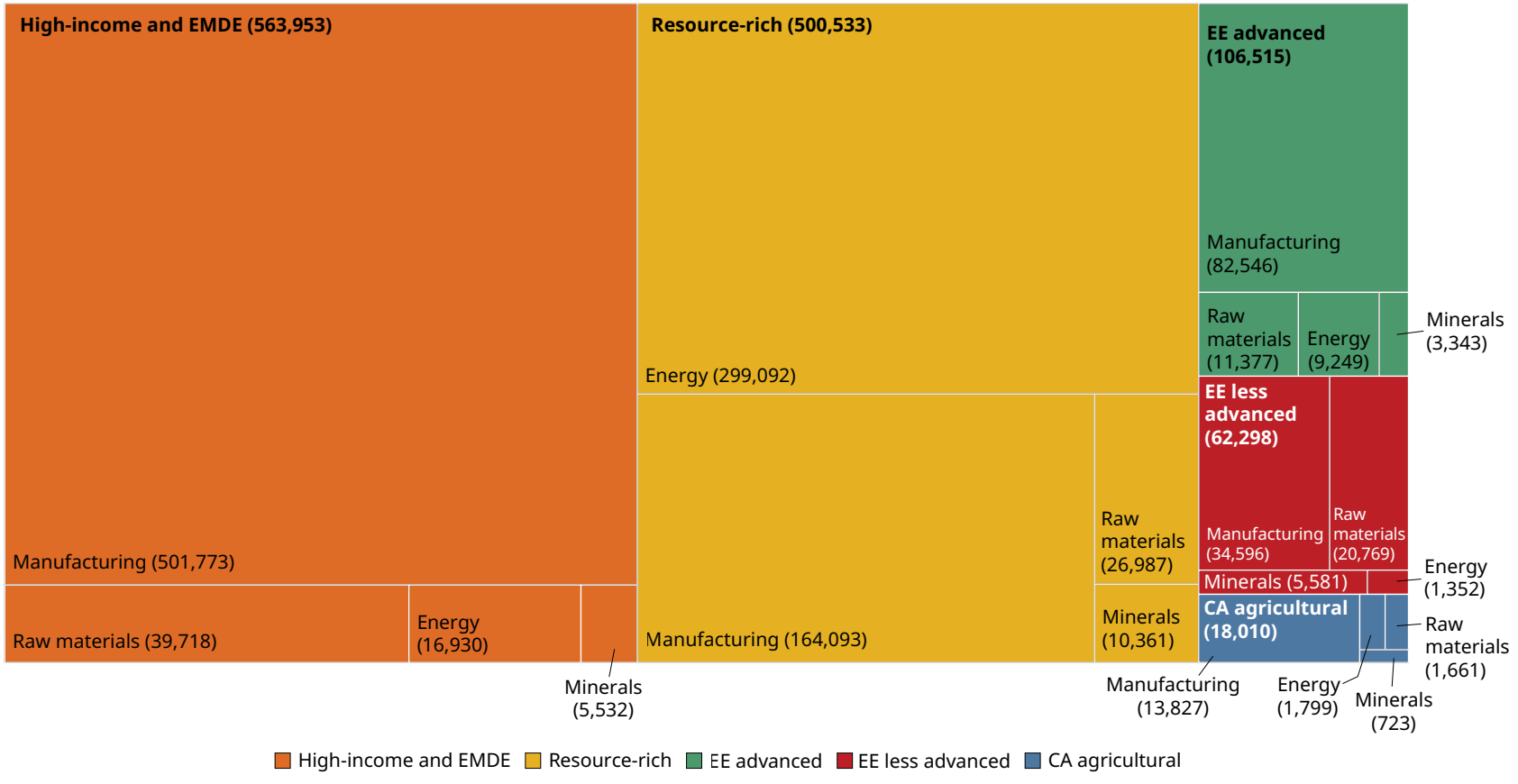
Note: CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; high-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; and resource-rich comprises Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan. CA = Central Asia; ECA = Europe and Central Asia; EMDE = emerging markets and developing economies.

Exports have been expanding but with substantial differences across ECA country groups. With declining exports since 2010, resource–rich countries and, even more so, Eastern Europe less advanced countries have lagged high-income and EMDE, Eastern Europe advanced, and Central Asian agricultural ECA countries (figure 2.3).

There are also large differences in export growth across destinations. Although ECA exports to all destinations have grown, growth has been strongest to China (including Hong Kong SAR and Taiwan), and Latin America (figure 2.4). Exports to Asia and Oceania grew just as fast until 2010 but then flatlined, so that end-period growth was comparable to that for Africa and the Middle East. Exports grew more slowly to the European Union, the United Kingdom, and Switzerland, and the United States and Canada.

FIGURE 2.2 **The composition of exports differs across country groups in ECA, 2018–22**

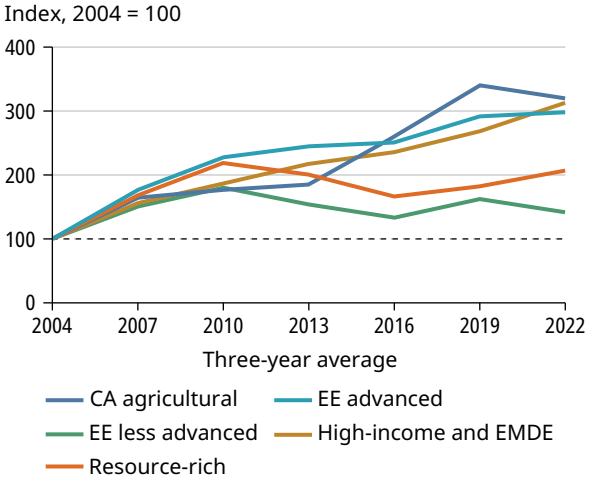
ECA's exports (US$, millions)



Source: Estimates based on data from Comtrade 2024.

Note: CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; high-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; and resource–rich comprises Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan). CA = Central Asia; ECA = Europe and Central Asia; EE = Eastern Europe; EMDE = emerging market and developing economies.

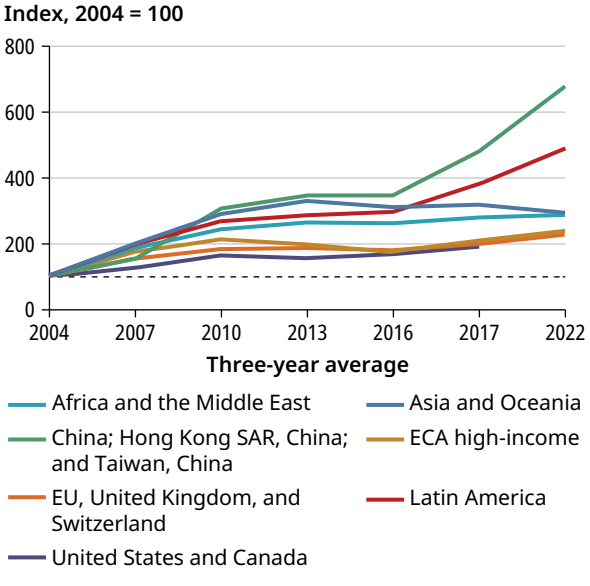
FIGURE 2.3 Exports have grown in ECA—but not for all country groups, 2004–22



Source: Estimates based on data from Comtrade 2024.

Note: CA agricultural comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan; EE advanced comprises Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Montenegro, North Macedonia, and Serbia; EE less advanced comprises Albania, Armenia, Moldova, and Ukraine; high-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; and resource-rich comprises Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan. CA = Central Asia; EE = Eastern Europe; EMDE= emerging markets and developing economies.

FIGURE 2.4 The total value of ECA's exports to all trading partners has increased, 2004–22



Source: Estimates based on data from Comtrade 2024.

Note: ECA = Europe and Central Asia; EU = European Union.

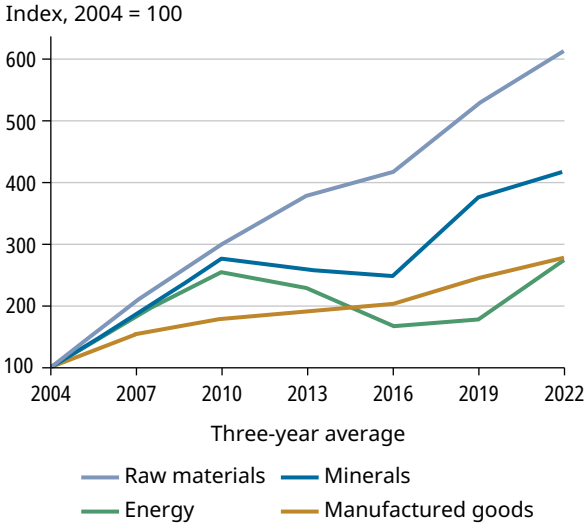
ECA's exports have grown in all sectors, but unevenly. Export growth has been much stronger in raw materials and minerals than in energy and manufacturing (figure 2.5). Export growth has thus been concentrated in industries with more limited scope for productivity gains along the four pathways that connect trade and FDI to productivity.

Since 2004, exports have grown across the board but relatively less for destinations and sectors with higher productivity–enhancing potential. Export growth has been stronger among high-income and EMDE and Eastern Europe advanced countries. Central Asia's export growth has been dominated by lower-income destinations such as China and Latin America, especially in raw materials and energy. Export growth has not been as strong for other destinations and sectors with higher potential productivity gains from structural transformation, within-sector reallocation, creative destruction, and incumbent firm upgrading (the four pathways).

Missing trade, missed opportunities

Despite increased trade, opportunities to expand exports remain largely unexploited in ECA countries. These missed opportunities can be measured in terms of "missing trade." Missing trade was estimated using a gravity model (refer to online annex 2B for details of the model). The ratio of missing trade to actual trade reveals how much more a country would be exporting if it were a typical upper-middle-income country. The larger the ratio, the larger the country's untapped export potential.

FIGURE 2.5 Exports have increased more in sectors with limited productivity growth potential, 2004–22

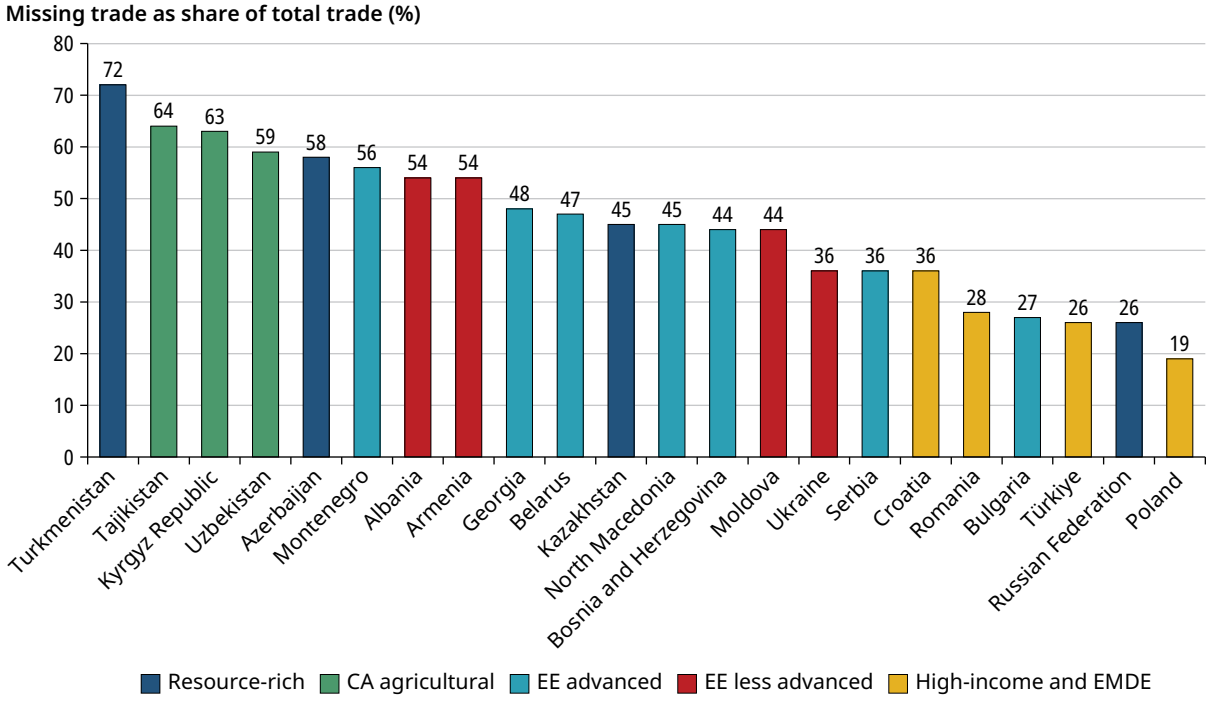


Source: Estimates based on data from Comtrade 2024.

Missing trade is large and pervasive across ECA countries, especially in resource-rich and Central Asian agricultural economies (figure 2.6). Its share of total trade ranges from 19 percent for Poland to 72 percent for Turkmenistan. Accordingly, if these two countries were typical upper-middle-income countries, Poland would export 19 percent more and Turkmenistan would export 72 percent more.

Logistics and trade policies are the main reasons for missing trade. Countries that have a higher Logistics Performance Index (figure 2.7) and that are more open (figure 2.8) tend to have less missing trade. There is no clear relationship between the size of the economy and the percentage of missing trade after controlling for total tradeflow.

FIGURE 2.6 Missing trade is pervasive among countries in ECA, 2000–22



Source: Estimates based on data from Comtrade 2024.

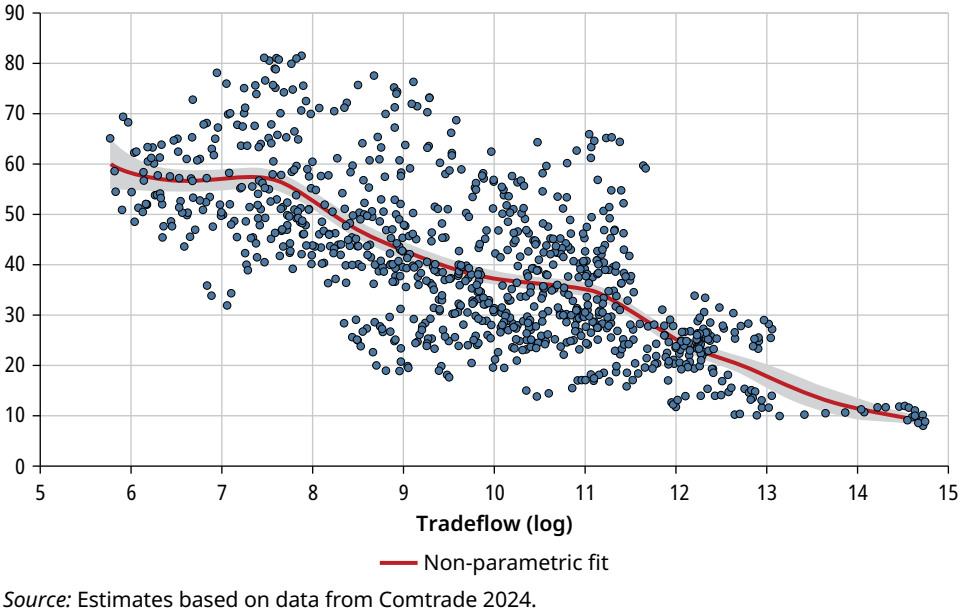
Note: The estimates are from the gravity model described in online annex 2B, available at https://hdl.handle.net/10986/43788. CA = Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies.

FIGURE 2.7 Poor logistics are linked to higher missing trade across all world countries, 2000–22



Sources: Estimates based on data from Comtrade 2024; the World Bank Logistics Performance Index (https://lpi.worldbank.org/).
Note: The estimates are from the gravity model described in online annex 2B, available at https://hdl.handle.net/10986/43788. The model controls for gross domestic product per capita and remoteness index based on Wei (1996).

FIGURE 2.8 More-open countries tend to have less missing trade across all countries, 2000–22



Source: Estimates based on data from Comtrade 2024.
Note: The estimates are from the gravity model described in online annex 2B, available at https://hdl.handle.net/10986/43788. The model controls for gross domestic product.

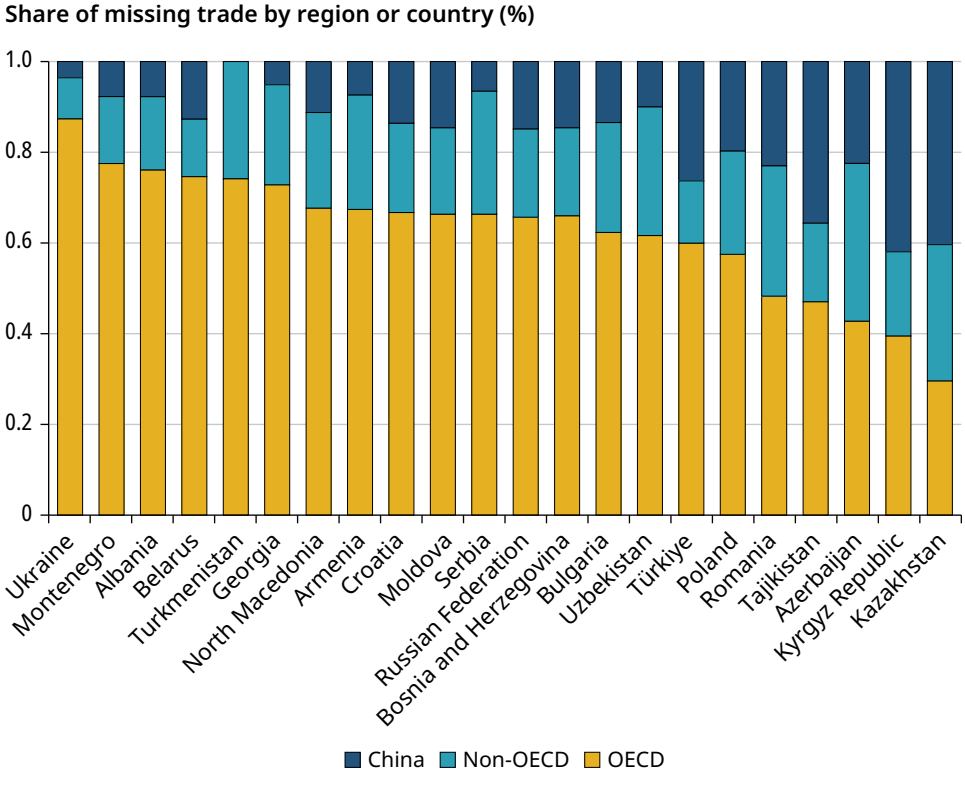
The forgone growth opportunities arising from missing trade are likely to be especially high for ECA countries. Most of ECA's missing trade is with OECD countries and China (figure 2.9). Further, a large share of ECA's missing trade is in manufactured goods (figure 2.10), the largest sector for all ECA country groups except resource-rich economies. The potential productivity gains associated with the four pathways are higher for trade in manufactured goods with advanced countries than for trade in other sectors and with less advanced partners.

Missing exporters

The substantial size of missing trade in ECA countries reflects the challenges firms face in integrating into the global economy. ECA's exporting firms share several features with their peers in other countries.

First, exporters fare better than other firms along a wide range of performance measures (figure 2.11). Exporters have higher values of sales per worker, value added per worker, total factor productivity (TFP), employment, capital per worker, investment, wage bill, average wage, and energy efficiency.

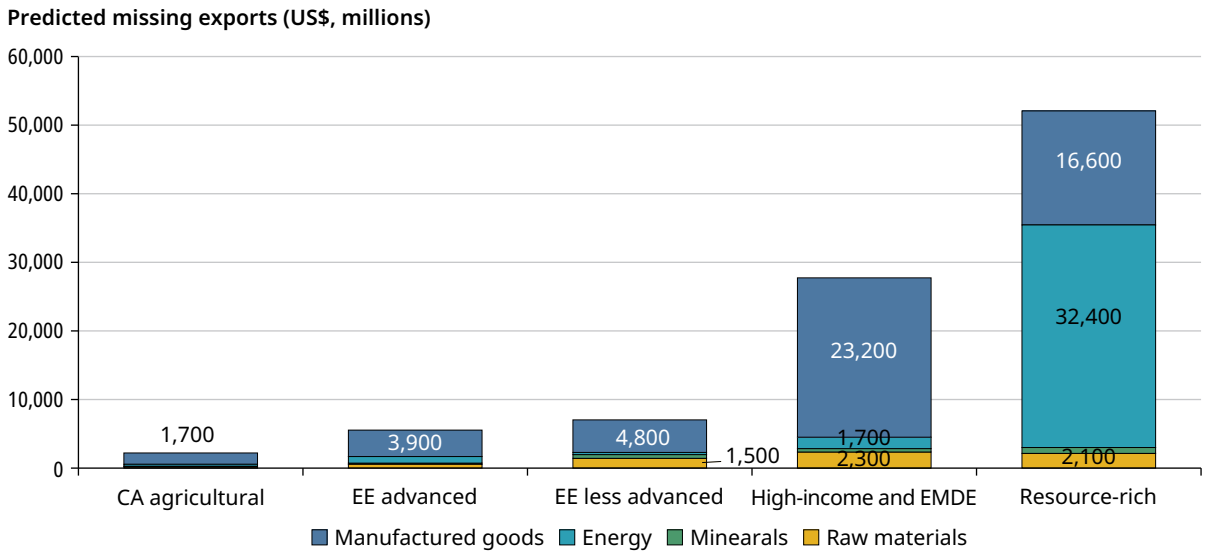
FIGURE 2.9 Most of the missing trade in countries in ECA is with high-income countries and China, 2020–22 average



Source: Estimates based on data from Comtrade 2024.

Note: The estimates are from the gravity model described in online annex 2B, available at https://hdl.handle.net/10986/43788. OECD = Organisation for Economic Co-operation and Development.

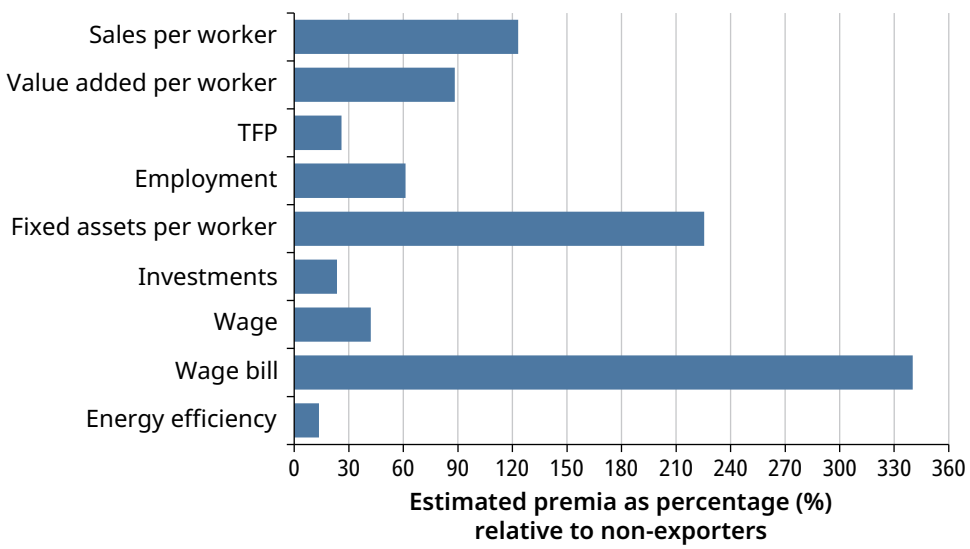
FIGURE 2.10 A large share of the missing trade in countries in ECA is in manufactured goods, 2020–22 average



Source: Estimates based on data from Comtrade 2024.

Note: The estimates are from the gravity model described in online annex 2B, available at https://hdl.handle.net/10986/43788. CA = Central Asia; EE = Eastern Europe; EMDE = emerging markets and developing economies.

FIGURE 2.11 Exporters outperform other firms in ECA along a wide range of performance measures (latest year available)



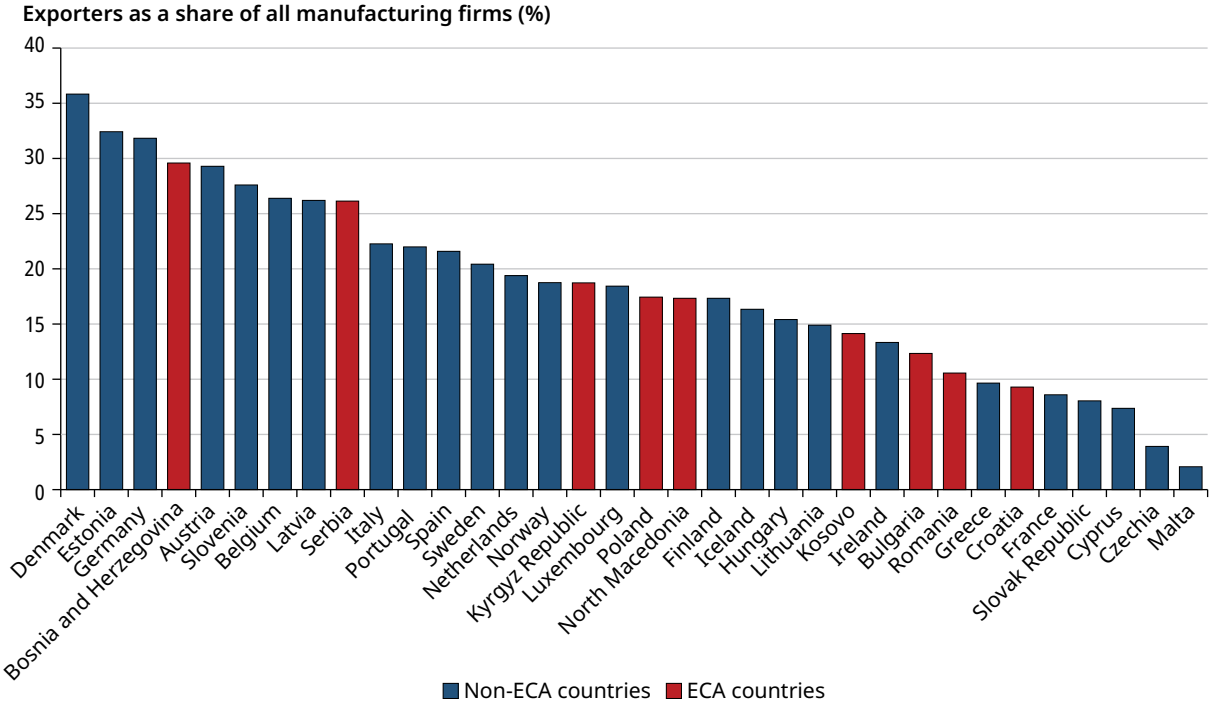
Sources: Estimates based on firm-level data from national statistical offices; Orbis.

Note: The figure shows the results of regressing each variable (in logs) on a dummy variable for exporters, with exporters assigned a value of 1 and non-exporters a value of 0. The regression includes controls for sector fixed effects at the Nomenclature of Territorial Units for Statistics level-2 equivalent, country fixed effects, and year fixed effects. ECA = Europe and Central Asia; TFP = total factor productivity; VA = value added.

Second, exporters constitute only a small share of all firms. Many ECA countries (especially the lower-income countries) have a below-median share of exporters compared to the most advanced countries, such as those in the European Union (figure 2.12).

Third, ECA exporters contribute a disproportionately high share of their countries' value added, employment, salaries, and fixed assets, considering their small representation among manufacturing firms (figure 2.13). Crucially, they have also been the main drivers of growth in these performance measures, especially in more advanced ECA economies (figure 2.14).

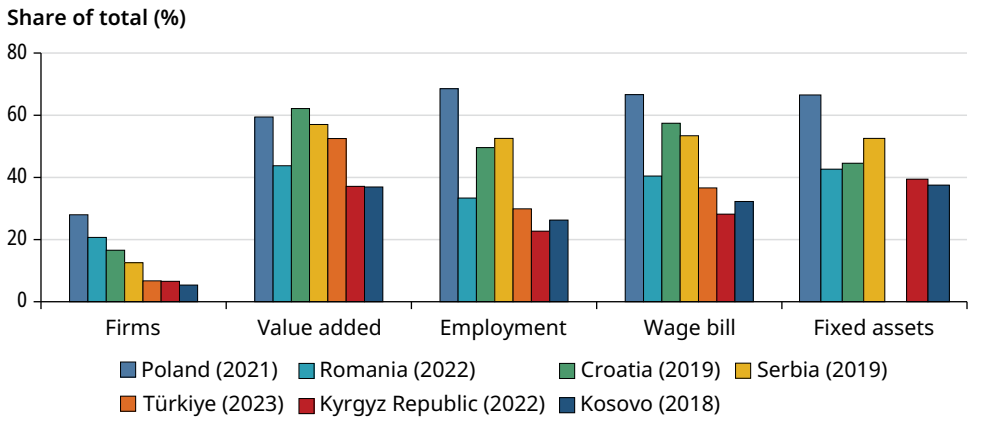
FIGURE 2.12 In many countries in ECA, manufacturing exporters are a small share of total manufacturing firms (latest data available)



Sources: Estimates based on firm-level data from national statistical offices; Orbis.

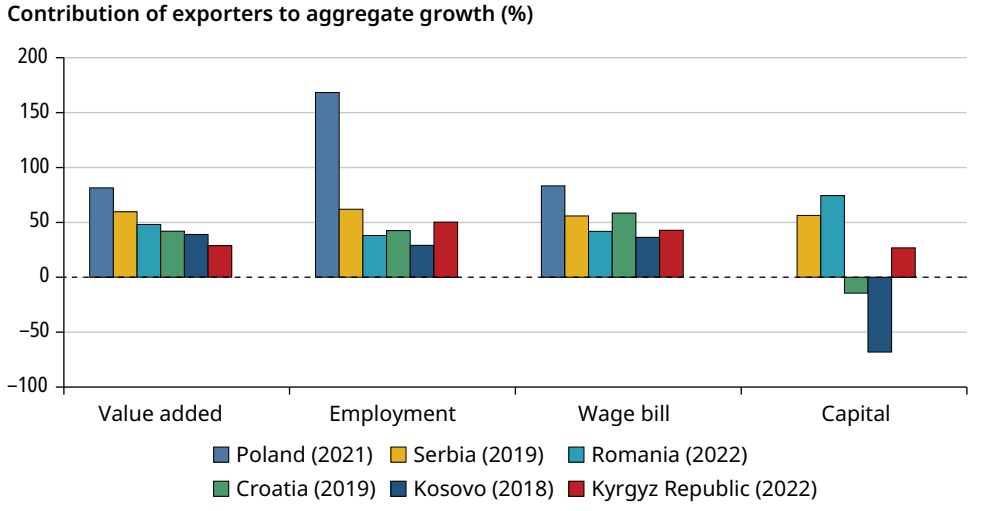
Note: ECA = Europe and Central Asia.

FIGURE 2.13 Exporters in countries in ECA contribute disproportionately to key economic indicators (latest year available)



Sources: Estimates based on firm-level data from national statistical offices; Orbis.

FIGURE 2.14 Exporters are drivers of growth in the more advanced countries in ECA (latest year available)

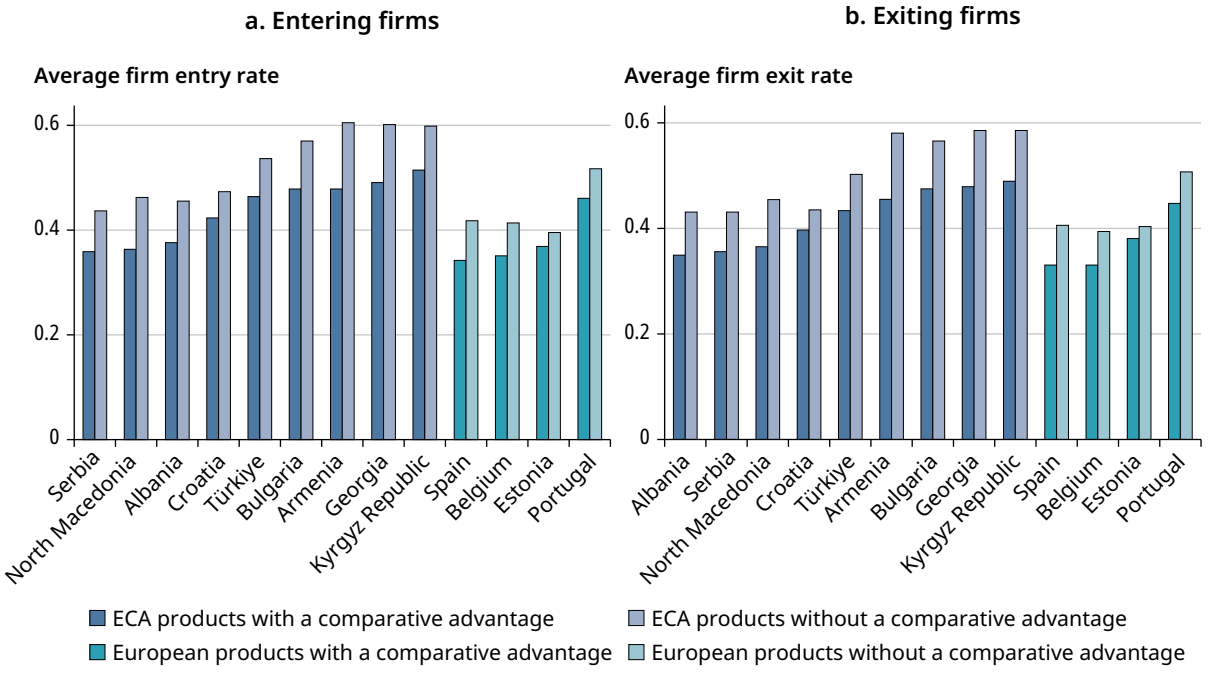


Sources: Estimates based on firm-level data from national statistical offices; Orbis.

That many ECA countries have a below-median share of exporters compared to EU countries implies that ECA countries rely on an underpowered engine of economic performance and productivity growth. Missing trade is thus associated with missing exporters, and this in turn implies lost opportunities for ECA countries' development.

Firm dynamics shed light on the patterns behind this phenomenon. In ECA countries, there is a lot of churning at the firm, product, and destination levels, meaning that it is hard for exporters to become established (figure 2.15). About 30 to 50 percent of firms enter exporting each year, but a similar share of firms leave. Among exporters, more than 30 percent of products are new every year, and again a similar share of products are dropped. Churning rates are much higher for products in which countries have a comparative disadvantage and for exports to non-OECD destination markets.

FIGURE 2.15 There is frequent entry and exit of export products and firms in countries in ECA, compared to countries in Europe (average over the three most recent years)



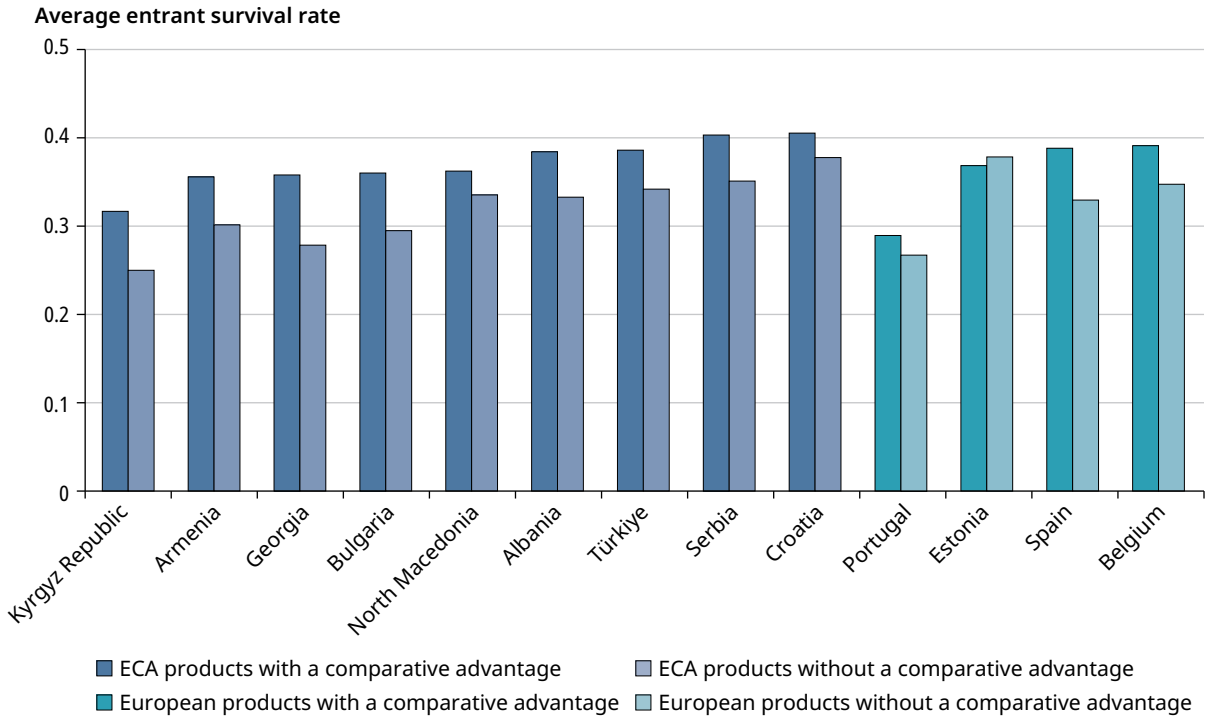
Source: Estimates based on data from the Export Dynamics Database (Fernandes, Freund, and Pierola 2016).

Note: Firm entry and exit rates are calculated as the number of new exporters or exiting exporters at a given Harmonized System (HS) 2-digit level divided by the total number of exporters at the same HS 2-digit level. Averages are calculated across HS 2-digit levels for firms with and without a comparative advantage. ECA = Europe and Central Asia.

ECA exporters' high churning rates reflect low firm survival rather than a product life cycle in which older products give ground to newer ones. Less than half of exported products survive beyond the first year (figure 2.16). Survival rates are even lower for products without a comparative advantage. New exported products constitute a small, although not insignificant, share of total exports of around 20 percent on average, but their share is smaller in sectors without a comparative advantage.

The expansion of established products and destinations, rather than the addition of new products and destinations, is what determines incumbent exporters' growth (figure 2.17). Among the several margins along which exports can grow—number of firms, number of products, number of destinations, and sales per firm/product/destination—only the last margin appears to be active.

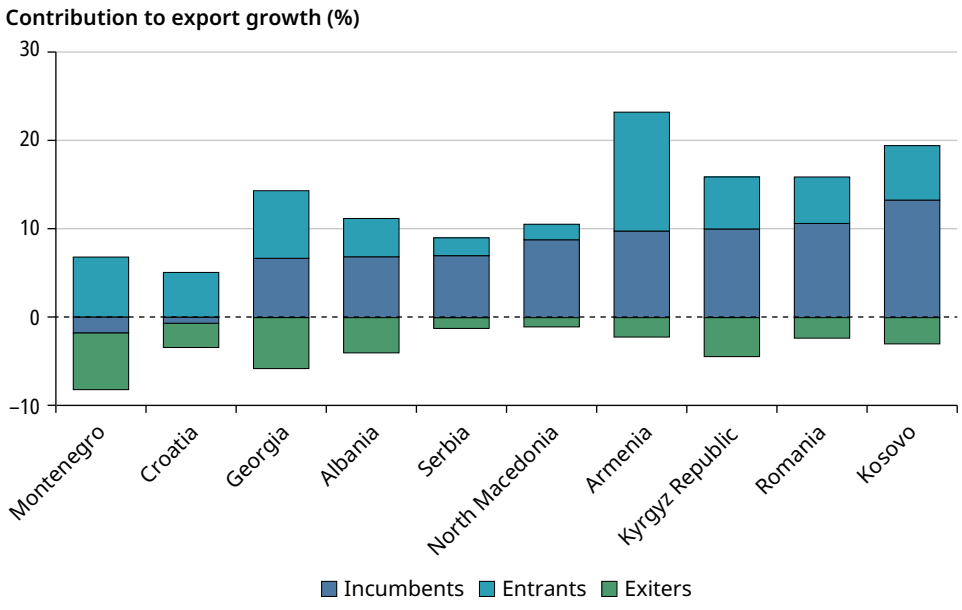
FIGURE 2.16 Exported products have low survival rates in countries in ECA, compared to countries in Europe (average over the three most recent years)



Source: Estimates based on data from the Export Dynamics Database (Fernandes, Freund, and Pierola 2016).

Note: Product survival is calculated as the number of new exporters at a given Harmonized System (HS) 2-digit level divided by the total number of exporters at the same HS 2-digit level each year. New exporters that survive are firms that do not export at a given HS 2-digit level in year t-1 but do export in years t and t+1. Averages are calculated across HS 2-digit levels for firms with and without a comparative advantage. ECA = Europe and Central Asia.

FIGURE 2.17 Incumbent exporters play a crucial role in export growth in countries in ECA (five-year average, most recent data)



Source: Estimates based on data from the Export Dynamics Database (Fernandes, Freund, and Pierola 2016).

Note: The data are five-year averages from year-to-year export growth decomposition.

Foreign Direct Investment Patterns, Untapped Opportunities, and Productivity

Declining investment inflows, reinvestment, and the promise of nearshoring

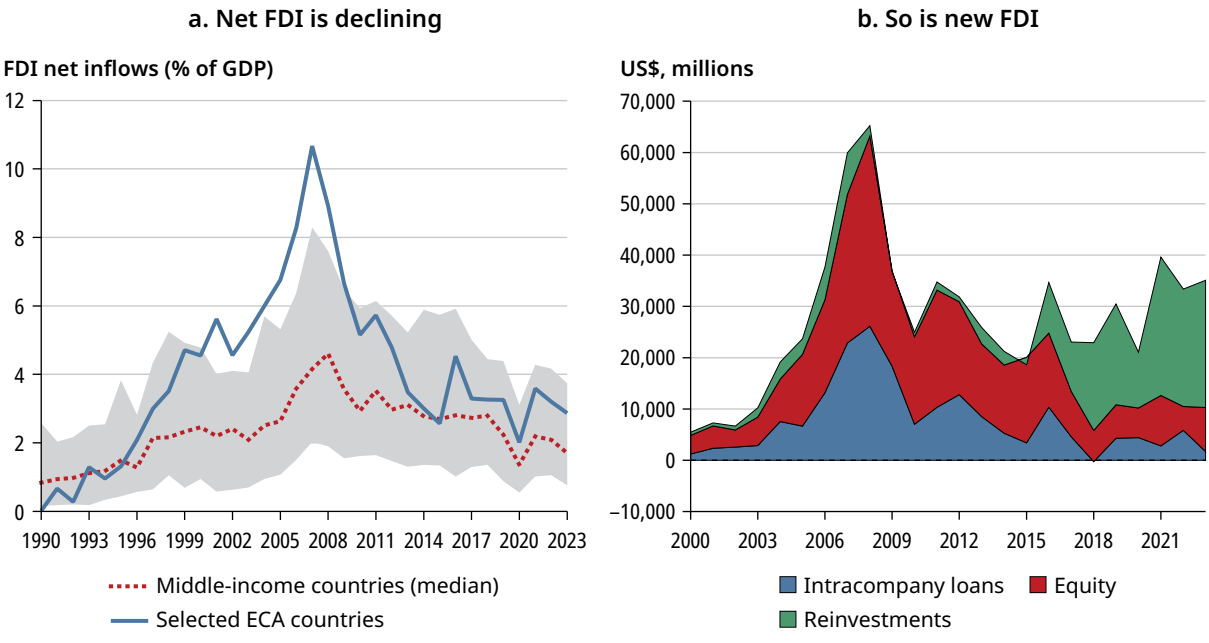
In recent years, FDI inflows in the ECA region have declined as a share of gross domestic product and have increasingly been driven by reinvestments, while equity FDI has declined since its 2015 peak. FDI has been a key part of ECA countries' integration into the global economy since their transition to market economies and opening to international trade in the 1990s and 2000s. In many ECA countries, FDI brought much-needed capital, technology, and access to international networks, contributing to productivity leaps in sectors ranging from banking to vehicle manufacturing. However, the nature and volume of FDI have been changing. A prominent trend has been the dwindling of new FDI inflows since their peak in 2007. Net FDI inflows into ECA have declined steadily, falling well below their levels two decades ago (figure 2.18, panel a). By the end of the 2010s, several ECA economies were receiving negligible new FDI inflows (and some experienced net outflows) as foreign investors pulled back.

Both global factors and regional trends have contributed to the retreat of FDI. On the global side, slower growth in advanced economies after the global financial crisis of

2008–09, waves of uncertainty (created by trade tensions, Brexit, and the COVID-19 pandemic), and rising interest rates have dampened the appeal of cross-border investment (World Bank and IFC 2023). FDI flows worldwide as a share of gross domestic product have not recovered to their mid-2000s peaks, and investors have become more cautious. Within the region, equity-based investment has shrunk relative to other modes of FDI over the past two decades. In addition, new investment projects (building new facilities or acquiring existing factories) have constituted a smaller share of total FDI, while the share of reinvested earnings has grown. In ECA countries, reinvested profits by existing foreign-owned firms are now a critical source of investment (figure 2.18, panel b). This shift away from new investment projects limits the infusion of new capital and capabilities into the region.

FDI from outside the region has diminished. In the early 2010s, many ECA countries were hoping for a surge of Chinese investment (as part of the Belt and Road Initiative, for example), but by the late 2010s, China's appetite for such investments had cooled. Chinese FDI inflows to ECA fell by 38 percent between 2013 and 2023, as China shifted its global outward investment pattern and some planned investments did not materialize. ECA countries could not adequately diversify their FDI sources to replace lost Chinese investment, and FDI between ECA countries also stagnated.

FIGURE 2.18 FDI is dwindling and new FDI is shrinking in importance in ECA, 2000–22



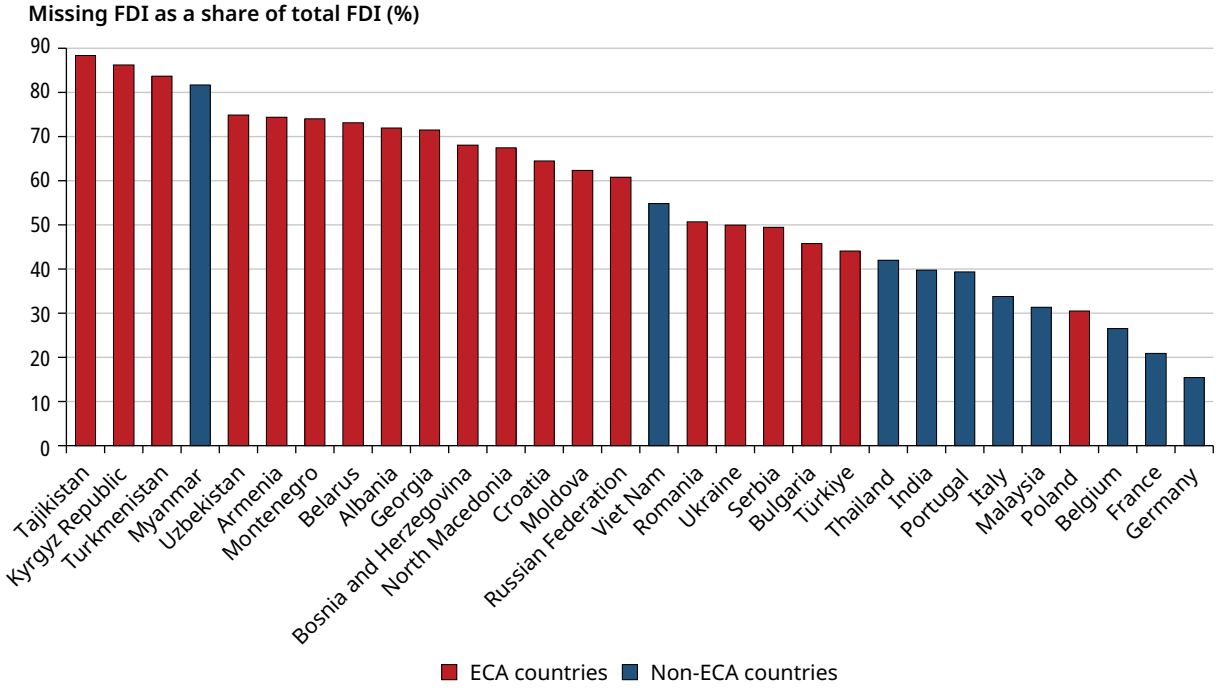
Sources: Estimates based on data from UN Trade and Development; International Monetary Fund.

Note: FDI net inflow is the value of inward direct investments made by nonresident investors in the reporting economy, including reinvested earnings and intracompany loans, net of repatriation of capital and repayment of loans. FDI stock is the value of capital and reserves attributable to a nonresident parent enterprise. The shaded part of panel a is the interquartile range for all countries included in the UN Trade and Development data sets. ECA countries in the sample include Bulgaria, Croatia, Georgia, Kazakhstan, Kosovo, Kyrgyz Republic, Moldova, North Macedonia, Serbia, and Ukraine. ECA = Europe and Central Asia; FDI = foreign direct investment; GDP = gross domestic product.

There is evidence of "missing" FDI inflows in some ECA countries. Gravity model analysis found that many ECA countries, especially those in the eastern part of the region, attract far less FDI than their economic fundamentals would predict (figure 2.19). For the Kyrgyz Republic and Tajikistan, for example, attracting this missing FDI could increase investment by as much as 80 percent, equivalent to between $1.5 billion to $2 billion. Levels of missing FDI are strongly correlated with levels of missing trade, suggesting that common barriers related to the business environment, logistics, and policy restrictiveness are impeding both forms of integration (refer to figure 2A.1 in online annex 2A). Countries with more-restrictive trade and investment policies (as captured by the trade and investment Freedom Index[2]) tend to have higher levels of missing FDI (refer to figure 2A.2 and 2A.3 in online annex 2A).

Since 2010, the establishment of new business operations in ECA countries—the dominant model in the past—has declined sharply, while mergers and acquisitions have risen in popularity (refer to figure 2A.8, panel a, in online annex 2A). The sectoral composition of FDI is also shifting toward services, mirroring global trends (refer to figure 2A.8, panel b, in online annex 2A).

FIGURE 2.19 Countries in ECA show higher levels of missing FDI opportunities, compared to other countries, 2023



Source: Estimates based on International Monetary Fund.

Note: FDI = foreign direct investment.

More recently, the pandemic and geopolitical fragmentation have prompted multinational companies to relocate production closer to end markets ("nearshoring") or to countries with shared strategic interests ("friendshoring").[3] Companies are reconsidering their supply chains and production locations, prioritizing resilience and political alignment in addition to cost efficiency. With its proximity to Western Europe and generally friendly ties with the European Union and the United States, ECA stands to benefit from these shifts in certain sectors. There are early signs that multinational firms are exploring or undertaking moves to set up or expand operations in ECA countries as alternatives to more distant or riskier locations (refer to figure 2A.4 in online annex 2A).

Some ECA countries (particularly EU members or close EU partners) could see a new wave of FDI inflows in the coming years, even as other countries (especially the Russian Federation) experience divestment. For example, manufacturing companies that are concerned about overreliance on East Asia consider Eastern and Central European countries as potential sites for factories serving the European market. Likewise, services and information technology companies are considering places like the Baltics or the Balkans for back-office or development centers, instead of more-remote locations, to take advantage of closer time zones and a stable environment. This creates a mixed picture for FDI: fragmentation hurts overall efficiency but realigns FDI in favor of politically stable and allied economies—a group that includes much of ECA outside Russia.

Increasing automation over the past decade has changed the cost dynamics of foreign investments. Automation can lower labor costs at home, reducing efficiency-seeking FDI outflows to developing countries. Instead of replacing FDI in Western Europe and, to a lesser degree, in Eastern Europe and Central Asia, investments in robotics at the source have been linked to increased FDI outflows, reflecting an increasing number of projects and greater capital intensity. However, these projects are creating fewer jobs, meaning that investments in robotics at the source do not necessarily lead to job creation abroad. The influence of automation on FDI outflows also depends on the business environment in the destination: countries with more-open investment and trade policies see a significant rise in FDI projects.

These evolving FDI patterns have differing implications for productivity in ECA. Declining FDI inflows are concerning since new foreign investments have historically been a vehicle for productivity convergence. Each new foreign project can introduce advanced technology, superior management, and competitive pressures that force local firms to improve (Braconier, Ekholm, and Knarvik 2001; Branstetter 2006; Crespo and Fontoura 2007; Farole and Winkler 2014). The lull in fresh FDI may slow the rate of innovation in ECA economies. Further, if current foreign investors are simply maintaining operations through reinvestment but not expanding significantly, the transformative impact of FDI could diminish. Mergers and acquisitions often involve adopting existing local technologies with gradual upgrades. The sectoral composition of FDI can also affect productivity gains. Services can generate high-value activities, but they typically offer

significantly more limited productivity spillovers than manufacturing, due to weaker linkages with local input suppliers and lower tradability.[4]

Although these shifts in FDI entry mode and sectoral composition are concerning, the nearshoring trend offers a chance to revitalize FDI's contribution to productivity. If ECA countries capture more nearshoring opportunities, that could bring in investment in higher-value manufacturing and services. These investments might come with cutting-edge technologies and can be oriented toward exporting to high-demand markets such as the European Union, integrating ECA firms into quality-sensitive value chains. To capitalize on these opportunities, ECA countries will need to address the factors that caused FDI to wane: the difficult business climate, political instability, and regulatory uncertainty. Simplifying investment procedures, protecting investor rights, and ensuring macroeconomic stability can attract investors looking for new production bases.

FDI in ECA is at a crossroads. The free flow of capital that characterized the 2000s has given way to a more cautious environment with fewer new players but potentially new directions (such as nearshoring). ECA countries need to reverse the downward trend in net FDI inflows that has affected nearly all of them. With the right policies, ECA countries could become beneficiaries of the reconfiguration of global investment flows. The next subsection discusses how ECA can best absorb the FDI it attracts (or retains), focusing on the conditional nature of FDI spillovers.

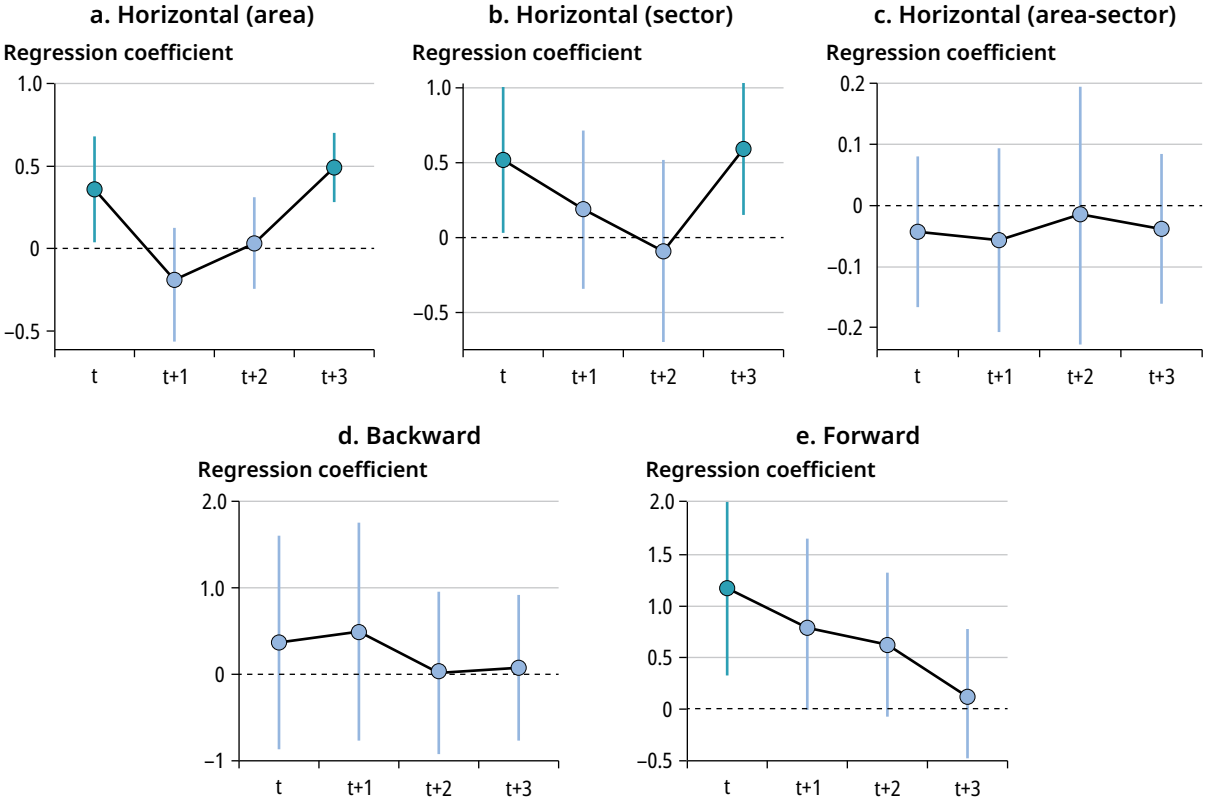
Elusive spillover effects of foreign investment and the importance of the domestic environment and absorptive capacity

Foreign investments can boost productivity directly and indirectly. Foreign-owned firms are often the most productive (because they bring superior technology or processes), pay higher wages, and can boost aggregate productivity through their own performance (Arnold and Javorcik 2009). As a result, they contribute directly to aggregate productivity. Beyond these direct effects, the broader promise of FDI is its ability to raise domestic firms' productivity through increased competition (Caves 1974), demonstration effects (Hamida and Gugler 2009), and linkages between firms that facilitate technology transfer or spillovers (Javorcik 2004).

In ECA, foreign companies consistently demonstrate higher productivity levels than domestic firms and tend to achieve faster productivity growth over time. This superior performance reflects their role as carriers of advanced technologies, innovative processes, and better management practices (refer to figure 2A.9 in online annex 2A). Because the foreign firms operate at a higher-productivity frontier, they have greater potential to generate positive spillovers by creating opportunities for knowledge and technology transfer to local firms. This dynamic positions foreign companies as crucial catalysts for broader productivity improvements in the host economy.

Firm-level analysis across ECA revealed that sustained productivity spillovers from FDI are not guaranteed.[5] Although FDI has the potential to boost the performance of domestic firms, whether these benefits materialize depends on specific conditions. A central finding of this report is that, on average, the presence of foreign firms does not lead to significant productivity gains for domestic firms in the region, at least for those in the supplying sectors (figure 2.20).[6] Some downstream sectors may have experienced an initial boost in productivity as they gained access to better inputs, logistics, or service providers linked to foreign firms. This would be consistent with the finding of a 2011 study that FDI liberalization in service sectors leads to productivity gains for downstream manufacturing firms (Arnold, Javorcik, and Mattoo 2011). However, these improvements tapered off immediately, suggesting short-lived or limited spillovers. There was a small, positive horizontal spillover effect for firms in the same industry, which may suggest that surviving local firms in the same sector and area may have benefited from competition-driven productivity gains.[7]

FIGURE 2.20 Spillover effects in ECA are not automatic (average across the period)

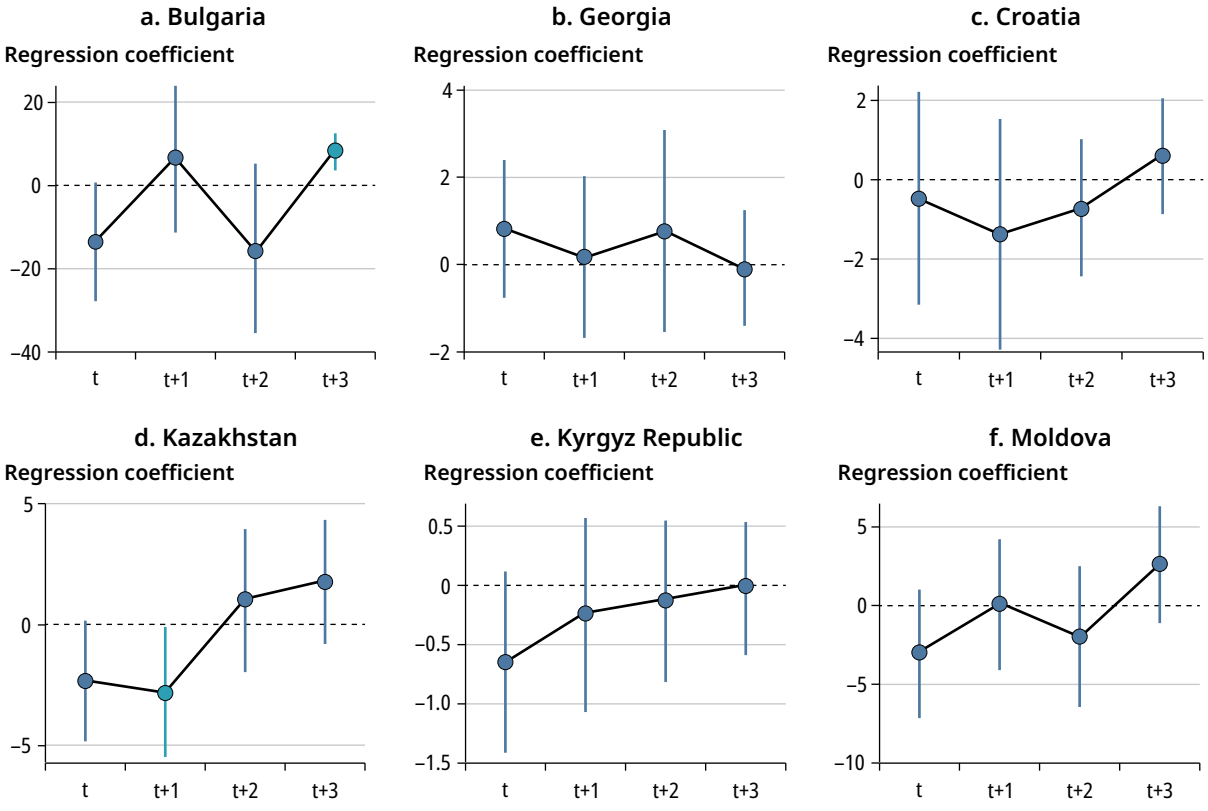


Source: Estimates based on a pooled country-specific firm-level data set. Refer to online annex 1A, available at https://hdl.handle.net/10986/43788, for details.

Note: Each panel is based on a separate regression of labor productivity (value added per worker) on the linkage index, controlling for sector-specific competition (Hirschman Herfindahl Index) and input demand (following Javorcik 2004), along with firm, industry, geographic area, and year fixed effects. A coefficient of 0.25 implies that a 10 percent increase in the share of foreign direct investment in a horizontally or vertically linked industry generates a 2.5 percent improvement in domestic firms' labor productivity. The sample includes only domestic firms that are identified in the data. Errors bars indicate the 95 percent confidence interval.

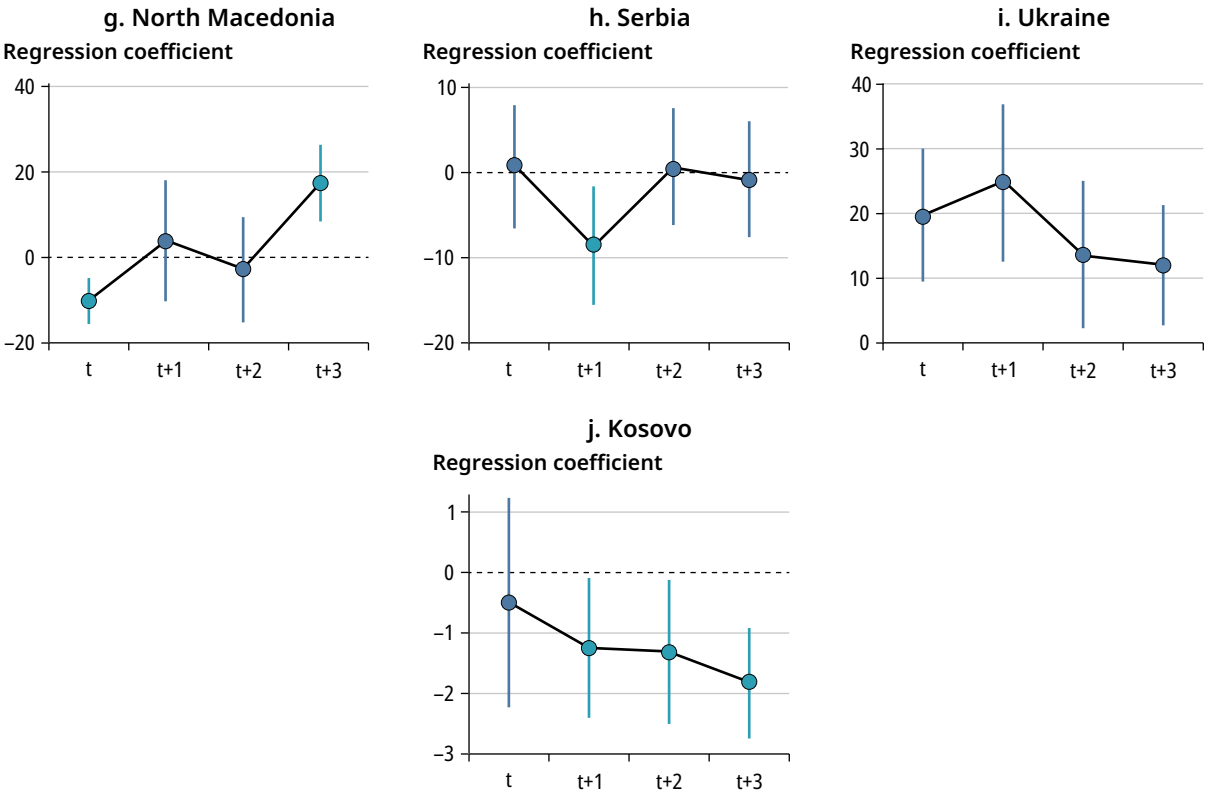
Few countries in the region have benefited from backward spillovers. In Central Europe (including in Hungary, Romania, and the Slovak Republic), inflows of FDI in manufacturing led to the emergence of local supplier networks. Initially, foreign car makers or electronics firms imported most of their components, but gradually they nurtured local suppliers.[8] In Southeast Europe and the Western Balkans, evidence of spillovers is mixed (figure 2.21). Some countries attracted FDI mainly into nontradable sectors (banking, retail, and real estate) or extractive industries, where spillovers to the broader economy are more limited. In manufacturing, there have been success stories, like automotive component suppliers in Serbia. There is also some evidence of positive spillovers in Bulgaria and North Macedonia, but only after three years.[9] In the resource-rich parts of ECA (such as Azerbaijan, Kazakhstan, and Russia), FDI in oil, gas, and mining brought in advanced extraction technology and generated government revenues, but the enclave nature of these industries meant that there was little transfer to the rest of the economy.[10]

FIGURE 2.21 Spillovers via backward linkages have been uneven across countries in ECA (average across the period)



Continued

FIGURE 2.21 Spillovers via backward linkages have been uneven across countries in ECA (average across the period) *(Continued)*



Source: Estimates based on a pooled country-specific firm-level data set. Refer to online annex 1A, available at https://hdl.handle.net/10986/43788, for details.

Note: Each figure is based on a separate regression of labor productivity (value added per worker) on the linkage index controlling for sector-specific competition (Hirschman Herfindahl Index) and input demand, following Javorcik (2004), along with firm, industry, geographic area, and year fixed effects. A coefficient of 0.25 implies that a 10 percent increase in the share of foreign direct investment in a horizontally or vertically linked industry generates a 2.5 percent improvement in domestic firms' labor productivity. The sample includes only domestic firms that are identified in the data.

FDI spillovers depend on the context. The findings in this report align with a broad literature that has found mixed results,[11] suggesting that spillovers are highly context dependent. The crucial question is not whether spillovers occur, but under what conditions. The literature and the analysis for this report point to two critical sets of mediating factors: the absorptive capacity of domestic firms and the quality of the host country business environment (refer to figure 2A.7 in online annex 2A).

Spillovers are far more likely when local firms have sufficient absorptive capacity—the ability to identify, assimilate, and apply new knowledge and technology (Khordagui and Saleh 2013). Backward spillovers, which occur when multinational firms source inputs locally, are often the most powerful channel for knowledge transfer (Javorcik 2004). However, these linkages form only when local suppliers can meet the demanding quality, reliability, and scale requirements of global firms.

The analysis for this report showed that spillovers are concentrated among a small number of ECA countries and, within those countries, among the most capable domestic firms.[12] Larger, more established, and more productive local firms are most likely to experience productivity gains from supplying multinational firms. Unobserved firm characteristics, such as the quality of management and technological sophistication, are key determinants of which firms can successfully connect with and learn from foreign investors. Few ECA countries have managed to integrate local companies into global supply chains. An example of successful integration is the auto industry in Central Europe, with local parts producers upgrading their capabilities to meet the requirements of foreign assemblers.

The local business environment is crucial in facilitating these linkages. An enabling environment—characterized by efficient regulations, quality infrastructure, well-functioning labor markets, and, critically, access to finance—is essential. Local firms often need to make significant investments to upgrade their technology and processes to become qualified suppliers for multinationals. Without access to credit, the needed productivity-enhancing investments may be impossible, preventing linkages from forming. Furthermore, the quality of local institutions, including transparency and control of corruption, can significantly affect the learning ability and productivity of domestic firms receiving FDI.

Fostering matching between multinationals and local firms and avoiding FDI enclaves can help achieve increased productivity. The analysis for this report revealed that FDI spillovers are not a passive process. They require a successful "match" between the needs of multinationals and the capabilities of the local economy. When domestic firms are unable to supply the required high-quality inputs because they lack absorptive capacity (Silajdzic and Mehic 2015; World Bank 2016), multinationals will import the inputs from their established global networks. This results in "enclave" FDI, where foreign firms operate in isolation from the local economy, generating few linkages and minimal spillovers. This is a missed opportunity for productivity gains and underscores the need for targeted policies that promote supplier development, technology upgrading, and institutional reform.

Foreign investment to increase market dynamism

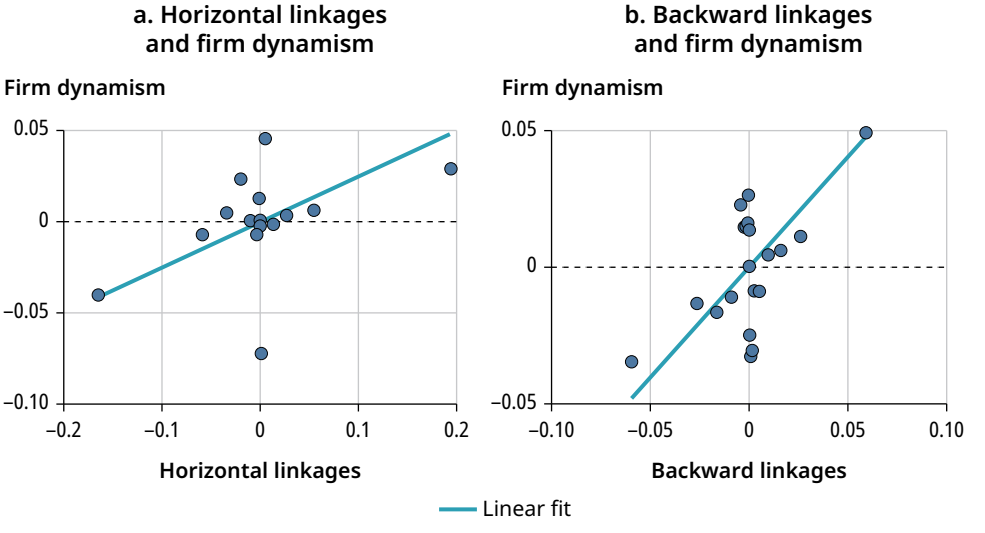
FDI shapes productivity not only through direct spillovers, but also by influencing market dynamics and allocative efficiency. Beyond knowledge transfer, FDI can reshape competition, firm entry and exit, and the reallocation of resources within an economy—mechanisms collectively known as market dynamism and allocative efficiency. When multinational firms enter new markets, they can sharpen competition, pressuring domestic firms to innovate, cut costs, or exit if they are unable to adapt. This process reallocates market shares and resources to more productive firms, raising aggregate productivity. Conversely, in some contexts, the presence of dominant foreign players can dampen competition or reinforce barriers to entry, thus reducing dynamism. The overall impact of FDI on productivity therefore depends not just on direct spillovers but also on how the

FDI alters the structure and functioning of local markets. These indirect effects can be as important as direct knowledge transfer, underscoring the power of complementary policies that foster competitive, flexible markets capable of reallocating resources efficiently.

Greater exposure to FDI is associated with greater firm dynamism, both within sectors and through supply chain linkages. The analysis revealed a positive correlation between higher levels of FDI—whether within the same sector (horizontal linkages) or in downstream sectors (backward linkages)—and greater firm dynamism, measured by the rate of firm entry and exit (figure 2.22). This pattern suggests that FDI not only brings in new technologies and practices but also stimulates churning, encouraging new firms to enter and underperforming firms to exit. Notably, the relationship is particularly strong for backward linkages, highlighting the broader impact of FDI that extends beyond entry sectors and influences the entire supply chain. These findings underscore the multifaceted ways FDI can reshape local market structures and foster a more dynamic and competitive business environment.

Greater FDI exposure is linked to reduced resource misallocation and support for more-efficient market functioning. Greater exposure to FDI—whether through horizontal linkages in the same sector or backward linkages with downstream sectors—is associated with less resource misallocation (figure 2.23). Markets with a more substantial FDI presence tend to allocate capital and labor more efficiently,

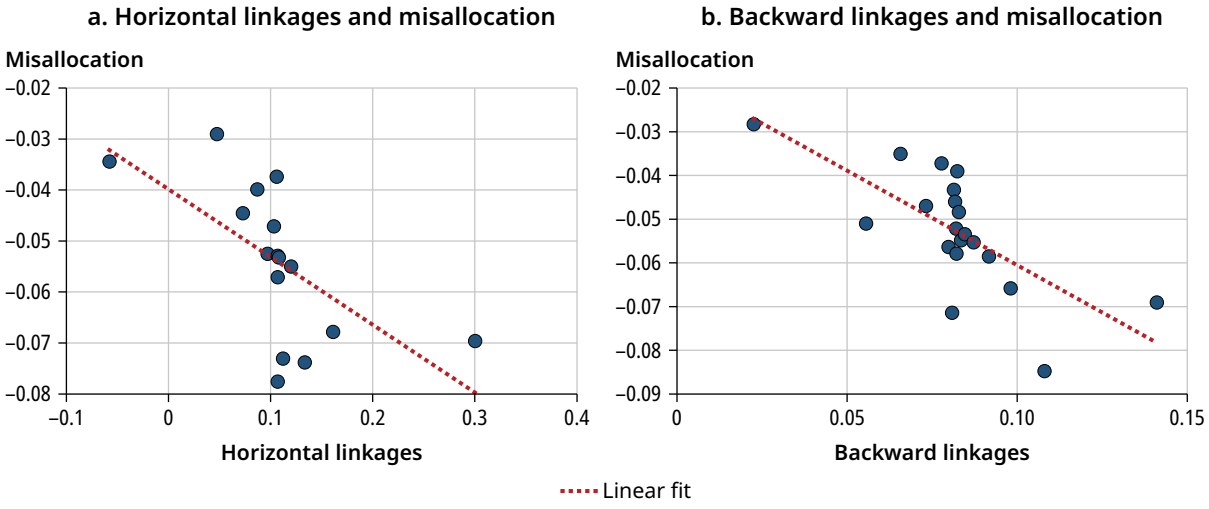
FIGURE 2.22 Higher exposure to foreign direct investment is correlated with higher firm dynamism



Source: Estimates based on a pooled country-specific firm-level data set. Refer to online annex 1A, available at https://hdl.handle.net/10986/43788, for details.

Note: Firm dynamism is calculated by taking the sum of country-, sector-, and year-net job creation divided by total employment. Backward linkage is the country-, sector-, and year-specific average share of foreign firms' output, weighted by the proportion of the sector's output supplied to "buying" sectors. Horizontal linkage is the country-, sector-, and year-specific average share of foreign firms' output operating in the same sector as the domestic firms.

FIGURE 2.23 Higher exposure to foreign direct investment is correlated with lower resource misallocation



Source: Estimates based on a pooled country-specific firm-level data set. Refer to online annex 1A, available at https://hdl.handle.net/10986/43788, for details.

Note: Misallocation is calculated by taking country-, sector-, and year-specific average deviation from the mean log-transformed TFP, weighted by employment. Backward linkage is the country-, sector-, and year-specific average share of foreign firms' output, weighted by the proportion of the sector's output supplied to "buying" sectors. Horizontal linkage is the country-, sector-, and year-specific average share of foreign firms' output operating in the same sector as the domestic firms. TFP = total factor productivity.

allowing productive firms to grow and less efficient ones to contract. This relationship highlights the role of FDI in promoting better market functioning by fostering competition and enabling a more effective reallocation of resources across firms. The effects are visible both within sectors directly affected by foreign entrants and across broader supply chains, reinforcing the case for policies that encourage integration with foreign investors to enhance market efficiency.

Conclusions and Policy Recommendations

ECA countries are missing out on untapped opportunities from integration with regional and global markets. Global integration through trade and FDI offers powerful pathways to productivity growth, but ECA countries capture only a fraction of this potential. The empirical evidence for ECA revealed that the four pathways of the integration-productivity nexus—structural transformation, within-sector reallocation, creative destruction, and incumbent upgrading—are often narrow and constrained.

The two main reasons are missing trade and missing FDI. Missing trade, particularly with high-income OECD countries and in the high-potential manufacturing sector, is considerable in the region. This macro-level gap is underpinned by micro-level weaknesses: a shortage of exporters and a high rate

of failure among firms that attempt to internationalize. This inefficient churning stifles the resource reallocation and learning effects that drive productivity. The story is similar for missing FDI. For many ECA countries, the recent global shift toward friendshoring threatens to exacerbate the loss. Critically, productivity spillovers from FDI in the region are not automatic. They emerge only under specific conditions, requiring a supportive business environment and adequate absorptive capacity among local firms to enable them to forge beneficial linkages with multinational firms.

A revitalized reform agenda is needed to reap the productivity benefits of integration. The pathways to productivity can be widened through a targeted reform agenda. Policies directly easing the blockages identified in this chapter are the key to unlocking the region's productivity potential.

To leverage structural transformation (Pathway 1), policies should facilitate resource mobility across sectors. To release resources trapped in low-productivity sectors, policies need to facilitate the movement of labor and capital to more-productive sectors. This requires removing distortions that trap labor or capital, such as by reducing subsidies for declining industries and enhancing labor market flexibility for retraining and relocation. Similarly, improving infrastructure to connect lagging regions with more-dynamic economic centers can support the reallocation of resources.

To reap the benefits of integration that come from the reallocation of resources between firms, or within-sector reallocation (Pathway 2), constraints on firm growth must be loosened. Resource reallocation requires pro-competition reforms (streamlining business licensing, simplifying regulations, and breaking up monopolies) that complement trade by enabling efficient new firms to grow and challenge incumbents. Removing reallocation barriers is crucial, including improving access to finance for high-performing small and medium-sized firms and phasing out support for failing ("zombie") firms. Flexible labor markets and schemes for worker reskilling are also important to assist workers in transitioning to expanding firms.

Maximizing the benefits from integration through creative destruction (Pathway 3) requires a dynamic business environment with easy entry for new firms and smooth exits for failing ones. Policy makers should lower bureaucratic hurdles for start-ups (including foreign investors) and reshape insolvency frameworks to expedite the exit or restructuring of unviable firms. Strengthening bankruptcy laws and removing barriers to firm exit are vital in many ECA countries. Flexible labor market policies that support retraining and relocation enable quicker replacement of shrinking firms with expanding ones. Fostering access to risk capital is also vital for new firm creation. Active labor market policies can cushion displaced workers during trade liberalization, maintaining support for openness. Overall, a policy framework prioritizing economic flexibility and innovation ensures that global integration yields net positive productivity effects.

To realize the benefits of firm upgrading from integration, or incumbent firm upgrading (Pathway 4), policies should facilitate firms' learning and absorptive capacities. Promoting upgrading requires investing in human capital and encouraging technology adoption (such as through tax incentives for research and development). Domestic capacity-building is crucial to enable local firms to partner with and learn from foreign companies. Supplier development programs linking domestic suppliers with multinationals can amplify FDI spillovers. A competitive services market (such as for telecommunications and logistics) provides manufacturers with better inputs. Trade facilitation (simplifying customs and improving airports and sea ports) reduces the costs of importing and exporting. To promote exports, targeted support such as helping firms meet international standards can be beneficial, as can addressing information externalities through targeted interventions such as "meet-the-buyer" events and providing information on prospective market opportunities. In ECA, where organizational and managerial quality are poor, targeted training to improve managerial practices is important. For FDI, policies are needed to attract quality investment and maximize local linkages by strengthening skills and the legal environment. Facilitating connections between foreign affiliates and local firms can enable spillovers. Competition policy should prevent foreign entrants from establishing dominant positions without local knowledge diffusion. Supporting domestic research and innovation also complements gains from global interactions by facilitating the infusion of frontier technologies.

Overall, thinking in terms of the four interconnected pathways highlights the multifaceted ways trade and FDI enhance productivity. A robust, competitive environment facilitates creative destruction and incumbent upgrading. Foreign investment plays a role across these channels. The overall productivity impact depends on these linked effects and supportive domestic policies and institutions. For ECA, this means continued structural reforms, competition-friendly regulation, flexible labor market policies, and accessible finance. Investments in education, skills, and innovation empower firms to learn and upgrade. When these conditions are in place, gains from trade and FDI can be substantial. Conversely, domestic barriers can mute these benefits. Given current global uncertainties, getting the domestic basics right is crucial. Adapting to shifting trade patterns may require finding new markets or investment sources. A flexible, productivity-oriented economy can safely navigate these shifts. By strengthening the enabling environment for the four pathways, ECA countries can harness trade and FDI for growth, leading to more competitive, innovative, and dynamic economies.

Table 2.1 summarizes this chapter's policy recommendations, with varying priority levels for each of the ECA country clusters.

TABLE 2.1 Priority level for policy recommendations, by country group

Recommendation	EU members	EU candidates	Türkiye	Central Asia and the South Caucasus
Facilitate resource mobility across sectors (labor and capital)	Low	Medium	Medium	High
Improve connectivity and logistics and remove barriers at the border	Low	Medium	Medium	High
Simplify regulations and remove nontariff barriers and barriers to trade in services	Medium	High	High	Medium
Refocus export promotion	Medium	Medium	Medium	Medium
Make the labor market more flexible and focus on retraining and labor mobility	High	Medium	Medium	Low
Implement capacity-building programs and supplier development schemes, including advisory and access to finance	Medium	High	High	Medium

Source: World Bank.

Note: Low, medium, and high indicate priority level. ECA = Europe and Central Asia; EU = European Union.

Notes

1. For the purpose of this report, ECA economies were classified into five groups using k-means clustering based on a variety of economic, geographic, and institutional factors (GDP share of agriculture, natural resource rents [percent of GDP], trade openness, distance to the geographic center of the European Union, and Bertelsmann Stiftung's Transformation Index): (a) high-income and emerging markets and developing economies (Croatia, Poland, Romania, and Türkiye), (b) Eastern Europe advanced economies (Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Montenegro, North Macedonia, and Serbia), (c) Eastern Europe less advanced economies (Albania, Armenia, Moldova, and Ukraine), (d) resource–rich economies (Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan), and (e) agricultural Central Asia economies (the Kyrgyz Republic, Tajikistan, and Uzbekistan). However, completeness of groups may vary due to data availability. Notes below figures list the exact countries used from each group.
2. Heritage Foundation (2023). The Trade Freedom Index from the Heritage Foundation measures a country's openness to international trade based on trade-weighted average tariff rates and the prevalence of nontariff barriers. The investment freedom index measures a country's regulatory restrictiveness imposed on investments. The scale ranges from 0 to 100, where 0 represents the highest level of protectionism and 100 represents complete openness. (Data can be found online at https://www.heritage.org/index/pages/all-country-scores).
3. Friendshoring is determined according to geopolitical alignment, as captured by voting patterns in the United Nations General Assembly.
4. Arnold, Javorcik, and Mattoo (2011) showed a positive relationship between service sector reform and the performance of domestic firms in downstream manufacturing sectors, which is consistent with this study's empirical finding of immediate yet quickly dissipating productivity spillover through forward linkages on average for select ECA countries.
5. Various types of FDI spillovers were analyzed: horizontal spillovers to domestic firms in the sectors in which multinational firms were investing, as well as vertical spillovers to firms in upstream (suppliers) or downstream (buyers) sectors. The main focus was on the effect of spillovers on productivity (measured as value added per worker or TFP).

6. Industrial linkages through which FDI spillovers can occur are based on input-output accounts from national statistical agencies (for details on calculating FDI exposure via these linkages, refer to box 2A.1 in online annex 2A, available at https://hdl.handle.net/10986/43788). Although they are detailed, the data do not include transaction-level granularity that would identify firms that actually supply multinationals (for more on this, refer to Alfaro-Ureña, Manelici, and Vasquez 2022). There is also a possibility that some within-industry suppliers cannot be observed due to the level of aggregation of industries in the input-output accounts.
7. This claim is supported by the strong negative correlation between foreign-owned output as a share of total output and misallocation, as measured by the average deviation from the mean log-transformed TFP, weighted by employment (refer to figure 2A.10 in online annex 2A, available at https://hdl.handle.net/10986/43788).
8. The productivity premium of exporters in some Central and Eastern European countries (including Hungary, Lithuania, and Romania) is partly attributable to a strong FDI presence and integration into European supply chains (Berthou et al. 2015).
9. Foreign ownership in North Macedonia is proxied by firms located in special economic zones, which may imply that the analysis missed multinationals outside the zones (mainly in wholesale and retail trade).
10. This underscores another condition: the type of FDI matters. Resource-sector FDI tends to have weaker spillovers than manufacturing or services FDI because in the former, the scope for local sourcing is smaller and the skills are not easily applied elsewhere.
11. Görg and Greenaway (2004), for example, reviewed 40 studies of horizontal productivity spillovers in several countries and found 22 positive and significant spillover effects. Some studies employing firm-level data found negative results (for example, Aitken and Harrison 1999), while others found insignificant results (for example, Girma and Wakelin 2002). Meanwhile, Javorcik (2004) and Alfaro and Rodriguez-Clare (2004) found evidence of backward linkages between the downstream suppliers and multinational firms in Brazil, Chile, Lithuania, and Venezuela. Alfaro et al. (2010) demonstrated that the growth-enhancing effects of FDI are conditional on the development of financial institutions, consistent with Villegas-Sanchez (2009), who showed that domestic firms enjoy productivity increases from FDI only if they are located in financially developed regions.
12. For a better understanding of the drivers of the observed heterogeneity in FDI spillovers, the study conducted empirical analyses, which showed that firm-level absorptive capacity is a key determinant. The analyses found that firms with stronger capabilities are significantly more likely to experience productivity gains above the predicted sector average (refer to box 2A.3 in online annex 2A, available at https://hdl.handle.net/10986/43788).

References

Acemoglu, D., and J. Linn. 2004. "Market Size in Innovation: Theory and Evidence from the Pharmaceutical Industry." *Quarterly Journal of Economics* 119 (3): 1049–90.

Ahmad, S., J. Bergstrand, J. Paniagua, and H. Wickramarachi. 2023, "The Multinational Revenue, Employment, and Investment Database (MREID)." Office of Economics Working Paper 2023–11-B. US International Trade Commission, Washington, DC.

Aitken, B. J., and A. E. Harrison. 1999. "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela." *American Economic Review* 89 (3): 605–18.

Alfaro, L., and A. Rodriguez-Clare. 2004. "Multinationals and Linkages: Evidence from Latin America." *Economia* 4 (2): 113–70.

Alfaro, L., A. Chanda, S. Kalemli-Ozcan, and S. Sayek. 2010. "Does Foreign Direct Investment Promote Growth? Exploring the Role of Financial Markets on Linkages." *Journal of Development Economics* 91 (2): 242–56.

Alfaro-Ureña, A., I. Manelici, and J. Vasquez. 2022. "The Effects of Joining Multinational Supply Chains: New Evidence from Firm-to-Firm Linkages." *Quarterly Journal of Economics* 137 (3): 1495–552.

Amiti, M., and J. Konings. 2007. "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia." *American Economic Review* 97 (5): 1611–38.

Arnold, J. M., and B. S. Javorcik. 2009. "Gifted Kids or Pushy Parents? Foreign Direct Investment and Plant Productivity in Indonesia." *Journal of International Economics* 79 (1): 42–53.

Arnold, J. M., B. S. Javorcik, and A. Mattoo. 2011. "Does Services Liberalization Benefit Manufacturing Firms?: Evidence from the Czech Republic." *Journal of International Economics* 85 (1): 136–46.

Berthou, A., E. Dhyne, M. Bugamelli, et al. 2015. "Assessing European Firms' Exports and Productivity Distributions: The CompNet Trade Module." Working Paper Series 1788, European Central Bank, Frankfurt, Germany. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1788.en.pdf.

Bloom, N., M. Draca, and J. Van Reenen. 2016. "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity." *Review of Economic Studies* 83 (1): 87–117.

Braconier, H., K. Ekholm, and K. H. M. Knarvik. 2001."In Search of FDI-Transmitted R&D Spillovers: A Study Based on Swedish Data." *Review of World Economics* 137 (4): 644–65.

Branstetter, L. 2006. "Is Foreign Direct Investment a Channel of Knowledge Spillovers? Evidence from Japan's FDI in the United States." *Journal of International Economics* 68 (2): 325–44.

Caves, R. E. 1974. "Multinational Firms, Competition, and Productivity in Host-Country Markets." *Economica* 41 (162): 176–93.

Comtrade. 2024. *UN Comtrade Database.* New York: United Nations Statistics Division (accessed October 30, 2024). https://comtrade.un.org/.

Crespo, N., and M. P. Fontoura. 2007. "Determinant Factors of FDI Spillovers—What Do We Really Know?" *World Development* 35 (3): 410–25.

De Loecker, J. 2007. "Do Exports Generate Higher Productivity? Evidence from Slovenia." *Journal of International Economics* 73 (1): 69–98.

Farole, T., and D. Winkler, eds. 2014. *Making Foreign Direct Investment Work for Sub-Saharan Africa: Local Spillovers and Competitiveness in Global Value Chains.* Washington, DC: World Bank.

Fernandes, A. M. 2007. "Trade Policy, Trade Volumes and Plant-Level Productivity in Colombian Manufacturing Industries." *Journal of International Economics* 71 (1): 52–71.

Fernandes, A. M., C. Freund, and M. D. Pierola. 2016. "Exporter Behavior, Country Size and Stage of Development: Evidence from the Exporter Dynamics Database." *Journal of Development Economics* 119: 121–37.

Foster, L., J. C. Haltiwanger, and C. J. Krizan. 2001. "Aggregate Productivity Growth: Lessons from Microeconomic Evidence." In *New Developments in Productivity Analysis*, 303–72. Chicago: University of Chicago Press.

Freund, C., and B. Bolaky. 2008. "Trade, Regulations, and Income." *Journal of Development Economics* 87 (2): 309–21.

Girma, S., and K. Wakelin. 2002. "Are There Regional Spillovers from FDI in the UK?" In *Trade, Investment, Migration and Labour Market Adjustment*, 172–86. London: Palgrave Macmillan UK.

Goldberg, P., Khandelwal, A., Pavcnik, N., and Topalova, P. 2009. "Trade liberalization and new imported inputs." *American Economic Review*, 99(2), 494-500.

Görg, H., and D. Greenaway. 2004. "Much Ado About Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" *World Bank Research Observer* 19 (2): 171–97.

Halpern, L., M. Koren, and A. Szeidl. 2015. "Imported Inputs and Productivity." *American Economic Review* 105 (12): 3660–703.

Hamida, L. B., and P. Gugler. 2009. "Are There Demonstration-Related Spillovers from FDI?: Evidence from Switzerland." *International Business Review* 18 (5): 494–508.

Harrison, A., and A. Rodríguez-Clare. 2010. "Trade, Foreign Investment, and Industrial Policy for Developing Countries." *Handbook of Development Economics* 5: 4039–214.

Heritage Foundation. 2023. *2023 Index of Economic Freedom.* Washington, DC: Heritage Foundation.

Javorcik, B. S. 2004. "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages." *American Economic Review* 94 (3): 605–27.

Khordagui, N. H., and G. Saleh. 2013. "FDI and Absorptive Capacity in Emerging Economies." *Topics in Middle Eastern and African Economies* 15 (1).

Melitz, M. J. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71 (6): 1695–725.

Melitz, M. J., and G. I. Ottaviano. 2008. "Market Size, Trade, and Productivity." *Review of Economic Studies* 75 (1): 295–316.

Pavcnik, N. 2002. "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants." *Review of Economic Studies* 69 (1): 245–76.

Silajdzic, Sabina and Eldin Mehic. 2015. "Absorptive Capabilities, FDI, and Economic Growth in Transition Economies." *Emerging Markets Finance and Trade.* 52. 1-19. 10.1080/1540496X.2015.1056000.

Syverson, C. 2011. "What Determines Productivity?" *Journal of Economic Literature* 49 (2): 326–65.

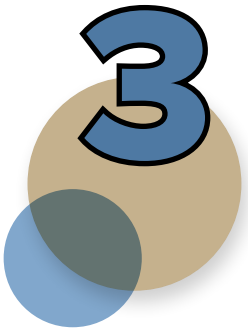
Teignier, M. 2018. "The Role of Trade in Structural Transformation." *Journal of Development Economics* 130: 45–65.

Villegas-Sanchez, C. 2009. "FDI Spillovers and the Role of Financial Development: Evidence from Mexico." Unpublished paper.

Wei, S. J. 1996. "Intra-National versus International Trade: How Stubborn Are Nations in Global Integration?" NBER Working Paper 5531, National Bureau of Economic Research, Cambridge, MA.

World Bank. 2016. "Regional Integration and Spillovers: Europe and Central Asia." World Bank, Washington, DC. https://www.worldbank.org/content/dam/Worldbank/GEP/GEP2016a/Global-Economic-Prospects-January-2016-Spillovers-ECA.pdf.

World Bank and IFC (International Finance Corporation). 2023. "Changing Foreign Direct Investment Dynamics and Policy Responses." White Paper for Japan's G7 Presidency. World Bank, Washington, DC. https://www.ifc.org/content/dam/ifc/doc/2023/changing-foreign-direct-investment-dynamics-and-policy-responses.pdf.



Beyond Connectivity: How Technology Adoption Unlocks Productivity Potential

Introduction

Digital technologies can be an important driver for boosting within-firm productivity growth in Europe and Central Asia (ECA). The increased availability of digital technology and digitalization of business processes offer immense opportunities to improve firm performance. Numerous recent studies, mainly from high-income countries, have shown that more digital-intensive firms are more productive (Bloom et al. 2010; Calvino, Criscuolo, and Ughi 2024), have higher markups (Bessen 2020; Calligaris et al. 2018; Criscuolo et al. 2021), and show lower productivity declines (Borowiecki, Giovannelli, and Høj 2023) and exit rates (Muzi et al. 2023) in times of crises. This chapter assesses the productivity gains, current state, and enabling factors of digital technology adoption in ECA.[1]

Digital technology adoption is a multistage process, from providing access, to initial adoption, to intensive use in business functions, and many firms struggle to complete it. One key finding of this chapter is that despite increasingly universal access to digital technologies across ECA, the usage of key enabling technologies—like cloud services and artificial intelligence (AI), as well as business function–specific technologies—remains low compared to more advanced economies. Bridging this gap from initial adoption of technologies to their intensive use is key to reaping the associated productivity benefits.



Technical and managerial skills as well as efficient markets are key for increasing the use of digital technologies. The availability of skilled workers emerges as an

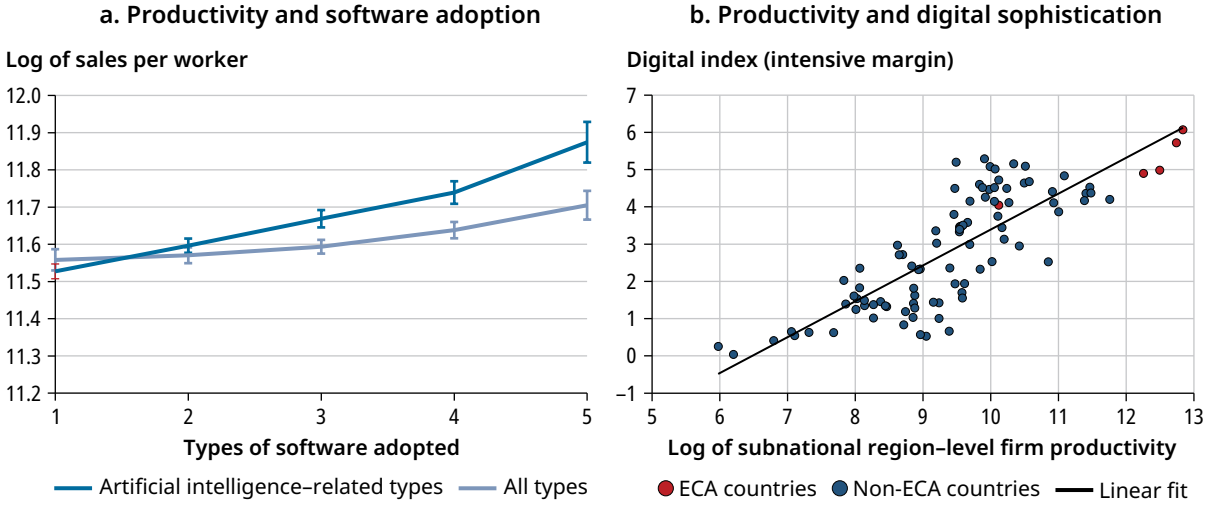
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important driver for digital technology adoption, but higher labor costs for scarce information technology (IT) professionals might impede faster diffusion of digital technologies in less advanced parts of ECA. In addition to workers' skills, management practices are associated with more advanced levels of digitalization, as they are required for effective implementation. In alignment with the findings from chapters 1 and 2, firms in more competitive and trade-open sectors demonstrate higher levels of digital adoption, underlining the complementarity between removing market distortions and within-firm upgrading.

Digitalization and Productivity

Both country- and firm-level data confirm a positive relationship between productivity and digitalization in ECA. The importance of digital technologies for productivity cannot be overstated: Administrative and survey-based firm-level data show that the intensity of firm digitalization is positively associated with productivity (figure 3.1). Similarly, sectoral data on value added per worker show a positive association with digitalization proxies, such as internet and computer use, cloud service use, e-commerce, and AI use,[2] even after controlling for sectors and differences in broadband infrastructure across countries (figure 3.2).

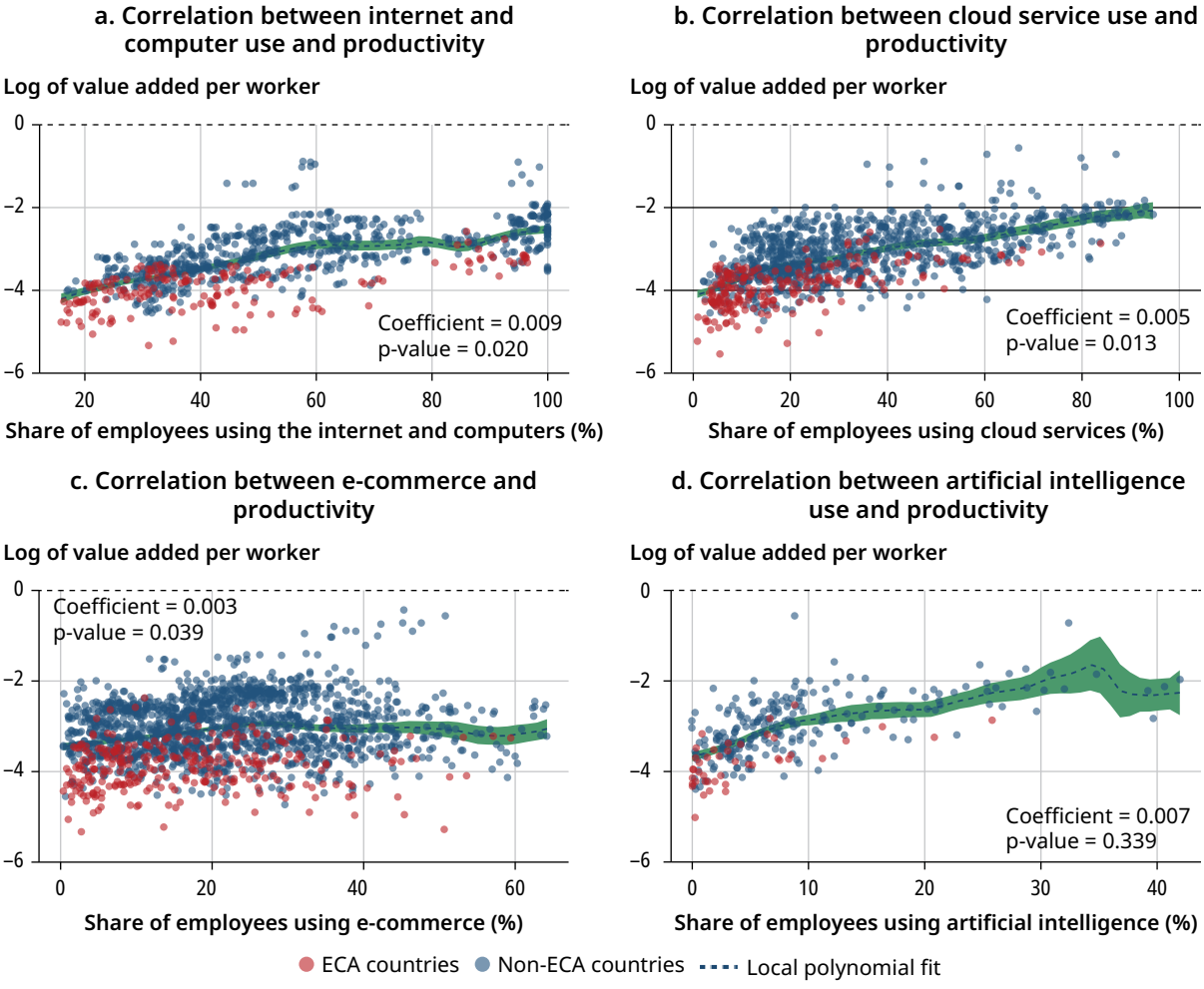
FIGURE 3.1 The positive relationship between productivity and firm digitalization is visible at the firm level



Sources: Orbis; Spiceworks Ziff Davis; World Bank Firm-level Adoption of Technology survey.

Note: In panel a, the regression controls for firm size, ownership (foreign or domestic), and two types of fixed effects (sector, at the one-digit European Statistical Classification of Economic Activities and country levels). Artificial intelligence (AI)–related software is software that has publicly announced AI features. Data includes Poland, Romania, Ukraine, Türkiye, and Bulgaria (2016–21). In panel b, the digital index indicates whether the most frequently used technology to perform tasks across six general business functions (administration, planning, sourcing, marketing, sales, and payments) is manual (value of 0), basic digital (value of 1), or advanced digital (value of 2). Here, y-values are the regional averages of the digital index. Subnational region–level firm productivity is the average value added per worker in each subnational region, after controlling for sectoral differences, adjusted by purchasing power parity. ECA = Europe and Central Asia.

FIGURE 3.2 A variety of measures of digital technology adoption by enterprises are positively correlated with value added per worker at the country-sector level



Source: Eurostat.

Note: Coefficient and p-value refer to a polynomial regression that controls for three types of fixed effects (sector at the one-digit European Statistical Classification of Economic Activities level, year, and country). Panels a, b, and c include data from 2016–23. In panel d, the data are from 2024. The green band indicates the 95 percent confidence interval. ECA = Europe and Central Asia.

Catching up to the European average of firm digitalization could raise average productivity by 5 percent to 7 percent in ECA countries. In six ECA countries with data (Bulgaria, Croatia, North Macedonia, Poland, Romania, and Serbia), reaching the EU average for the share of firms using cloud services could boost productivity by up to 7 percent after controlling for sector-, country-, and year-specific differences and by up to 5 percent after also controlling for differences in capital intensity.[3] Moving to the European frontier (the maximum value for a specific sector and year) could result in productivity gains of 18–25 percent. Informational digital technologies, such as cloud services, play an

enabling role, and productivity gains are likely to come from implementing other digital technologies in combination with cloud services.

The State and Evolution of Digital Technology Adoption

To understand the role of digital technologies in firm productivity, it is important to distinguish the stages of access, adoption, and intensive use. Access refers to the availability of a digital enabler (internet, computers, or cloud services) and is a necessary but not sufficient condition for benefiting from the technology because it does not imply productive use. Adoption refers to first-time integration and availability of the technology in a company. The final and most important stage is when a company starts to use the technology intensively as the primary tool for addressing specific production problems in a certain business function. It is key to distinguish these stages because they have different productivity implications for firms (refer to box 3.1 for more details on the stages and a concrete example).

BOX 3.1 Steps in firm digitalization: From access, to adoption, to intensive use

Digitalization goes beyond providing digital enablers and exists on a spectrum. To identify differences in the intensity and sophistication of the technology used in a firm's business functions, the World Bank Firm-level Adoption of Technology survey differentiates among access, adoption, and intensive use.

Access refers to the basic availability of a digital enabler (internet, computers, or cloud services) regardless of whether it is actually used. Adoption occurs when a firm integrates the technology for specific purposes. Intensive use happens when the technology becomes the primary tool for a function. To identify technologies that are adopted but not used intensively, the survey asks firms to report the frequency of use for each technology, since firms may be using multiple technological solutions for the same business function with different intensities.

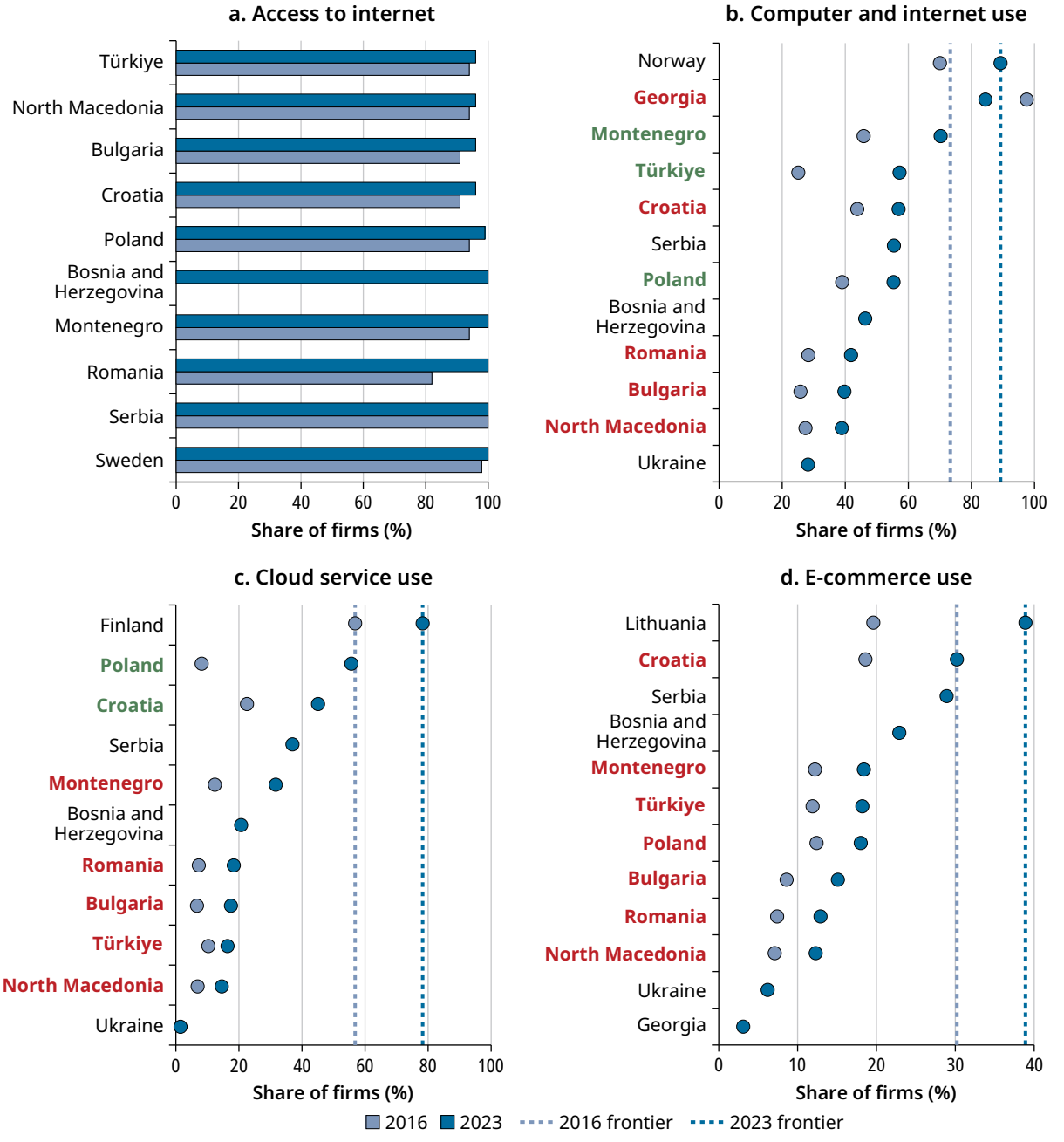
For example, when firms use enterprise resource planning (ERP) for production, the first step in digitalization is accessing the internet. In Croatia, Georgia, and Poland, the gap in access to the internet is minimal, with less than 1 percent of firms lacking connectivity. However, not all connected firms adopt ERP for production. The adoption gap refers to connected firms that do not adopt ERP or digital tools for production planning. Full digitalization happens when firms intensively use ERP or advanced digital tools as their primary technology for these tasks. The final use gap refers to firms that have adopted advanced digital technologies but do not use them intensively, meaning that the firms rely on other technologies more frequently for production planning.

Source: Cirera, Comin, and Cruz (2024).

Although access to digital technologies is almost universal in ECA, a gap in use remains between ECA and higher-income regions in Europe—and this gap has been widening. Nearly all firms report having access to the internet, with very little variation across ECA (figure 3.3). Yet, the differences in firms' use of basic digital technologies between most of ECA and the European frontier are stark. Between 2016 and 2023, all ECA countries reported improvements in the share of firms using the internet and computers, cloud services, and e-commerce. However, in the majority of countries, the gap with the European frontier also widened (as indicated by the countries in red in figure 3.3, panels b, c, and d), suggesting a growing digital divide. The divide seems to be driven by small and medium-sized enterprises (SMEs) rather than large firms. For example, the gap in use of cloud services between SMEs in Bulgaria, North Macedonia, Romania, and Türkiye and the European frontier (Finland) widened between 2016 and 2023 (refer to figure 3A.1 in online annex 3A). In all the ECA economies, large enterprises are catching up to the frontier, but the gap remains wide in the previously mentioned group of countries. Croatia and Poland are on a better trajectory, with firms of all sizes closing in on the frontier. This size-specific trend is similar for other digital technologies, such as internet, computer, and e-commerce use.

According to data from the World Bank Firm-level Adoption of Technology survey, in three ECA countries, firms display a basic level of digitalization across their business functions. The survey data for Croatia, Georgia, and Poland provide greater insight on the extensive and intensive margins of business function–specific digital technologies, compared to Eurostat data on basic digital enablers. For the extensive margin, which measures the breadth of technologies adopted across business functions on a scale from 1 to 5,[4] firms average 3.4 in Croatia, 2.6 in Georgia, and 2.9 in Poland. The averages are lower for the intensive margin, which captures how sophisticated the most heavily used technologies in each function are: 2.3 for Croatia and 2.0 for both Georgia and Poland. These values reflect the use of basic digital technologies such as standard business administration software, supply chain management systems, and computer-based quality control (refer to figures 3A.3 and 3A.4 in online annex 3A). The values also show that less than half of the firms intensively use advanced digital technologies, such as specialized software or enterprise resource planning systems.

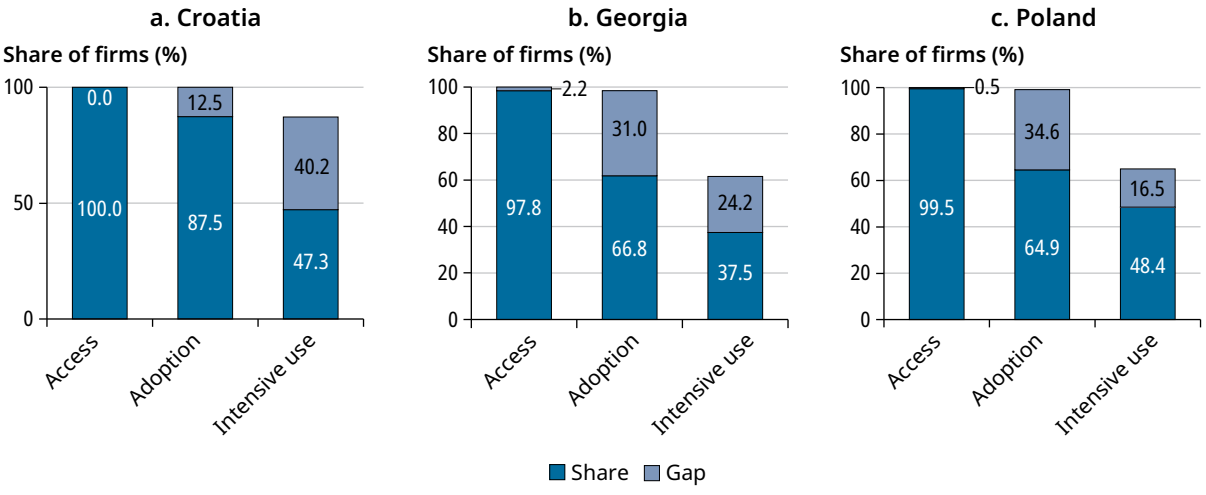
FIGURE 3.3 Access to the internet is nearly universal in ECA, but the digitalization gap in use with the European frontier is widening



Sources: Eurostat, except for Georgia and Ukraine, for which data are from the national statistical office and may use different definitions.

Note: The data cover all sectors. Countries in red are those where the gap with the European frontier is widening. Countries in green are those where the gap is narrowing.

FIGURE 3.4 Access to digital technologies is universal, but companies struggle to move from adoption to intensive use

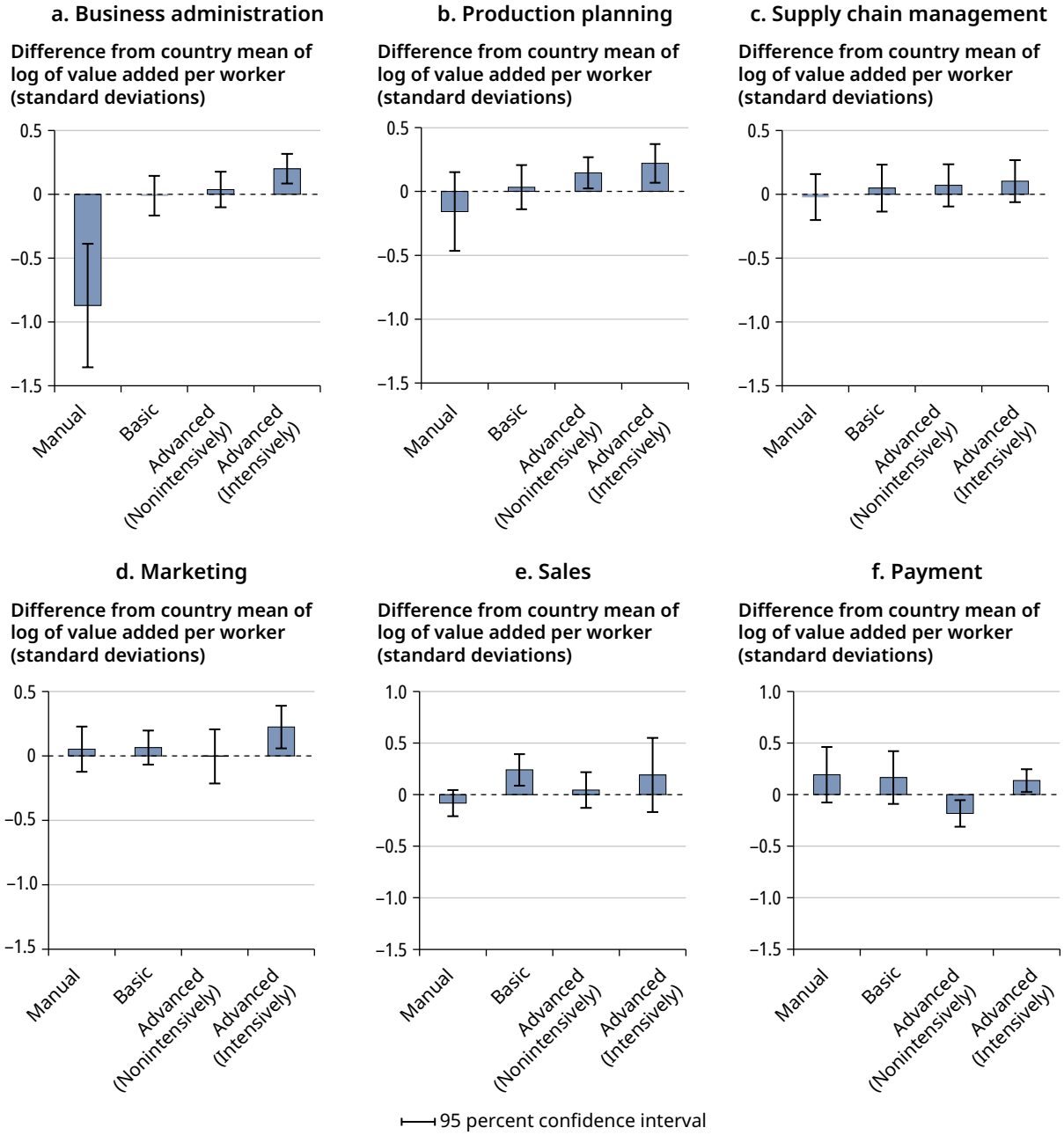


Source: World Bank Firm-level Adoption of Technology survey.

Note: Access refers to the availability of a digital enabler (internet, computers, or cloud services). *Adoption* refers to the first-time integration and availability of the technology in a company. *Intensive use* refers to when a company starts to use the technology intensively as the primary tool for addressing specific production problems in a certain business function. Gap refers to the share of firms that achieved the previous stage, but not this one. Data reflects digital technology adoption in business administration only. The data for Poland are from 2021, and the data for Georgia and Croatia are from 2022.

Firms in ECA struggle in moving from having access to digital technologies, to initial adoption, and ultimately to more frequent and intensive use of advanced technologies, which is important for productivity. Although access to basic digital enablers is close to universal, there are wide gaps between access and adoption in Georgia and Poland and adoption and intensive use in Croatia and Georgia (less wide in Poland). The latter gap indicates that many firms in these countries have started to use more sophisticated digital technologies but are not using them intensively in their business functions (figure 3.4). To reap the productivity gains of digitalization, firms must use these technologies intensively, especially for administration, production planning, and marketing (figure 3.5). Transactional technologies, such as digital sales and payment solutions, are not associated with significant productivity gains. This pattern of higher rates of adoption and lower rates of intensive use is also found in advanced economies such as the United States (Zolas et al. 2021), although the differences between adoption and intensive use are smaller (more comparable to those in Poland than those in Croatia and Georgia).

FIGURE 3.5 To reap productivity gains from digitalization, firms must use digital technologies intensively, especially for administration, production planning, and marketing

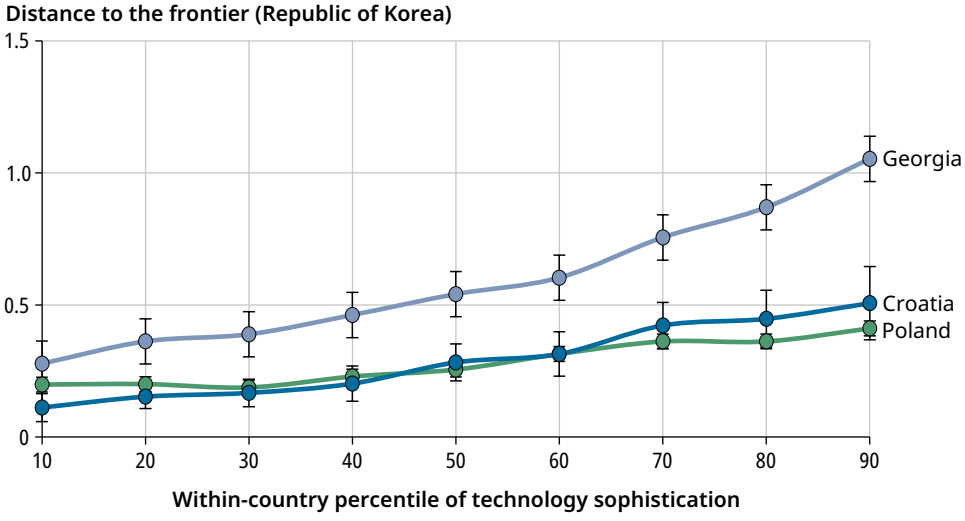


Source: World Bank Firm-level Adoption of Technology survey.

Note: The data for Poland are from 2021, and the data for Georgia and Croatia are from 2022.

The gap in the intensive margin of technology sophistication with frontier economies tends to be larger among firms that are among the top users of digitalization than among the bottom ones. The firms in each of the three ECA countries with data were ranked into deciles based on their technology sophistication (on a scale of 1, nondigital technologies, to 5, state-of-the-art technologies). The ranking shows that the gap with the Republic of Korea is particularly high among the most digitalized firms and that less digitalized firms are more similar to the least digitalized firms in Korea (figure 3.6). The trend is weaker in Croatia and Poland than in Georgia, suggesting that the most digitalized firms in Croatia and Poland are not as far from the frontier. The gap to the frontier among the top tier of digitalized firms is larger for the intensive margin of basic digital enablers than for the extensive margin, for which Eurostat data revealed a widening gap among SMEs. This underlines a double challenge for ECA economies: ensuring that the least sophisticated firms adopt basic digital technologies and that the most sophisticated ones do not lose the connection to the latest digital technologies in their sectors and business functions. The gap between the domestic and global frontiers is particularly large among very mature firms, aged 15 years or older (refer to figure 3A.2 in annex 3A).

FIGURE 3.6 The gap with the frontier in technology sophistication is wider for more-digitalized firms

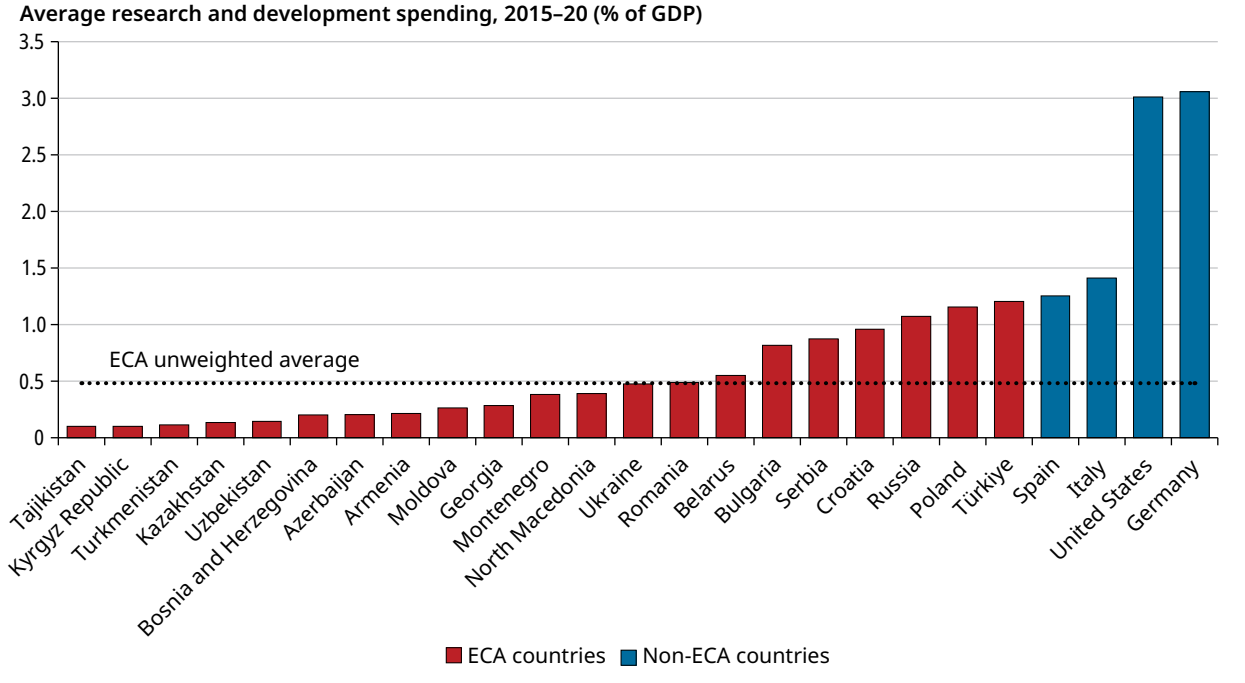


Source: World Bank Firm-level Adoption of Technology survey.

Note: Technology sophistication in general business functions is measured using the intensive margin, which calculates the average level of sophistication of the most frequently used technologies across six business functions (administration, planning, sourcing, marketing, sales, and payments; Cirera, Comin, and Cruz 2024) on a scale from 1 (least sophisticated) to 5 (most sophisticated). All results incorporate sampling weights. The data for Poland are from 2021, and the data for Georgia and Croatia are from 2022.

Most of the countries in ECA exhibit low levels of innovation and research and development (R&D), which not only is associated with low innovation output but also lowers firms' capacity to absorb outside technologies. It has long been established that internal innovation activities not only affect innovation output and but also enhance the capacity to assimilate and exploit new knowledge (Cohen and Levinthal 1990). Recent evidence has shown that this also applies to digital technologies, as digital innovation enhances firms' acquisition, assimilation, and transformation of digital innovations (Kastelli et al. 2024). Although data on private sector spending on R&D are not available for all of ECA, gross R&D spending in the region averages 0.5 percent of gross domestic product (GDP)—a sixth of that in Germany and the United States. There is considerable variation within ECA, with Poland and Türkiye's averages close to those of Italy and Spain, while eastern parts of ECA are farther behind (figure 3.7). Countries' efficiency in turning innovation input into innovation output, as measured by patent applications, also varies widely (refer to figure 3A.5 in online annex 3A). There are multiple possible reasons for the variation, from sectoral composition to innovation ecosystems, and a detailed analysis is beyond the scope of this report. Overall, low innovation spending and the correspondingly lower innovation output in ECA is concerning because it may make catching up to the frontier in digitalization even harder. However, there is also great potential for productivity gains, if innovation activity grows across the region.

FIGURE 3.7 Research and development spending averages 0.5 percent of GDP in ECA, with large variation across countries



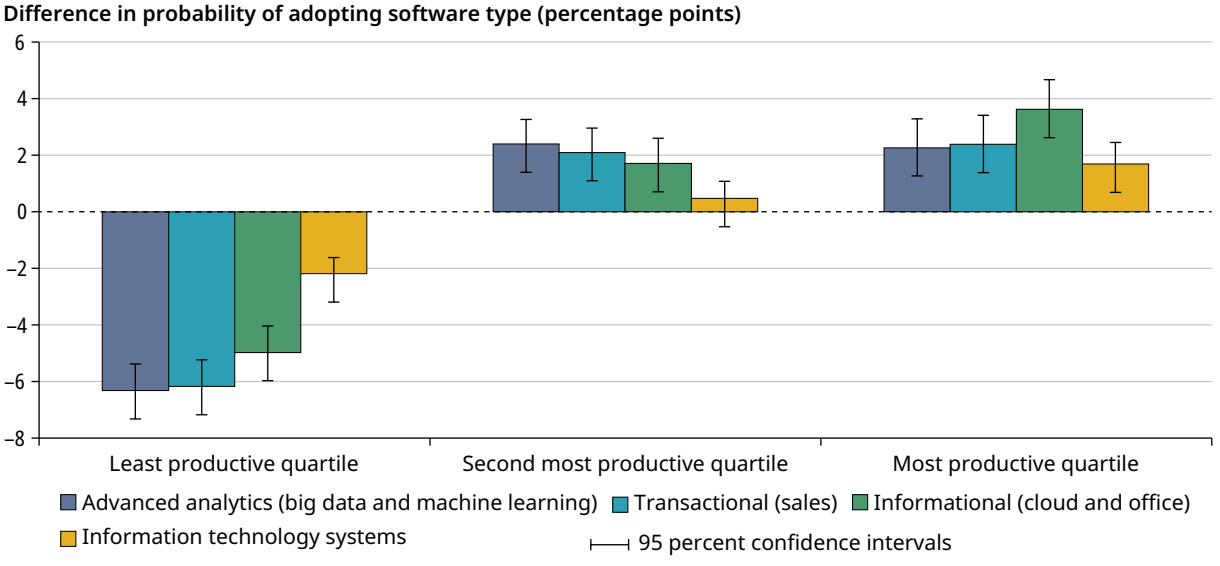
Source: World Bank, World Development Indicators database.

Note: ECA = Europe and Central Asia; GDP = gross domestic product; R&D = research and development.

In addition to the gap with advanced economies, ECA shows differences in digital sophistication within countries between high- and low-productivity firms. Data on software installation from 65,000 firms in five ECA countries (Bulgaria, Poland, Romania, Türkiye, and Ukraine) indicate that companies in the top two quartiles of the productivity distribution are about 8 percent more likely than firms in the bottom quartile to adopt advanced applications and analytics such as machine learning and sales software (figure 3.8). Given that the share of adopters in the sample ranges from 52 percent to 58 percent, that represents a 14–15 percent increase between the lowest and highest quartiles. The differences are particularly pronounced for advanced analytics, sales, and workplace software and much smaller for IT systems. These findings are in line with those from a recent study of Organisation for Economic Co-operation and Development countries (Calvino, Criscuolo, and Ughi 2024).

Despite the positive impacts of digitalization on productivity, there are also concerns that technologies like AI could reduce employment, although the overall displacement risk appears low in ECA. While AI can provide substantial productivity gains for certain occupations (Brynjolfsson, Li, and Raymond 2025; refer to box 3.2 for additional details), one fear is that AI-driven automation will replace numerous jobs, causing high unemployment (Acemoğlu and Restrepo 2019; Autor et al. 2024). However, for ECA the risk of automation-induced mass

FIGURE 3.8 More productive firms are more likely to adopt advanced software



Sources: Orbis; Spiceworks Ziff Davis.

Note: Firms are categorized into quartiles based on productivity within their sector (at the four-digit NACE level). The reference category is second least productive quartile. The regression controls for firm size, ownership (foreign or domestic and state-owned or private), and three types of fixed effects (sector at the one-digit NACE level, year, and country). The data cover Bulgaria, Poland, Romania, Türkiye, and Ukraine. NACE = European Statistical Classification of Economic Activities.

unemployment appears to be low, as at least 70 percent of the workers in ECA have occupations that are minimally exposed or not exposed to automation through generative AI (figure 3.9). Exposure is highest in the Western Balkans and lowest in Central Asia (refer to figure 3A.6 in online annex 3A). Women tend to be more affected by automation risks than men because women tend to work in jobs with a larger share of tasks at risk of being automated. Differences across age groups tend to be small, with the 25–34 cohort most exposed. Exposure does not necessarily mean displacement—it can also mean augmentation. In many jobs, particularly those where exposure is concentrated in a few tasks, AI-enhanced automation may free workers to spend more time on tasks that cannot be automated, leading to higher productivity.

BOX 3.2 Artificial intelligence, productivity, and economic growth

Artificial intelligence (AI) is advancing at remarkable speed and will potentially profoundly influence the trajectory of the global economy. By expanding production possibilities, AI is likely already reshaping investment patterns, altering the balance between labor and capital, and transforming the structure of industries. Its ability to process vast quantities of data, improve forecasting accuracy, and support complex decision-making could act as a catalyst for productivity growth, economic expansion, and improved living standards. At the same time, the breadth of potential applications means that its long-term economic and social consequences remain uncertain. These prospects generate both optimism about productivity gains and concerns about possible disruptions to employment and labor markets (Ilzetzki and Jain 2023; IMF 2025).

Despite its potential, the actual impact of AI on productivity is still unknown. Historical experience has shown that technological breakthroughs do not always lead to immediate or predictable gains in aggregate productivity. Nobel laureate Robert Solow famously captured this paradox in 1987, noting that "computers were everywhere except in the productivity statistics" (Solow 1987). According to the Brookings Institution, annual productivity growth averaged around 3 percent between 1995 and 2005—likely driven by the spread of digital technologies—but slowed to roughly 1.5 percent from 2005 to 2022, similar to the rate observed between 1973 and 1995 (Financial Times 2025).

To date, the diffusion of AI has not translated into faster productivity growth at the macroeconomic level, and it has not reversed the prolonged slowdown (Goldin et al. 2024; Filippucci et al. 2024). One explanation is that productivity improvements often require complementary capabilities—such as a skilled workforce and high-quality management—to integrate and exploit the new technologies effectively. The absence of these complementarities, or the time needed for them to materialize, may help explain

Continued

BOX 3.2 Artificial intelligence, productivity, and economic growth *(Continued)*

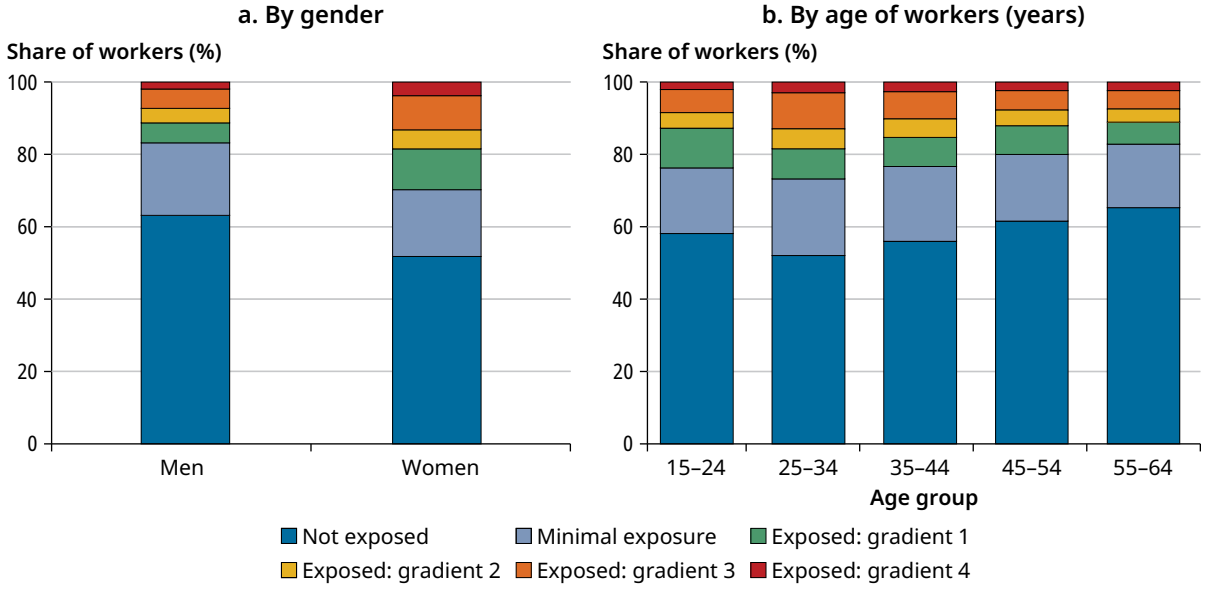
the lack of visible gains (Bergeaud et al. 2025; Cirera, Comin, and Cruz 2025). Evidence from Organisation for Economic Co-operation and Development economies has shown that firms adopting and effectively using AI outperform their peers (Calvino and Fontanelli 2023; Czarnitzki, Fernandez, and Rammer 2023). AI adoption is also associated with higher worker efficiency (Brynjolfsson, Li, and Raymond 2023; Peng et al. 2023). Experimental studies have further found that AI tools can enhance both the speed and quality of knowledge-intensive work, including professional writing and business consulting (Dell'Acqua et al. 2023; Haslberger, Gingrich, and Bhatia 2023; Noy and Zhang 2023). Therefore, although aggregate productivity growth gains are yet to materialize, microeconomic evidence has shown that the performance prospects could be promising.

The implications of AI for labor markets remain uncertain. Earlier waves of automation and digitalization primarily affected routine and lower-skill jobs, whereas AI also reaches into domains requiring advanced cognitive abilities, data analysis, and research. As a result, its impact will vary across sectors and countries, reflecting differences in economic structures and stages of development. Advanced economies—where 6 in 10 jobs are exposed to AI—face greater risks but also have stronger capabilities to capture potential benefits. In emerging markets and low-income countries, exposure ranges between 2 and 4 in 10 jobs (Georgieva 2024). Research by the International Monetary Fund and JPMorgan has suggested that AI could displace up to half of US jobs by 2034. Although such large-scale occupational shifts have occurred before, the speed of this transformation could heighten social pressures (Cazzaniga et al. 2024).

Maximizing the benefits of AI while mitigating risks will require proactive policies aimed at fostering inclusive and sustainable growth. Policy priorities will vary by country, but key areas include strengthening human capital, updating labor regulations, improving digital infrastructure, deepening economic integration, and supporting innovation (Tett 2025; Georgieva 2024).

To reap the benefits of AI while protecting citizens from adverse effects, ECA countries need to invest in their AI preparedness. Good preparedness for AI depends on several prerequisites, such as digital infrastructure, skilled workers, labor markets with a safety net for displaced workers and strong legal frameworks, and enforcement mechanisms to protect citizens from adverse effects. The International Monetary Fund summarizes these dimensions in its AI Preparedness Index (figure 3.10). Preparedness varies widely in ECA, with the four EU member countries close to the EU average and countries in Central and Eastern ECA farther behind.

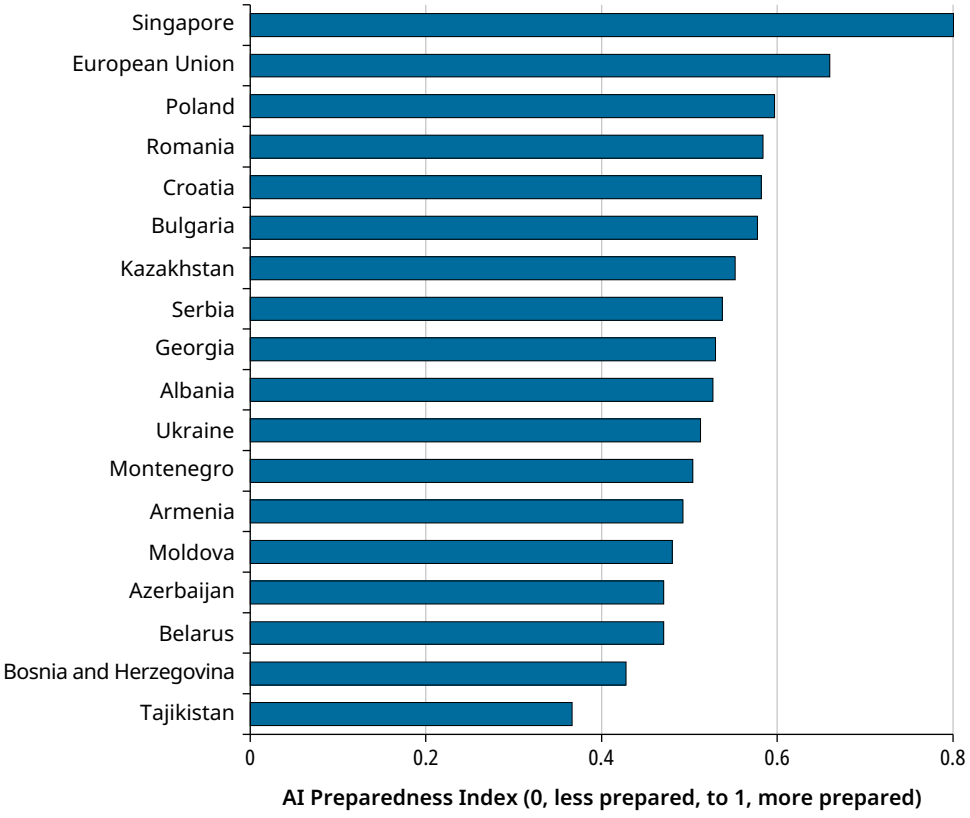
FIGURE 3.9 Female workers in ECA are more exposed than male workers to automation risks from generative AI



Sources: Labor force surveys from 16 countries in Europe and Central Asia (Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kosovo, Montenegro, North Macedonia, Poland, Romania, Serbia, Tajikistan, Türkiye, and Uzbekistan).

Note: Exposure to AI is calculated at the four-digit occupation code level of the International Standard Classification of Occupations 2008, based on the methodology in Gmyrek et al. (2025). Minimal exposure means only a few tasks are at risk of automation by generative AI. Gradient 4 refers to jobs with the highest share of tasks at risk of AI-driven automation. AI = artificial intelligence.

FIGURE 3.10 Preparedness for implementing AI varies across ECA



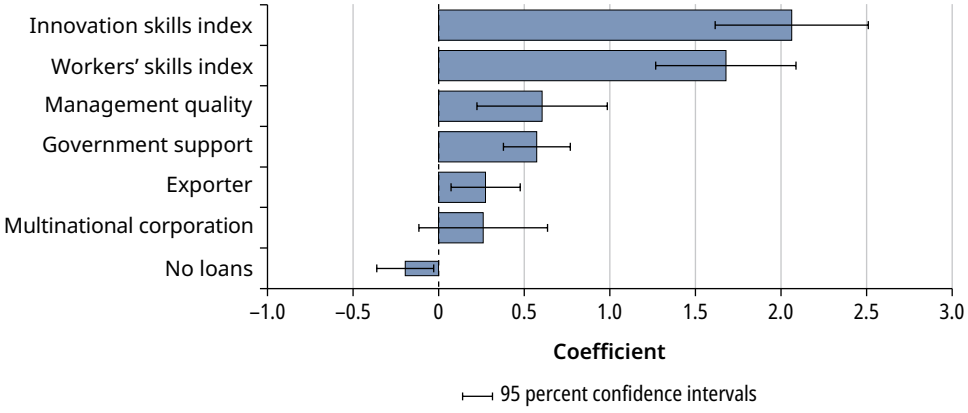
Source: Cazzaniga et al. 2024.

Note: The AI Preparedness Index combines multiple indicators across four equally weighted dimensions: digital infrastructure, human capital and labor market policies, innovation and economic integration, and regulation and ethics. AI = artificial intelligence.

What Drives Firms' Adoption and Use of Digital Technologies?

Given the strong productivity benefits of digital technologies, why are more firms not adopting and using advanced digital technologies? Workers' skills, managers' skills, and management quality are the main predictors of firm digitalization (figure 3.11). Exporters and firms with government support also show higher digitalization. These findings are in line with a recent World Bank study in Armenia that identified management quality and international market access, among other factors, as drivers of digital technology adoption (World Bank 2024a). This section details how skills availability and competition affect firm digitalization.

FIGURE 3.11 Workforce and management skills and quality drive digitalization



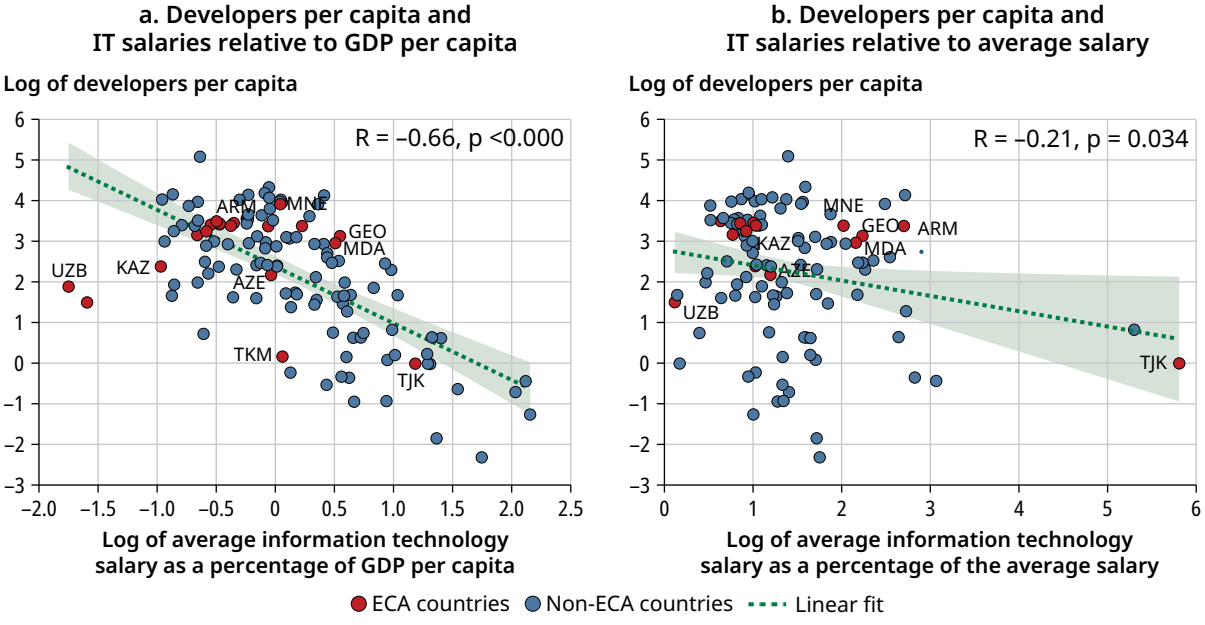
Source: World Bank Firm-level Adoption of Technology survey.

Note: The regression examines how select covariates influence digital technology adoption in business administration across Croatia, Georgia, and Poland. Workers' skills are measured by the innovation and skills index, which combines the college-educated percentage of the workforce, the share of staff working in research and development, and recent equipment and software modifications. Managers' skills are measured by the management human capital index, which combines managers' education and experience. Management quality is measured by the managerial quality index, which combines formal incentives, performance indicators, and nonfamily business status. No loans indicates that a firm has not taken out a loan for technology purchases in the past three years. Exporter and MNC are binary variables. The regression also controls for sector, firm size and region, access to digital enablers, firm ownership, and capital intensity. The data for Poland are from 2021, and the data for Georgia and Croatia are from 2022.

Digital skills and management practices

Having high-skilled workers and managers is the most important driver of digital technology adoption, but higher labor costs may impede hiring. Workers' skills, managers' skills, and management quality are key to digital technology adoption (see figure 3.11), but skilled IT staff might be scarce and expensive in less advanced parts of ECA. The number of people who upload code on GitHub per capita (a proxy for the density of skilled IT personnel in an economy) is inversely correlated with the average IT salary. This means that countries with a smaller supply of digitally skilled people need to pay higher salaries to IT workers relative to GDP per capita (figure 3.12, panel a) and the average salary (figure 3.12, panel b). Although the correlation between IT salaries and average salary is weaker, it confirms the negative association between IT salaries and GDP per capita.

FIGURE 3.12 Countries with fewer developers per capita need to pay higher IT wages relative to GDP per capita and the average salary

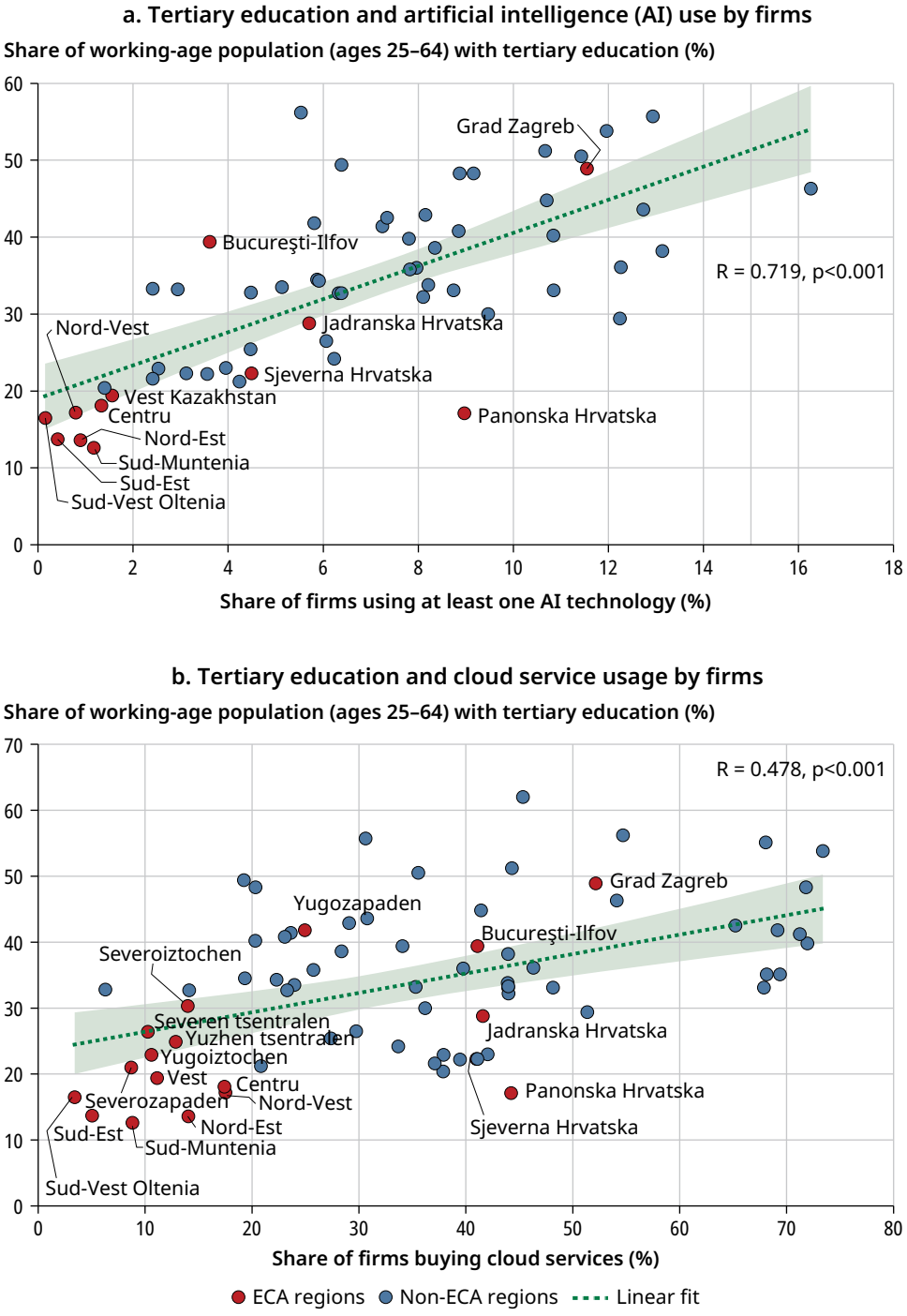


Sources: GitHub 2024; International Labour Organization; World Development Indicators database, World Bank; Worldsalaries.com.

Note: The shaded area is the 95 percent confidence interval. The data on developers per capita are based on the number of people that upload code on GitHub. The data cover 2020–24. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia; GDP = gross domestic product; IT = information technology; R = Pearson correlation coefficient.

Firms in regions with a higher-skilled workforce tend to have a higher share of firms adopting digital technologies. There is a strong correlation (greater than 0.7) between the share of the working-age population with tertiary education and adoption of AI technologies by EU firms, confirming the link between the availability of high-skilled labor and firm digitalization (figure 3.13, panel a). The correlation is slightly weaker for cloud usage (just below 0.5), but the results point in the same direction (figure 3.13, panel b). Most ECA subnational regions, except the capital regions of Croatia and Romania, exhibit low tertiary education and low firm digitalization compared to other European regions. The positive association between the availability of skilled workers in a subnational region and digital adoption is in line with findings from a broader study of 12 European countries (Falk and Biagi 2017).

FIGURE 3.13 Subnational regions in ECA with a higher-skilled workforce lead in adopting digital technologies



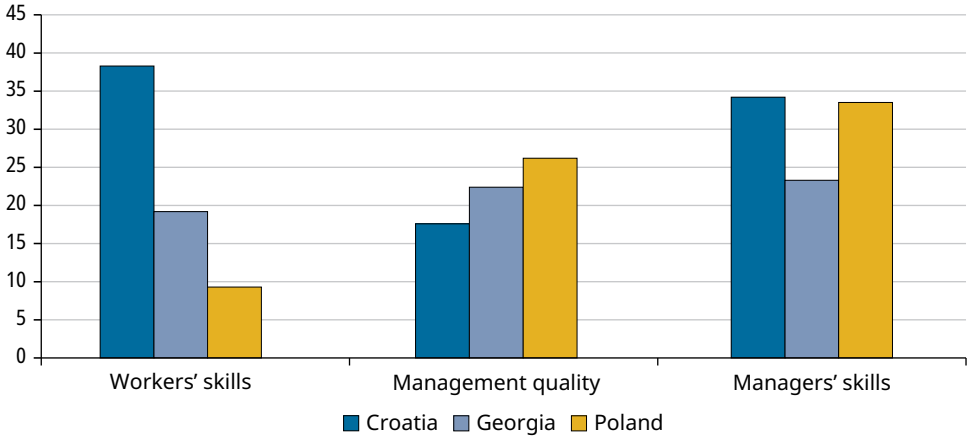
Source: Eurostat.

Note: The sample comprises the population ages 25 to 64. The shaded area is the 95 percent confidence interval. The data are from 2023. AI = artificial intelligence; ECA = Europe and Central Asia; R = Pearson correlation coefficient.

In addition to workers' skills, managers' skills and management quality are important for firms' integration of new technologies. Together, for firms in Croatia, Georgia, and Poland, the differences in the human capital of workers and managers (proxied by education background) and the quality of a firm's managerial practices explain explain 35–50 percent of the variation between firms at the 10th and 90th percentile of digital intensity (figure 3.14). This finding underlines the importance of skills and education. The importance of each factor differs across countries: Having high-skilled employees explains 19.2 percent of the variation in Georgia and 38.3 percent in Croatia but only 9.3 percent in Poland. A recent impact evaluation of a World Bank project in Bulgaria, Poland, and the Slovak Republic highlighted the crucial role of managers' skills in implementing digital solutions in firms. Companies that received both financial subsidies and 12-week capacity-building support on selecting, implementing, and using digital tools saw a 12.5 percent increase in the use of those tools (box 3.3). In contrast, firms that received only financial support showed no improvement compared to a similar control group.

FIGURE 3.14 Human capital and management quality explain 35–50 percent of the variation between firms at the 10th and 90th percentiles of digital intensity

Share of the variation explained between firms in at the 10th percentile of digital intensity and firms at the 90th percentile (%)



Source: World Bank Firm-level Adoption of Technology survey.

Note: Total variation explained is smaller than sum of bars, due to interactions between variables. Workers' skills are measured by the innovation and skills index, which combines the college-educated percentage of the workforce, the share of staff working in research and development, and recent equipment and software modifications. Management quality is measured by the managerial quality index, which combines formal incentives, performance indicators, and nonfamily business status. Managers' skills are measured by the management human capital index, which combines managers' education and experience. The data for Poland are from 2021, and the data for Georgia and Croatia are from 2022.

BOX 3.3 Bridging the capability gap: Evidence from the Digitrans digitalization pilot for micro, small, and medium-sized enterprises

Despite strong evidence linking managerial capabilities to successful digitalization, most EU public support for micro, small, and medium-sized enterprises focuses on financial assistance. The Digitrans pilot was designed to address this critical gap with a novel approach combining capability building with financial support. The approach tests whether enhancing firms' managerial and organizational foundations leads to more successful digital adoption, more intensive and productive technology use, and ultimately stronger business performance.

The impact of the program was evaluated through a rigorously designed randomized controlled trial with 595 participating firms across Bulgaria, Poland, and the Slovak Republic. The program targeted micro and small enterprises with 5 to 35 employees at the foundational digital sophistication level across all economic sectors, with a median annual revenue of €510,000. To determine the most effective approach for accelerating digitalization, firms in each country were randomly assigned to one of three groups: firms that received only a financial subsidy (65 firms per country); firms that received both a financial subsidy and technical assistance (65 firms per country); and comparison group firms, which received neither a financial subsidy nor technical assistance (65 firms per country).

All participating firms received automated benchmarking reports generated from application and interview data, including slide presentations comparing their digital maturity across eight general business functions and artificial intelligence applications with that of their peers.

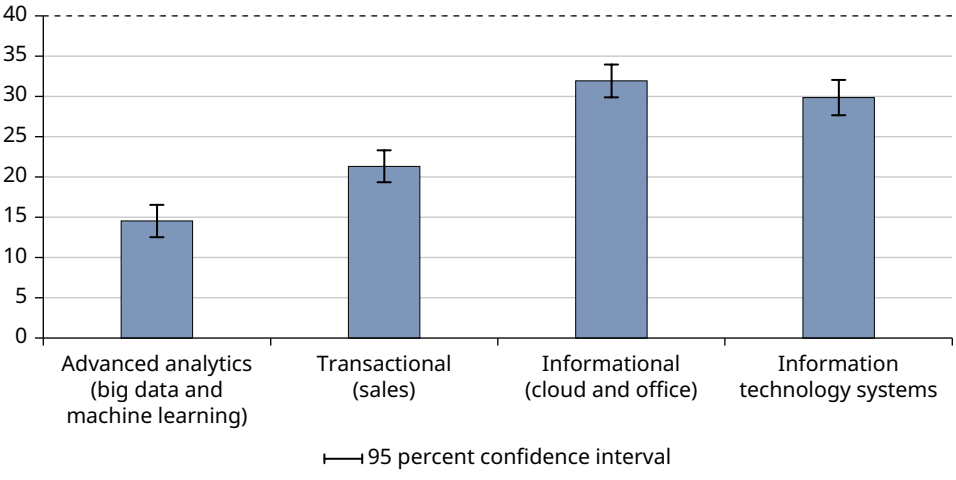
The following were among the key findings:

- Firms that received both a financial subsidy and technical assistance showed a 12.5 percent increase in digital tool use (measured using the extensive general business functions index), compared to no significant change for firms that received only a financial subsidy.
- Intensity of technology use (measured using the intensive general business functions index) increased by over a fifth among firms that received both a financial subsidy and technical assistance, correlating with approximately one-third higher firm productivity relative to firms that exhibited no meaningful change in digital tool use.
- Firms that received both a financial subsidy and technical assistance were twice as likely to implement the organizational changes needed for effective digitalization, with 70 percent implementing changes in at least one business function, compared to less than 50 percent in the comparison group.
- While firms that received only a financial subsidy saw no significant effect on managerial practices, firms that received both a financial subsidy and technical assistance increased adoption of these practices by 9.3 percent, particularly change management practices (12.9 percent) and planning practices (6.0 percent).
- Firms that received both a financial subsidy and technical assistance invested an average of 30 percent more in digital tools and selected more sophisticated solutions and solutions with longer subscription periods, compared to firms that received only a financial subsidy.

Skills and capital to implement digital solutions can also come from abroad. The 2024 World Development Report stated that to overcome the middle-income trap, countries first need to combine investment with "infusion," integrating new technologies from abroad (World Bank 2024b). This can be achieved by importing foreign technologies and encouraging their adoption by domestic firms, as Korea did in the 1970s and 1980s, or by spurring foreign direct investment, as Poland did during the 2000s. In both cases, this requires technically skilled workers to integrate the new solutions into work processes.[5] Foreign-owned firms tend to have higher shares of adoption of transactional and informational software and IT systems, but not of advanced technologies (figure 3.15). The effect is essentially driven by US-owned firms, which have higher adoption rates than firms with foreign owners from other parts of the world (figure 3.16). This finding confirms the results from a previous study, which found that US multinationals obtain higher productivity gains from IT investment than non-US multinationals do (Bloom, Sadun, and Van Reenen 2012). One reason for higher adoption of informational and transactional software could be that domestic subsidiaries need to install these systems to operate with their foreign parent companies.

FIGURE 3.15 Foreign-owned firms tend to be more digitalized

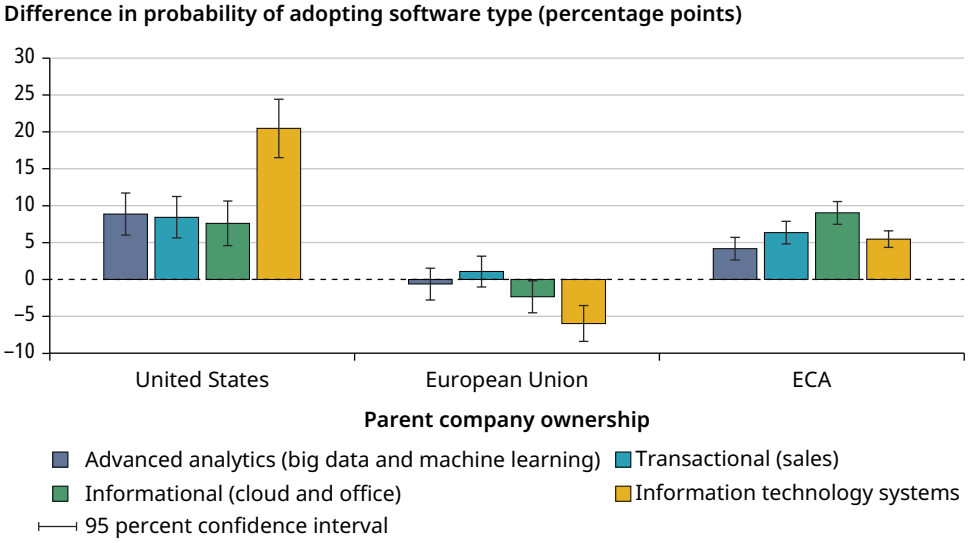
Difference in probability of adopting software type (percentage points)



Sources: Orbis; Spiceworks Ziff Davis.

Note: The reference category is domestically-owned firms. The results are based on an ordinary least squares regression on a binary dummy variable of having installed at least one software application of the indicated type, with controls for firm size, firm productivity quartile, and three types of fixed effects (sector at the one-digit European Statistical Classification of Economic Activities level, country, and year). The data cover Bulgaria, Poland, Romania, Türkiye, and Ukraine (2016–21).

FIGURE 3.16 Firms with US parent companies are more digitalized than firms with owners from other parts of the world across all types of software



Sources: Orbis; Spiceworks Ziff Davis.

Note: The reference category is firms with foreign owners that are not from the United States, European Union, or Europe and Central Asia. The results are based on an ordinary least squares regression on a binary dummy variable of having installed at least one software application of the indicated type, with controls for firm size, firm productivity quartile, and three types of fixed effects (sector at the one-digit European Statistical Classification of Economic Activities level, year, and country). The data cover Bulgaria, Poland, Romania, Türkiye, and Ukraine (2016–21). ECA = Europe and Central Asia.

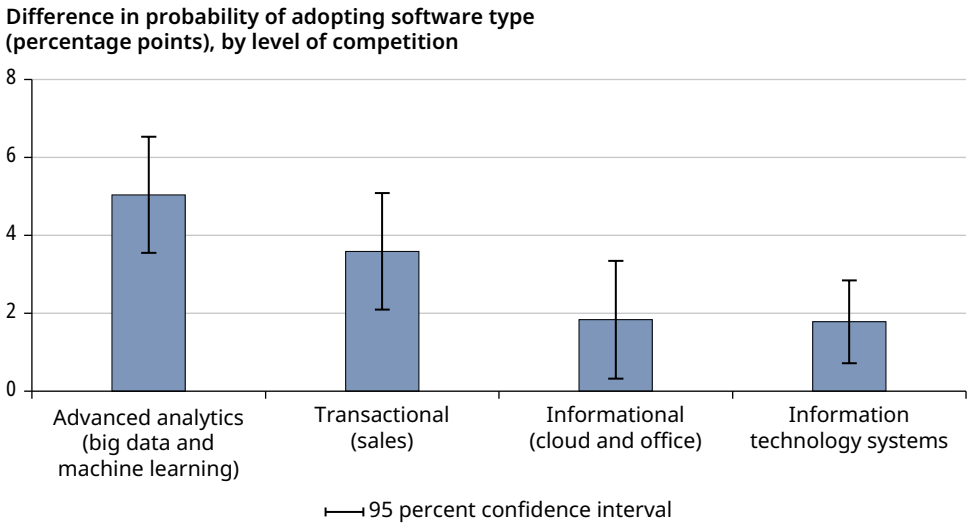
Misallocation and access to large markets

Misallocation is another important driver of differences in technology adoption across countries because it affects both the potential gains and costs of adoption and thus shapes firms' incentives to adopt. Misallocation of resources—that is, not allocating resources to the most productive firms—can have a variety of causes, such as regulations, property rights, trade and competition, or financial and informational friction (Restuccia and Rogerson 2017). Misallocation is widespread in ECA (refer to chapter 1). A growing literature has shown that misallocation also affects a firm's decision on whether to invest in new technologies (Ayerst 2025; Bloom et al. 2022). Misallocation can affect technology adoption through a variety of channels: Misallocation of credit—for example, through subsidized interest rates for state-owned enterprises (SOEs) (Cusolito, Fattal-Jaef, Patiño Peña, and Singh 2024)—increases the relative cost of adoption for private firms and may lead to underinvestment in technological upgrades with high upfront costs. This applies especially to digital technologies, which tend to have higher fixed costs and low marginal costs (Calligaris, Criscuolo, and Marcolin 2018). Another channel is the degree of competitive pressure that firms face, which moderates their propensity to invest in and use digital technologies. In Mexico, the productivity-enhancing impact of IT investment exists only in sectors exposed to high competition from China, but

productivity gains are restricted to firms that also underwent organizational changes (Iacovone et al. 2023), which underlines the necessity of good managerial practices.

In ECA, firms in more competitive sectors and sectors with fewer SOEs are more likely to adopt digital technologies. Although misallocation is difficult to measure, two proxies are available: market concentration at the country-sector level and the share of SOEs in a country sector. Firms in sectors with more competition, measured by an inverse Hirschman-Herfindahl Index,[6] have a higher probability of adopting different types of software (figure 3.17). There are small differences (less than 2 percentage points) in the adoption rates of informational software and IT systems, suggesting that competitive pressures do not explain differences in investment decisions related to the basic functioning of the firms. However, competitive pressures affect investment in more productivity-enhancing software categories, such as advanced analytics and digital payment services to reach new customers. Firms in subsectors with a higher concentration of SOEs tend to have less digitalization, even after controlling for high-level sectoral differences (at the one-digit level of the European Statistical Classification of Economic Activities), productivity, size, and other ownership-related characteristics (figure 3.18). Again, the most productivity-enhancing and sophisticated software type, advanced analytics, shows the lowest adoption rate.

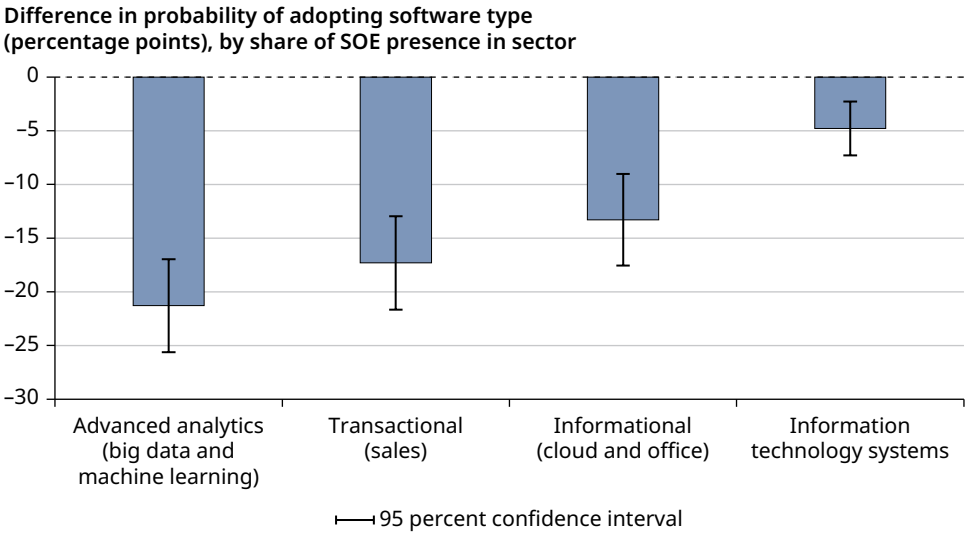
FIGURE 3.17 Firms in sectors with lower market concentration (higher competition) are more likely to adopt digital software



Sources: Orbis; Spiceworks Ziff Davis.

Note: Competition is measured using the inverse Hirschman-Herfindahl Index at the country-sector level (at the four-digit level of the European Statistical Classification of Economic Activities). The results are based on an ordinary least squares regression on a binary dummy variable of having installed at least one software application of the indicated type, with controls for firm size, firm productivity quartile, and three types of fixed effects (sector at the one-digit European Statistical Classification of Economic Activities level, year, and country). The data cover Bulgaria, Poland, Romania, Türkiye, and Ukraine (2016–21).

FIGURE 3.18 Sectors with a large presence of SOEs have a lower share of digital technology adoption

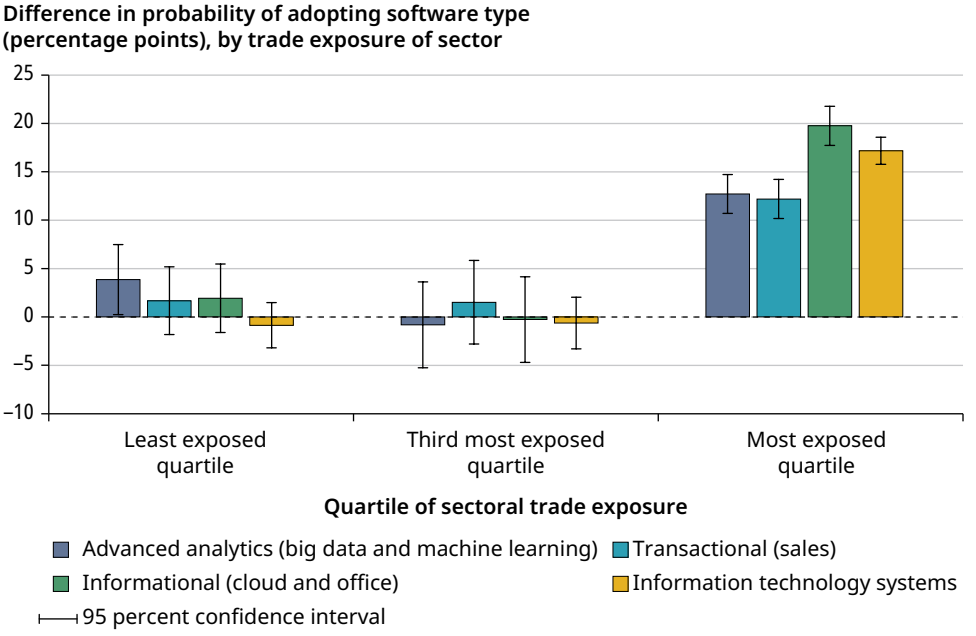


Sources: Orbis; Spiceworks Ziff Davis.

Note: The presence of SOEs is measured using the share of SOEs in a sector (at the four-digit NACE level). The results are based on an ordinary least squares regression on a binary dummy variable of having installed at least one software application of the indicated type, with controls for firm size, firm productivity quartile, and three types of fixed effects (sector at the one-digit NACE level, year, and country). The data cover Bulgaria, Poland, Romania, Türkiye, and Ukraine (2016–21). NACE = European Statistical Classification of Economic Activities; SOE = state-owned enterprise.

Access to larger markets also plays an important role in firm digitalization through economies of scale, network effects, and stronger selection effects, underlining the importance of trade integration for digital technology adoption in ECA. Differences in markups and productivity between large firms and SMEs have increased over the past four decades (De Loecker, Eeckhout, and Unger 2020), particularly in digitally intensive sectors (Calligaris, Criscuolo, and Marcolin 2018). This is partly because of strong network effects and partly because the cost structure of digital investment, with higher fixed costs and usually very low marginal costs, provides large economies of scale that amplify differences between large and small firms. To grow and benefit more from the impact of digital technologies, firms in ECA need better access to larger markets, such as the European Union or neighboring countries. Better trade integration (refer to chapter 2) has benefits for firm digitalization: Operating in a sector with higher trade exposure, measured as total trade over total value added, is associated with a higher probability of adopting different types of software (figure 3.19). Access to larger markets can affect technology through competition (because selection effects tend to be bigger [Melitz and Ottaviano 2008]) or because new customers incentivize firms to improve their production processes (Atkin, Khandelwal, and Osman 2017).

FIGURE 3.19 Operating in a sector with higher trade exposure is associated with a higher probability of adopting digital technologies



Sources: Eurostat; Orbis; Spiceworks Ziff Davis.

Note: The reference category is the second most exposed quartile. Trade exposure is measured as imports plus exports, divided by total value added, at the two-digit NACE level, based on Eurostat data. The results are based on an ordinary least squares regression on a binary dummy variable of having installed at least one software application of the indicated software type, with controls for firm size, firm productivity quartile, and three types of fixed effects (sector at the one-digit NACE level, year, and country). The data cover Bulgaria, Poland, Romania, Türkiye, and Ukraine (2016–21). NACE = European Statistical Classification of Economic Activities.

Conclusion and Policy Recommendations

Firms in ECA are becoming more digitalized, but they need to speed up their use of digital technologies to avoid widening the gap with the frontier and to reap important productivity benefits. The productivity gains from digitalization are considerable: Catching up to the European frontier in cloud services would boost productivity by 18 percent to 25 percent. However, firms may need to overcome a variety of barriers to integrate novel technologies into their business processes. Skills, market competition, and access to finance stand out as three main facilitators of digitalization. So what can governments do to reduce these barriers and help firms digitalize faster and deeper? Concrete policy solutions require a deeper understanding of each country's context, the country-specific constraints that firms face, and how different firms react to these challenges. The following recommendations provide some general directions for increasing digital technology use across ECA:

- Subsidizing access, purchase, and adoption of digital technologies alone is insufficient; governments need to incentivize their widespread use within firms. Universal access to basic digital enablers such as the internet or computers does not guarantee the widespread use of advanced digital technologies in firms. Policy instruments that incentivize only the purchase of digital technologies might fall short because companies appear to have difficulty integrating advanced technologies into routine processes. Support should be conditioned on successfully integrating digital technologies into business processes to avoid new technologies being used only sporadically.

- Investing in the education and digital skills of ECA citizens can close the digital gap with the frontier economies. One reason behind incomplete digitalization is that firms lack workers with enough skills to integrate and operate advanced digital technologies once they have been acquired. Because firm digitalization is related to workers' basic education and their specific digital skills, improving both traditional education and vocational or on-the-job training can foster digitalization in the private sector. On-the-job training initiatives should be developed jointly by industry, academia, and the government and potentially in collaboration with educational technology platforms to ensure digital skills training is aligned with industry demand and easily accessible. Introducing national digital skills strategies that develop different policies for basic and more advanced skills could help to promote digital skills across all education and skill levels.

- Fostering competition by promoting market entry and leveling the playing field between SOEs and private firms can help promote the digitalization of firms. Digitalization levels vary widely across sectors, and the level of competition and presence of SOEs in a sector may shape firms' propensity to invest in digital technology. Firms that have been exposed to more competition show higher adoption of sophisticated digital solutions, such as advanced analytical software, which have a higher positive association with productivity. Hence, facilitating entry of domestic and foreign firms into more concentrated sectors can incentivize firms to digitalize and yield productivity gains. Creating a conducive business environment, including through promoting alternative sources of financing, is particularly important for digital start-ups. Digital start-ups often adopt new business models and are more productive, which can catalyze creative destruction.

- Investing in digital infrastructure remains important, particularly in the middle-income countries of ECA. In these countries, lack of connectivity (beyond basic internet) remains an obstacle to firm growth. Digital infrastructure investment priorities vary across countries but could include high-speed internet, internet exchange points, and access to computing infrastructure, either through domestic data centers or by supporting usage of international providers.

Different policies need to target different countries and firms, as constraints differ. There is considerable variation in firm digitalization within and across countries, which may require different solutions. For example, the distance to the frontier in the intensive use of digital technologies is driven more by older firms than by younger ones, suggesting that mature firms have greater difficulty digitalizing business functions. Similarly, on use of basic digital enablers (such as cloud services and e-commerce), smaller firms in less advanced ECA countries—but not in Croatia and Poland—are struggling to catch up to the frontier countries. Table 3.1 summarizes the policy recommendations arising from this chapter, with varying priority levels for each of the ECA country clusters.

TABLE 3.1 Priority level for policy recommendations, by country group

Recommendation	High-income and EMDE	EU accession	Central Asia	
			Resource-intensive	Non-resource-intensive
Facilitate access to basic digital goods and services	Low	Low	High	High
Invest in digital skills and education	Medium	High	High	High
Foster market entry and competition to increase incentives for digital upgrading	Medium	High	High	High
Invest in digital infrastructure (for example, high-speed internet, international exchange points, computing infrastructure)	Low	Medium	High	High

Source: World Bank.

Note: High-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; EU accession comprises Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Moldova, Montenegro, North Macedonia, Serbia, and Ukraine; Central Asia, resource-intensive comprises Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan; Central Asia, non-resource-intensive comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan. Low, medium, and high indicate priority levels. EMDE = emerging markets and developing economies.

Notes

1. For more details on the broader benefits of digital infrastructure for development, refer to Clark et al. (2025).
2. The correlation between AI use and productivity is positive but not statistically significant, which is likely due to the very small sample (AI data from Eurostat are available only for 2021). Recent causal evidence from the United States suggests that generative AI raises worker productivity, measured in issues resolved per hour, by 15 percent (Brynjolfsson, Li, and Raymond 2025).
3. Based on Eurostat data.
4. The scale refers to the sophistication of the technology used, and the categories vary by business function. For business administration, 1 indicates handwritten business administration and 5 indicates use of enterprise resource planning software.

5. Although foreign-owned firms may often temporarily send headquarters staff to integrate new technologies into subsidiaries, long-term success requires enough skilled domestic workers to operate and maintain the technology.
6. The Hirschman-Herfindahl Index is a widely used metric of market concentration that is the sum of the squared market shares of firms within a sector. Lower values indicate a less concentrated market.

References

Acemoğlu, D., and P. Restrepo. 2019. "Automation and New Tasks: How Technology Displaces and Reinstates Labor." *Journal of Economic Perspectives* 33 (2): 3–30.

Atkin, D., A. K. Khandelwal, and A. Osman. 2017. "Exporting and Firm Performance: Evidence from a Randomized Experiment." *Quarterly Journal of Economics* 132 (2): 551–615.

Autor, D., C. Chin, A. Salomons, and B. Seegmiller. 2024. "New Frontiers: The Origins and Content of New Work, 1940–2018." *Quarterly Journal of Economics* 139 (3): 1399–465.

Ayerst, S. 2025. "Distorted Technology Adoption." *Economic Journal* 135 (668): 1167–90.

Bergeaud, A., A. B. Jaffe, and D. Papanikolaou. 2025. "Natural Language Processing and Innovation Research." Working Paper 33821, National Bureau of Economic Research, Cambridge, MA.

Bessen, J. 2020. "Industry Concentration and Information Technology." *Journal of Law and Economics* 63 (3): 531–55.

Bloom, N., M. Draca, T. Kretschmer, R. Sadun, H. Overman, and M. Schankerman. 2010. "The Economic Impact of ICT." London School of Economics, Centre for Economic Performance, London.

Bloom, N., R. Sadun, and J. Van Reenen. 2012. "Americans Do IT Better: US Multinationals and the Productivity Miracle." *American Economic Review* 102 (1): 167–201.

Bloom, N., L. Iacovone, M. Pereira-Lopez, and J. Van Reenen. 2022. "Management and Misallocation in Mexico." Working Paper 29717, National Bureau of Economic Research, Cambridge, MA.

Borowiecki, M., F. Giovannelli, and J. Høj. 2023. "COVID-19 and Productivity-Enhancing Digitalisation: Firm-Level Evidence from Slovenia." OECD Economics Department Working Paper 1766, Organisation for Economic Co-operation and Development, Paris. https://doi.org/10.1787/5f7e9340-en.

Brynjolfsson, E., D. Li, and L. Raymond. 2025. "Generative AI at Work." *Quarterly Journal of Economics* 140 (2): 889–942. https://doi.org/10.1093/qje/qjae044.

Calligaris, S., C. Criscuolo, and L. Marcolin. 2018. "Mark-ups in the Digital Era." OECD Science, Technology, and Industry Working Paper 2018/10, Organisation for Economic Co-operation and Development, Paris. https://doi.org/10.1787/4efe2d25-en.

Calvino, F., C. Criscuolo, and A. Ughi. 2024. "Digital Adoption During COVID-19: Cross-Country Evidence from Microdata." OECD Science, Technology and Industry Working Paper 2024/03, Organisation for Economic Co-operation and Development, Paris. https://doi.org/10.1787/f63ca261-en.

Calvino, F., and L. Fontanelli. 2023. "A Portrait of AI Adopters Across Countries." OECD Science, Technology and Industry Working Paper 2023/02, Organisation for Economic Co-operation and Development, Paris.

Cazzaniga, M., F. Jaumotte, L. Li, et al. 2024. "Gen-AI: Artificial Intelligence and the Future of Work." IMF Staff Discussion Note SDN2024/001, International Monetary Fund, Washington, DC.

Cirera, X., D. A. Comin, and M. Cruz. 2024. "Anatomy of Technology and Tasks in the Establishment." Working Paper w32281, National Bureau of Economic Research, Cambridge, MA.

Clark, J., G. Marin, O. P. Ardic Alper, and G. A. Galicia Rabadan. 2025. "Digital Public Infrastructure and Development: A World Bank Group Approach." Digital Transformation White Paper, volume 1, World Bank, Washington, DC. http://hdl.handle.net/10986/42935.

Cohen, W. M., and D. A. Levinthal. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation." *Administrative Science Quarterly* 35 (1): 128–52.

Comin, D. A., X. Cirera, and M. Cruz. 2025. "Technology Sophistication Across Establishments." Working Paper 33358, National Bureau of Economic Research, Cambridge, MA.

Criscuolo, C., P. Gal, L. Leidecker, F. Losma, and G. Nicoletti. 2021. "The Role of Telework for Productivity during and Post-COVID-19: Results from an OECD Survey among Managers and Workers." OECD Productivity Working Paper 2021-31, Organisation for Economic Co-operation and Development, Paris.

Cusolito, A. P., R. N. F. Jaef, F. P. Peña, and A. V. Singh. 2024. "The Financial Premium and Real Cost of Bureaucrats in Businesses." Policy working paper, World Bank, Washington, DC.

Czarnitzki, D., G. P. Fernández, and C. Rammer. 2023. "Artificial Intelligence and Firm-Level Productivity." *Journal of Economic Behavior and Organization* 211 (July 2023): 188–205.

De Loecker, J., J. Eeckhout, and G. Unger. 2020. "The Rise of Market Power and the Macroeconomic Implications." *Quarterly Journal of Economics* 135 (2): 561–644.

Dell'Acqua, F., E. McFowland III, E. R. Mollick, et al. 2023. "Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity and Quality." Harvard Business School Technology and Operations Management Unit, Working Paper 24-013, Harvard University, Cambridge, MA.

Falk, M., and F. Biagi. 2017. "Relative Demand for Highly Skilled Workers and Use of Different ICT Technologies." *Applied Economics* 49 (9): 903–14.

Filippucci, F., P. Gal, A. Leandro, C. Jona-Lasinio, and G. Nicoletti. 2024. "The Impact of Artificial Intelligence on Productivity, Distribution and Growth: Key Mechanisms, Initial Evidence and Policy Challenges." OECD Artificial Intelligence Papers, No. 15, OECD Publishing, Paris. https://doi.org/10.1787/8d900037-en.

Georgieva, K. 2024. "AI Will Transform the Global Economy. Let's Make Sure It Benefits Humanity." International Monetary Fund. January 14, 2024. https://www.imf.org/en/Blogs/Articles/2024/01/14/ai-will-transform-the-global-economy-lets-make-sure-it-benefits-humanity.

GitHub. 2024. "Innovation Graph." GitHub, San Francisco, CA. https://github.com/github/innovationgraph.

Gmyrek, P., J. Berg, K. Kamiński, et al. 2025. "Generative AI and Jobs: A Refined Global Index of Occupational Exposure." ILO Working Paper 140, International Labour Organization, Geneva.

Goldin, I., P. Koutroumpis, F. Lafond, and J. Winkler. 2024. "Why Is Productivity Slowing Down?" *Journal of Economic Literature* 62 (1): 196–268.

Haslberger, M., J. Gingrich, and J. Bhatia. 2023. "No Great Equalizer: Experimental Evidence on AI in the UK Labor Market." Social Science Research Network Working Paper 4594466, Georgia State University Law Library, Atlanta, GA.

Iacovone, L., M. Pereira-López, and M. Schiffbauer. 2023. "Competition Makes IT Better: Evidence on When Firms Use IT More Effectively." *Research Policy* 52 (8): 104786.

Ilzetzki, E., and S. Jain. 2023. "The Impact of Artificial Intelligence on Growth and Employment." Center for Economic Research and Policy. https://cepr.org/voxeu/columns/impact-artificial-intelligence-growth-and-employment.

Kastelli, I., P. Dimas, D. Stamopoulos, and A. Tsakanikas. 2024. "Linking Digital Capacity to Innovation Performance: The Mediating Role of Absorptive Capacity." *Journal of the Knowledge Economy* 15 (1): 238–72.

Melitz, M. J., and G. I. Ottaviano. 2008. "Market Size, Trade, and Productivity." *Review of Economic Studies* 75 (1): 295–316.

Muzi, S., F. Jolevski, K. Ueda, and D. Viganola. 2023. "Productivity and Firm Exit during the COVID-19 Crisis: Cross-Country Evidence." *Small Business Economics* 60 (4): 1719–60.

Noy, S., and W. Zhang. 2023. "Experimental Evidence on the Productivity Effects of Generative Artificial Intelligence." *Science* 381 (6654): 187–92.

Peng, S., E. Kalliamvakou, P. Cihon, and M. Demirer. 2023. "The Impact of AI on Developer Productivity: Evidence from GitHub Copilot." https://doi.org/10.48550/arXiv.2302.06590.

Restuccia, D., and R. Rogerson. 2017. "The Causes and Costs of Misallocation." *Journal of Economic Perspectives* 31 (3): 151–74.

Solow, R. 1987. "We'd Better Watch Out." *New York Times*, July 12.

Tett, G. 2025. "Could AI Help America Out of Its Debt Hole?" *Financial Times*, August 7, 2025. https://www.ft.com/content/3c56d56e-b889-4eff-a8db-324c487334f3.

World Bank. 2024a. *Armenia Firms' Adoption of Digital Technologies*. Washington, DC: World Bank. http://hdl.handle.net/10986/42530.

World Bank. 2024b. *World Development Report 2024: The Middle-Income Trap*. Washington, DC: World Bank. http://doi.org/10.1596/978-1-4648-2078-6.

Zolas, N., Z. Kroff, E. Brynjolfsson, et al. 2021. "Advanced Technologies Adoption and Use by US Firms: Evidence from the Annual Business Survey." NBER Working Paper 28290, National Bureau of Economic Research, Cambridge, MA.

4

Aligning Energy and Productivity: Reform Pathways for a Low-Carbon Europe and Central Asia

Introduction

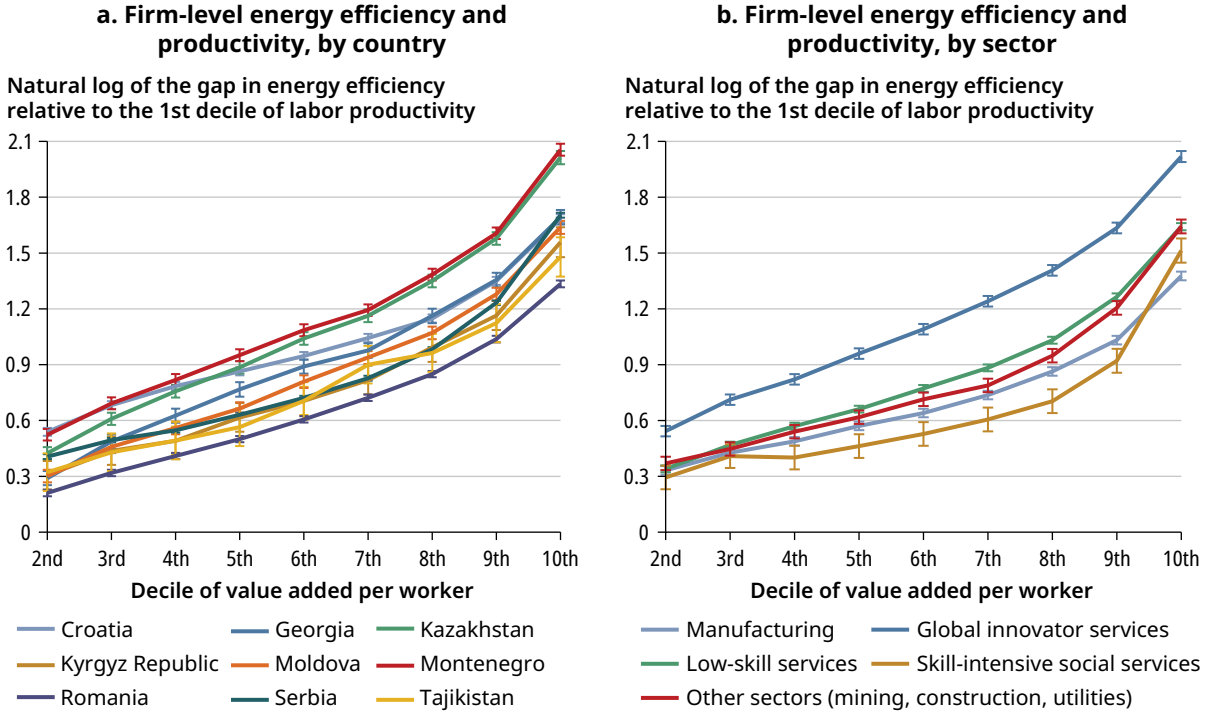
Resource efficiency and modern low-carbon technologies are drivers of productivity growth in Europe and Central Asia (ECA). This chapter examines the link between productivity and energy efficiency, which can be strengthened through the adoption of new technologies or more efficient management practices. It then identifies key sector- and firm-level enablers that support greater energy efficiency and the uptake of modern low-carbon technologies. The chapter highlights how the policy and regulatory environment shapes firms' incentives to invest in energy efficiency. The analysis also includes a brief assessment of ECA's policy mix, showing that high levels of fossil fuel subsidies, combined with low and often subsidized electricity tariffs reduce firms' incentives to adopt more efficient and low-carbon technologies.[1]

Productivity and Energy Efficiency: Two Closely Linked Efficiency Metrics

Becoming more energy efficient is strongly linked with productivity across countries, sectors, and metrics. Energy is an essential input for production and a key cost component for firms. More productive firms—those using production inputs more efficiently—also tend to use energy more efficiently. A positive

relationship exists between value added per worker and energy efficiency, measured as the ratio of sales to energy costs, across nine ECA countries (figure 4.1, panel a) and four sectors (figure 4.1, panel b). Despite some differences across countries in the level of energy efficiency at each productivity decile, the trend is similar across countries and sectors. Firms at the top (10th decile) of the productivity distribution in their sector are 3.6–7.7 times[2] more efficient than those at the bottom (1st decile). The relationship appears particularly strong at the top of the productivity distribution, with a larger gap in energy efficiency between the top two productivity deciles than between other deciles. Further, the efficiency gap between the lowest and highest productivity deciles is slightly smaller in manufacturing, where energy accounts for a larger share of total costs, than in services.

FIGURE 4.1 Energy efficiency correlates with productivity across countries and sectors



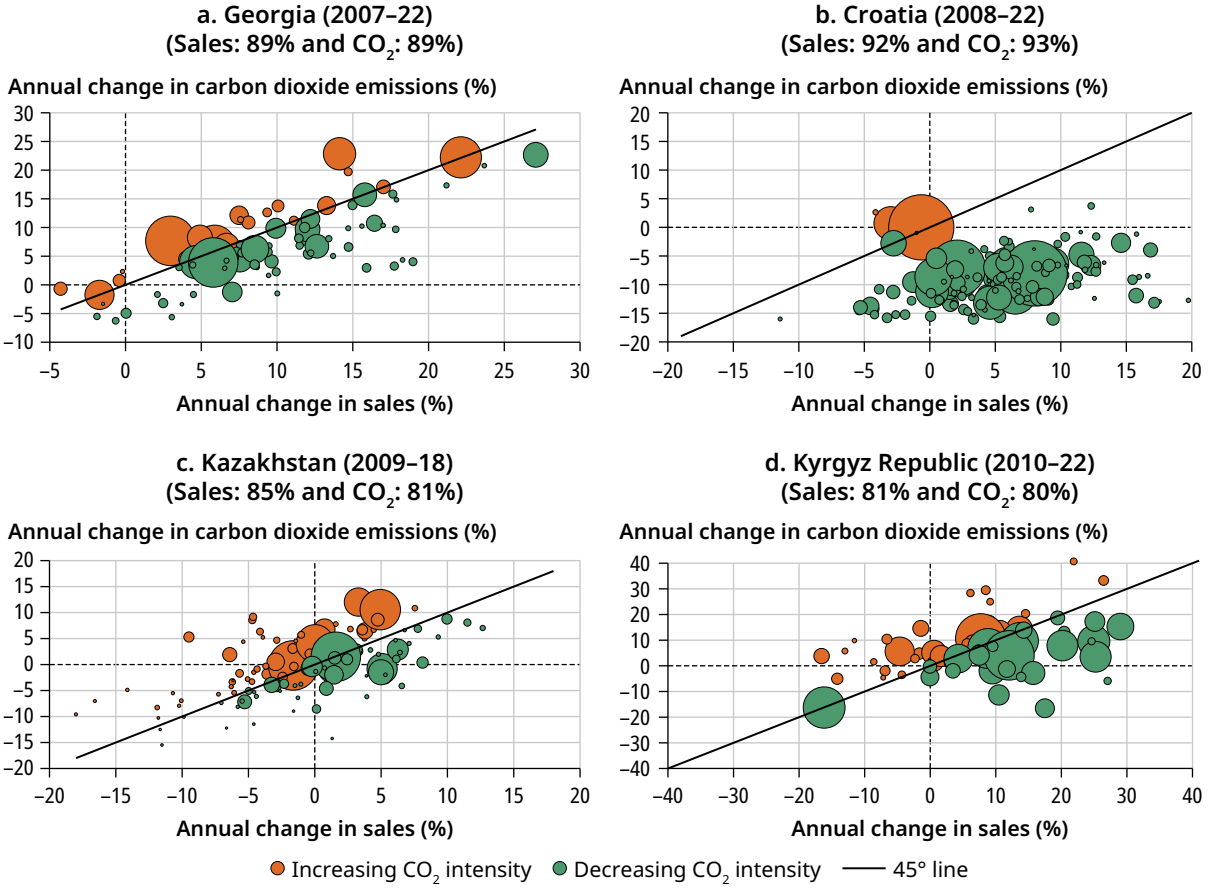
Source: Calculations based on firm-level data from national statistical offices.

Note: Energy efficiency is measured as sales divided by energy costs. Labor productivity is measured as value added per worker. The cross-country sample covers 2006–23. For a detailed description of the years covered for each country, refer to table 1A.1 in annex 1A, available at https://hdl.handle.net/10986/43788.

Improvements in Energy Efficiency but Lack of Allocative Efficiency

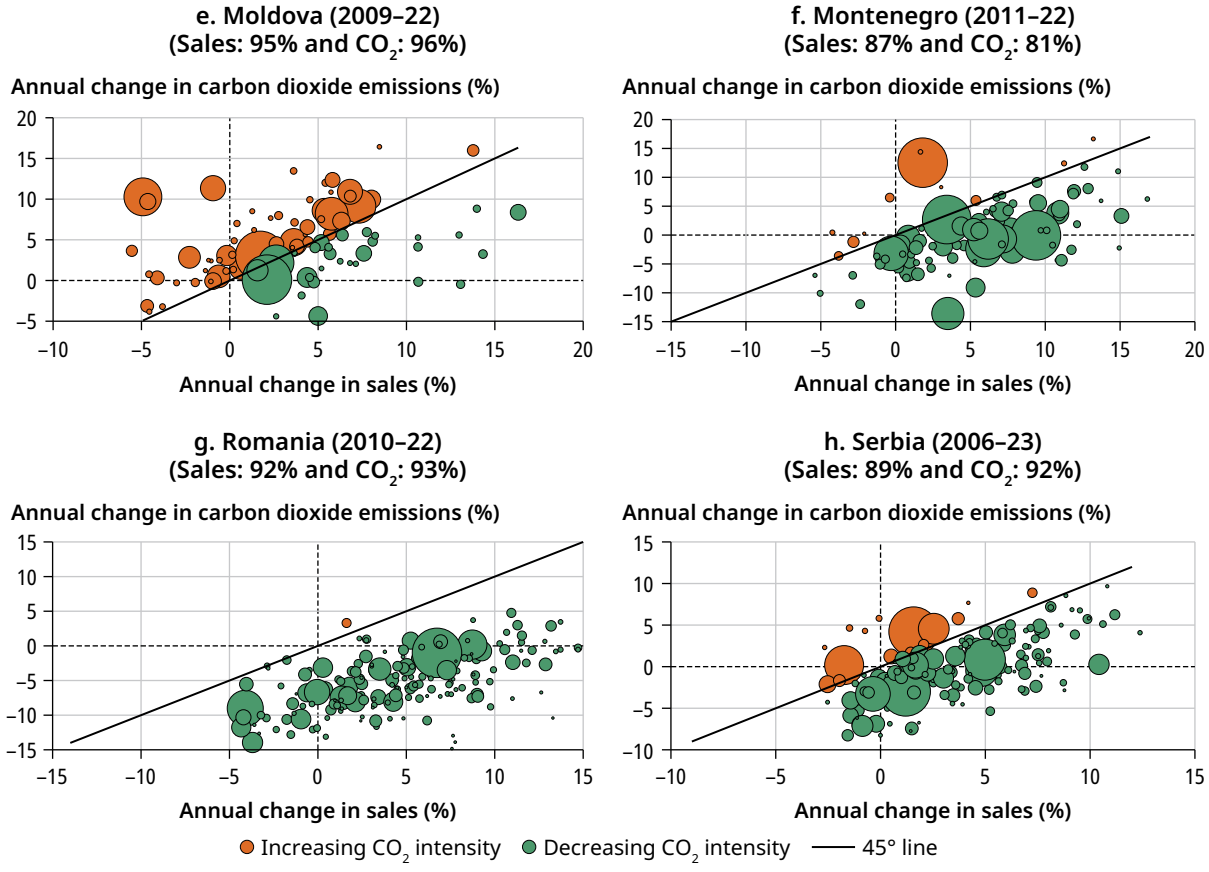
On average, growth has become less CO_2-intensive across several ECA economies according to firm-level data on energy consumption. However, emissions still grow faster than sales in many carbon-intensive sectors. Croatia stands out because most of its sectors are growing in terms of output while carbon dioxide emissions are declining, a phenomenon referred to as "absolute decoupling" (figure 4.2).[3] Romania also exhibits less CO_2-intensive growth. In contrast, in numerous sectors in Kazakhstan, the Kyrgyz Republic, and Moldova, carbon dioxide emissions are increasing faster than sales. Georgia and Serbia are improving but still have many energy-intensive sectors in which CO_2 emissions are growing faster than sales. Overall, despite some progress in reducing the CO_2 intensity of certain sectors, economic growth is still leading to higher carbon dioxide emissions in most parts of ECA.

FIGURE 4.2 ECA is becoming more environmentally friendly but has not reduced its carbon footprint



Continued

FIGURE 4.2 ECA is becoming more environmentally friendly but has not reduced its carbon footprint *(Continued)*



Source: Calculations based on firm-level data from national statistical offices.

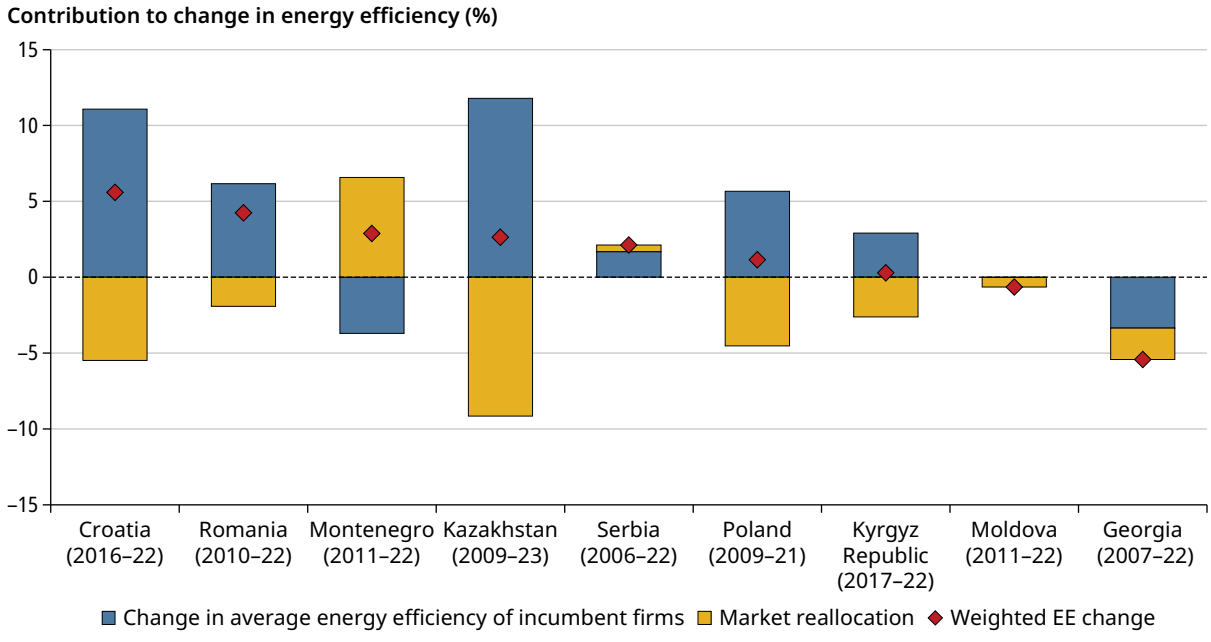
Note: The figure depicts change in sales and CO_2 emissions at the sector level. In each panel, the subtitle shows sales-based and emissions-based data coverage in percent. The size of the bubble indicates the sector's share of total carbon dioxide emissions. Sectors below the 45-degree line show faster growth in sales than in carbon dioxide emissions (increasing efficiency). Sectors below y = 0 show reduced carbon dioxide emissions over the period. The lengths of the periods vary due to data availability. CO_2 = carbon dioxide.

Gains in energy efficiency are driven mainly by within-firm improvements, rather than by the reallocation of market shares toward more energy-efficient firms. The countries with the largest gains in efficiency at the sectoral level—Croatia, Montenegro, and Romania (figure 4.2)—also show the largest average gains at the firm level (figure 4.3). Although improvement among incumbent firms contributes to higher energy efficiency in seven of the nine ECA countries with data, market reallocation contributes in only two: Montenegro and Serbia. The other seven countries all show negative contributions from market reallocation. Positive efficiency gains in market reallocation can come from two sources: new entrants that are on average more efficient than exiting firms, or reallocation of

market shares among incumbent firms to more efficient firms. Overall, these findings suggest that more efficient firms are not gaining larger market shares.

Energy price subsidies contribute to negative market allocative efficiency. By distorting price signals, subsidies reduce the incentives for producers and consumers to allocate resources efficiently. This can lead to distortions across sectors, by slowing structural transformation toward less energy-intensive sectors, as well as within sectors, by leaving little or no role for energy efficiency to determine a firm's competitiveness within a market. This ultimately reduces the returns on adopting modern low-carbon technologies, training workers and managers, and introducing structured and improved energy management practices. Subsidized energy prices may also lead to overconsumption and waste because consumers do not bear the full cost of energy use. This excessive demand can strain energy infrastructure, compromising the reliability and stability of the power grid, which could threaten productivity and efficient market reallocation.

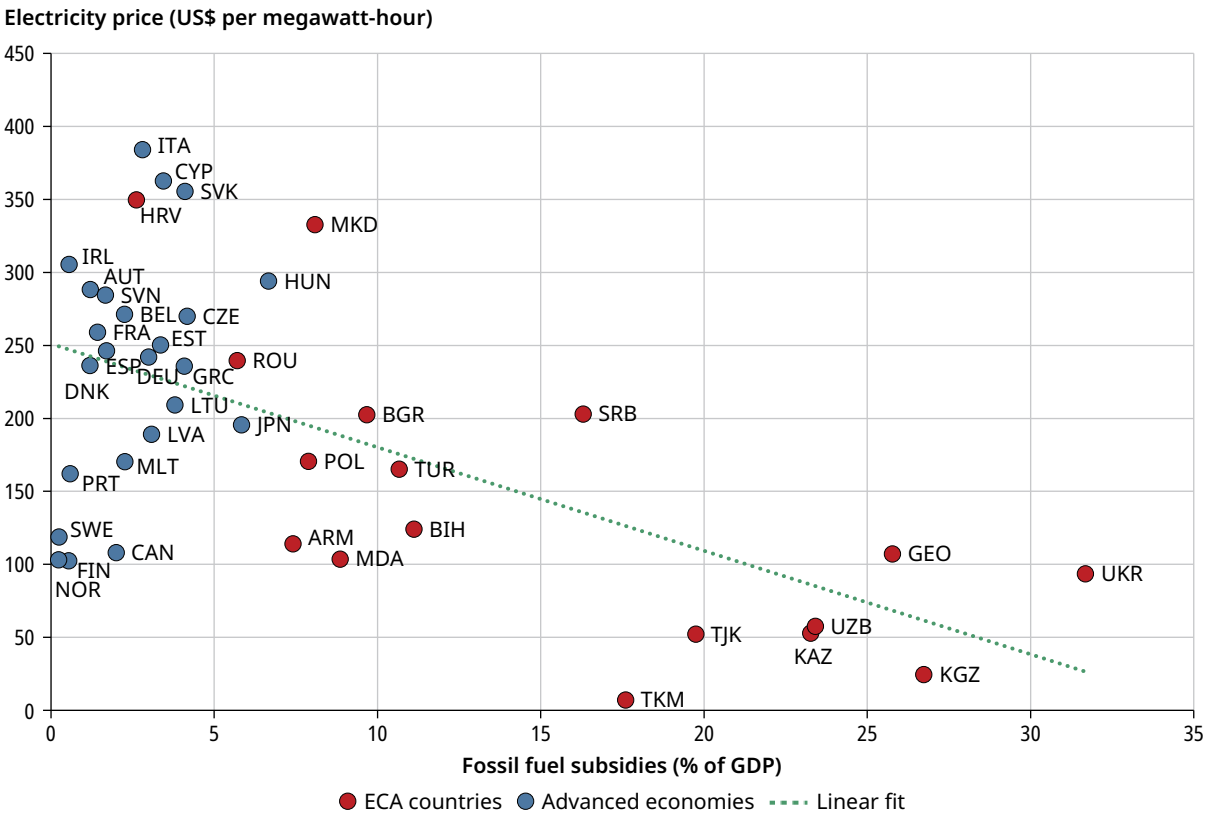
FIGURE 4.3 Markets do not reallocate market shares in accordance with energy efficiency in less advanced parts of ECA



Source: Calculations based on firm-level data from national statistical offices.

Note: The data reflect the decomposition of the log of energy efficiency (sales divided by energy costs). ECA = Europe and Central Asia; EE = energy efficiency.

FIGURE 4.4 Energy remains heavily subsidized in less developed countries in ECA, reducing incentives for within-firm improvement and market reallocation based on energy efficiency



Source: International Monetary Fund Climate Change Indicators Dashboard and the International Energy Agency.

Note: Fossil fuel subsidies include implicit and explicit subsidies. The data are the latest available for 2019–23. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. GDP = gross domestic product.

Energy is heavily subsidized in ECA countries, particularly countries that show low or negative market reallocation dynamics. One potential explanation for the negative market reallocation effects (figure 4.3) could be that energy remains strongly subsidized in the non-EU parts of ECA. The correlation between electricity prices and fossil fuel subsidies is negative, meaning that in countries with larger subsidies, electricity prices are below market levels (figure 4.4). This reduces the incentives for firms to become more efficient and makes energy efficiency less of a factor in competition between firms in the same sector. Countries in Central Asia, together with Georgia, Ukraine, and to a lesser extent Serbia, spend more than 15 percent of gross domestic product on explicit and

implicit fossil fuel subsidies while charging low electricity prices. A second set of ECA countries (Armenia, Bosnia and Herzegovina, Bulgaria, Moldova, North Macedonia Poland, and Türkiye) spend fiscal resources equivalent to 5–10 percent of GDP on energy subsidies, which is less than what Central Asian countries spend but still more than most advanced economies, such as France, Germany, and Italy. Larger subsidies and lower energy prices coincide with market efficiency's limited contribution to energy efficiency growth, as in Georgia, Kazakhstan, the Kyrgyz Republic, and Moldova, although they are not the only cause. Below-market energy prices not only affect market reallocation but also discourage firm upgrading, thereby reducing within-firm efficiency improvements (refer to box 4.1 on how price rationalization can spur energy efficiency). Although some of these gains could be a side effect of capital replacement (new capital tends to be more energy and carbon efficient), low energy prices reduce the returns on green investments, slowing the transition to a greener economy and hampering productivity growth.

BOX 4.1 Effects of electricity price rationalization in Georgia

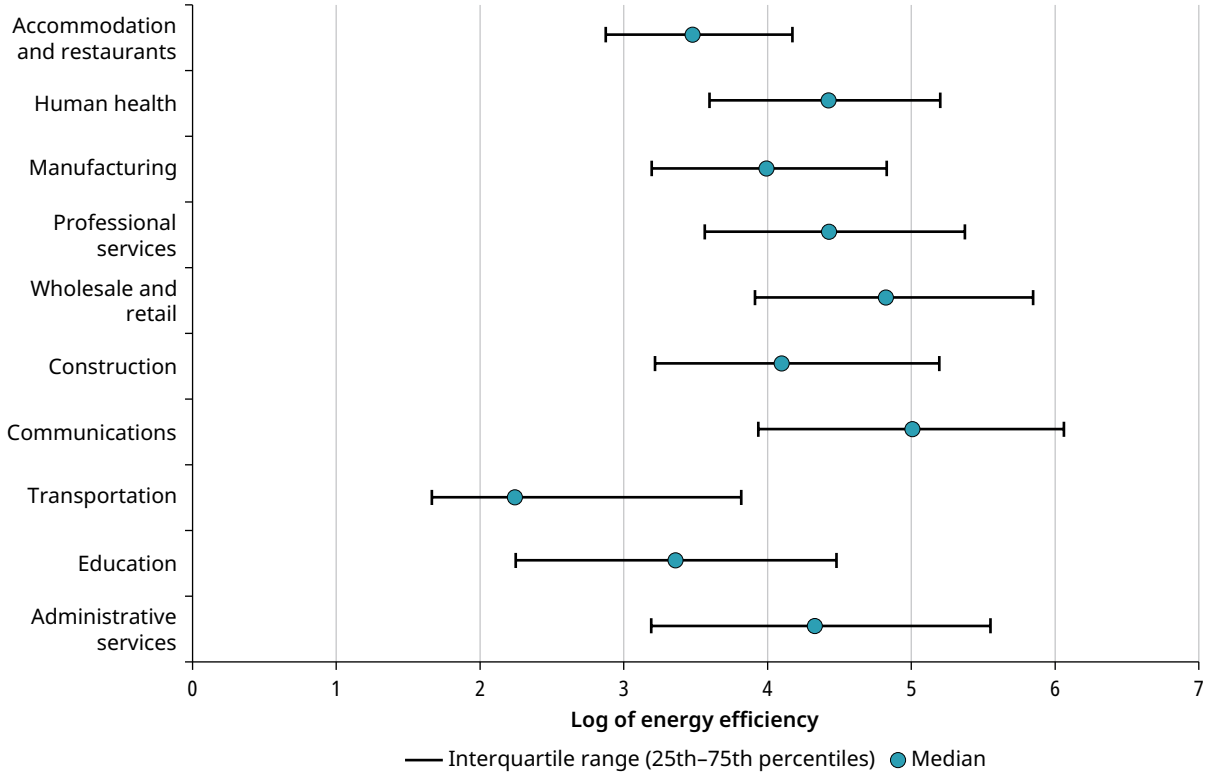
Subsidized energy prices pose considerable obstacles to enhancing energy efficiency and reducing carbon emissions. In contrast, price rationalization can spur machinery upgrading. Leveraging a panel data set of firms for 2013–22 and motivated by a January 2021 adjustment in electricity prices, one study on Georgia found that higher electricity prices led firms to improve their energy efficiency. After they were instrumented, a 1.00 percent increase in electricity prices resulted in a 0.79 percent decline in electricity demand, driven mainly by higher energy efficiency (a 1.00 percent price increase was associated with a 1.05 percent improvement in efficiency). The study identified the importance of the machinery and equipment upgrading mechanism, documenting a positive correlation between upgrading and (instrumented) electricity prices (a 1.00 percent price increase was associated with a 2.3 percent jump in new investment in machinery and equipment). Moreover, greater energy efficiency appeared to be explained by new investment upgrading a plant's stock of machines. Additional reductions in electricity consumption per unit of fixed assets came from newly purchased machinery. Put simply, part of the increase in energy efficiency and energy consumption savings due to an electricity price adjustment was from upgraded machinery and not simply more energy-efficient practices.

Source: Belacin et al., forthcoming.

Factors That Drive Improvements in Within-Sector Energy Efficiency

Large differences in efficiency within sectors underline the importance of technology adoption and management practices as drivers of energy efficiency and productivity. Despite narrow sector definitions, the interquartile range of energy efficiency for each sector is larger than the differences in median efficiency between sectors (figure 4.5). For example, in construction, firms at the 75th percentile are 11.0 times more efficient than firms at the 25th percentile, while the median firm in construction is only 2.2 times more efficient than the median firm in wholesale and retail. These results suggest that despite operating in the same sector, large differences remain between firms in production processes, technology use, and management practices.

FIGURE 4.5 Large differences in energy efficiency within sectors

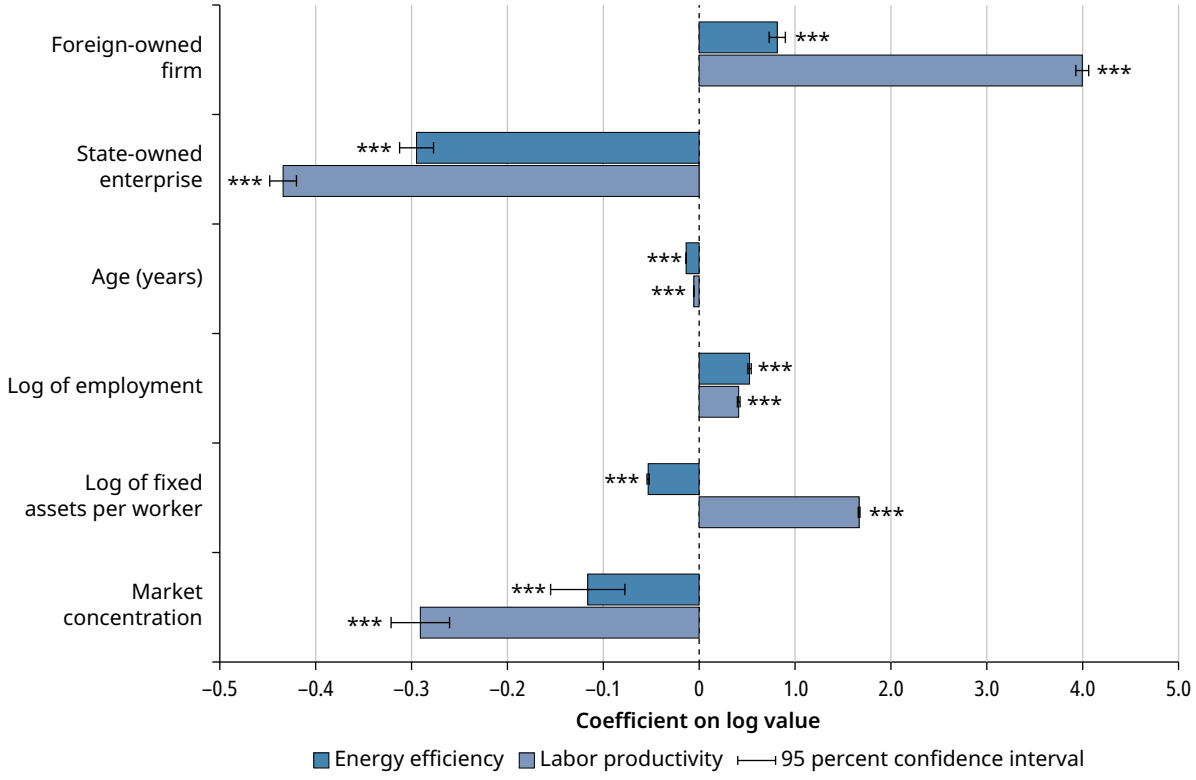


Source: Calculations based on firm-level data from national statistical offices.

Note: Energy efficiency is measured as sales divided by energy costs. Sectors are at the section level of the Statistical Classification of Economic Activities in the European Community, Revision 2. The dots display the median values of the sectors and the brackets show the interquartile ranges (25th to 75th percentiles). The period considered covers 2006–23. The countries included in this analysis are Croatia, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Montenegro, Romania, Serbia, and Tajikistan.

State-owned enterprises (SOEs) and firms in more concentrated sectors have lower energy efficiency and productivity, underlining that addressing misallocation will also benefit energy efficiency. Reducing misallocation will not only improve productivity (refer to chapter 1) but also enhance energy efficiency (figure 4.6). Improving competition (reducing market concentration), incentivizing the entry of more foreign-owned firms (increasing foreign direct investment [FDI]), and shrinking the role of SOEs all work in favor of productivity and energy efficiency. One reason for the below-average productivity and energy efficiency of SOEs is that they enjoy lower finance costs than private firms, which may allow SOEs to survive despite their low efficiency (Cusolito, Fattal-Jaef, Patiño Peña, and Singh 2024). However, several important differences in the

FIGURE 4.6 State-owned enterprises, domestically owned firms, and smaller firms are less energy efficient than privately owned enterprises, foreign-owned firms, and larger enterprises



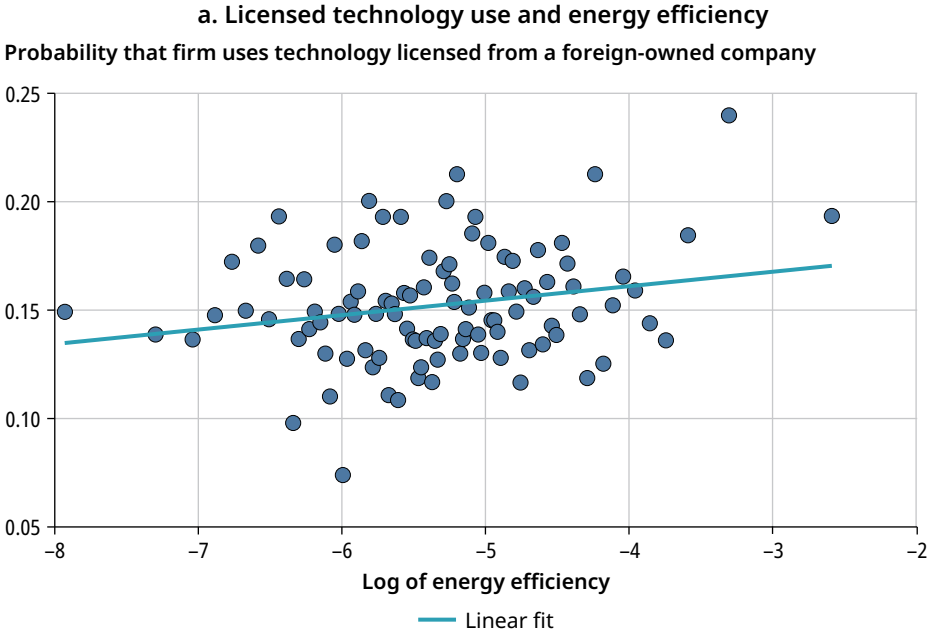
Source: Calculations based on firm-level data from national statistical offices.

Note: Labor productivity is measured as value added per worker. Market concentration refers to the combined market share of the five largest companies in a sector. The analysis controls for country-year fixed effects, sector fixed effects, region fixed effects, and firm size. The period considered covers 2006–23. The countries included in this analysis are Croatia, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Montenegro, Romania, Serbia, and Tajikistan. *** $p < .001$.

effects on productivity and energy efficiency are worth highlighting. Capital intensity is positively associated with productivity but negatively associated with energy efficiency, because machinery and other capital assets increase firms' energy consumption, when everything else is held constant. Older firms tend to be less energy efficient.[4] This might also be related to capital intensity, which usually grows over time. Thus, governments need to introduce additional incentives to ensure continuous efficiency gains as firms age.

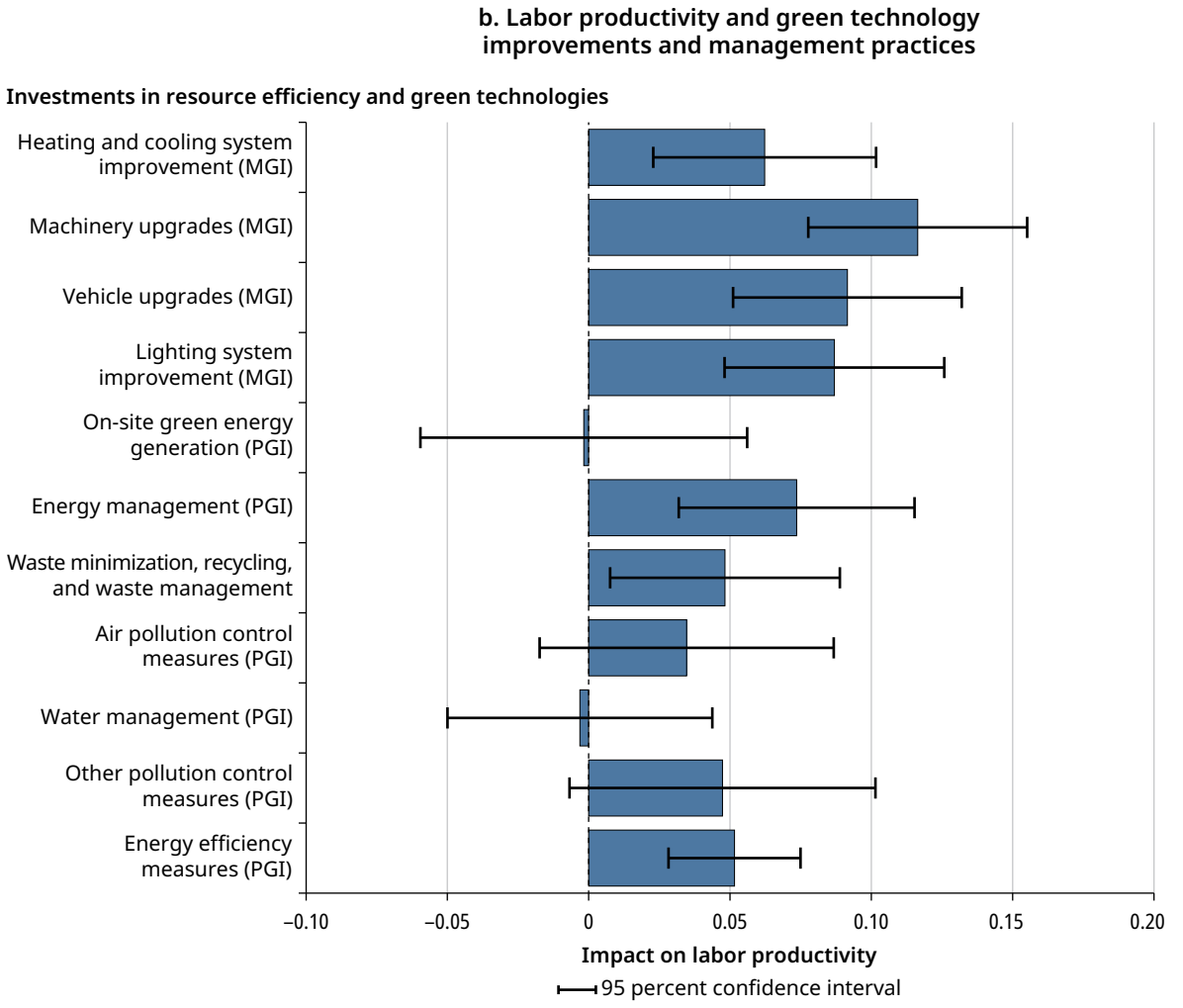
Similarly, adopting more resource-efficient technologies not only improves energy efficiency but also boosts productivity. In 25 ECA countries with World Bank Enterprise Survey data, firms that have adopted technologies licensed from a foreign-owned company have higher energy efficiency than peer firms of the same size in the same sector (figure 4.7, panel a). Installing technologies to reduce energy use—such as heating, cooling, or lighting improvements; vehicle upgrades; and pollution control measures—is associated with higher labor productivity (figure 4.7, panel b). Although the findings do not imply causality, they are in line with the association between digital technology adoption and productivity identified in chapter 3 and show that initiatives to promote technology adoption in firms are important for the energy and digital transition of ECA firms.

FIGURE 4.7 Technology adoption is positively associated with energy efficiency and labor productivity



Continued

FIGURE 4.7 Technology adoption is positively associated with energy efficiency and labor productivity *(Continued)*



Source: Calculations based on firm-level data from the World Bank Enterprise Surveys, Green Module.

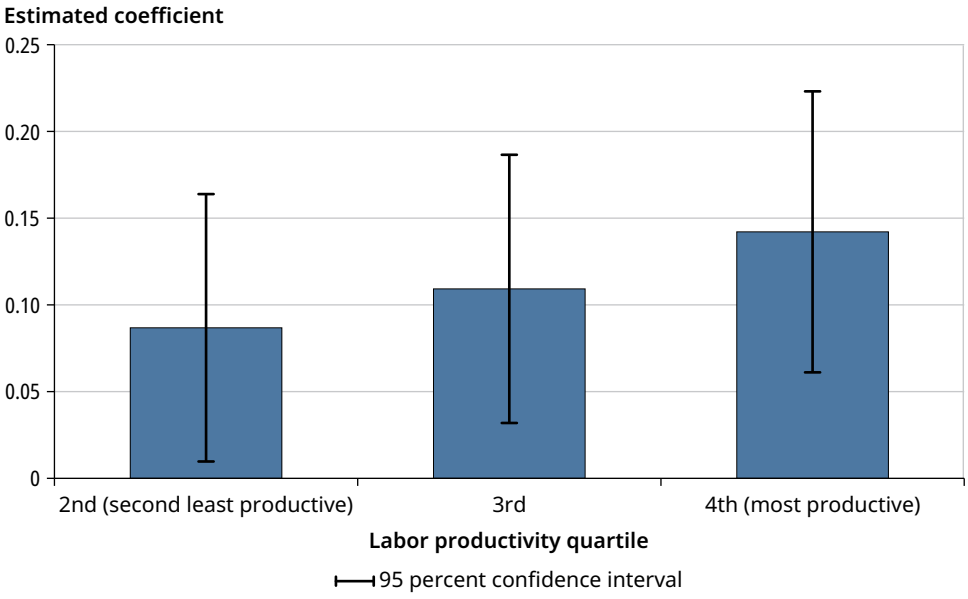
Note: The countries included in the analysis are Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Estonia, Georgia, Hungary, Kazakhstan, Kosovo, the Kyrgyz Republic, Latvia, Lithuania, Moldova, Mongolia, Montenegro, North Macedonia, Poland, Romania, the Russian Federation, Serbia, the Slovak Republic, Slovenia, Tajikistan, Türkiye, Ukraine, and Uzbekistan. The country sample covers 2018–22. MGI = mixed green investment; PGI = pure green investment.

In addition to technology, good green management is associated with higher productivity. Firms in the three highest quartiles of the labor productivity distribution in their sector have significantly higher Green Management Quality Index values (which are based on environment-related actions and firm practices such as green strategic objectives, responsibilities taken toward

environmental and climate change issues, green monitoring of energy consumption and pollution, and having green targets) than firms in the lowest quartile (figure 4.8). These findings are in line with the general evidence from the World Bank Firm-level Adoption of Technology survey on the link between managerial skills, human capital, and the intensive use of advanced technologies in firms (Cirera, Comin, and Cruz 2024).

Firms lagging behind in terms of energy efficiency are catching up to the frontier, but it will take many years for them to converge fully. Convergence analysis that regresses the change in energy efficiency on a variety of factors—most importantly, a firm's distance to the frontier in energy efficiency in its country and sector—yields evidence of within-sector convergence, as firms that are farther from the frontier improve their energy efficiency faster (figure 4.9).[5] Convergence is driven by factors external to a firm, such as movements in the sectoral frontier

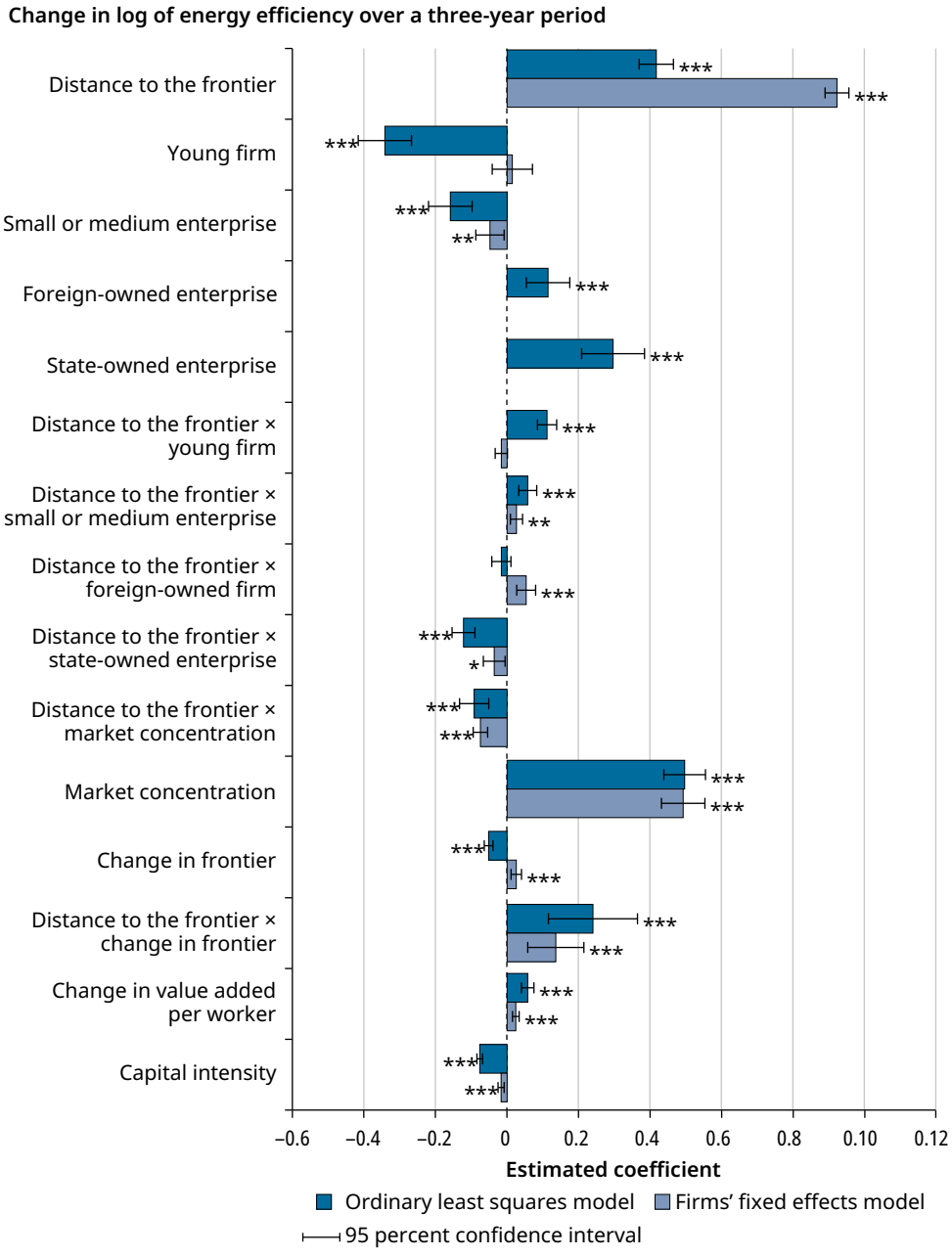
FIGURE 4.8 Firms with higher labor productivity have higher green management quality



Source: World Bank Enterprise Surveys 2019, Green Module.

Note: The reference group is firms in the first quartile (bottom 25 percent) of the labor productivity distribution. Values reflect the regression of Green Management Quality Index values on labor productivity (log of sales per worker), with controls for country and sector (at the three-digit level of the International Standard Industrial Classification of All Economic Activities) fixed effects. The Green Management Quality Index is a z-score summarizing firms' environment-related actions and practices, such as green strategic objectives, responsibilities for environmental and climate change issues, green monitoring (of energy consumption, carbon dioxide emissions, and other pollutants), and green targets. The sample includes the 23 countries in Europe and Central Asia, as well as Hungary, Latvia, Lithuania, Mongolia, the Slovak Republic, and Slovenia.

FIGURE 4.9 Laggards are catching up to the frontier, but state-owned enterprises and large firms are doing so more slowly



Source: Calculations based on firm-level data from national statistical offices.

Note: The regression controls for sector (at the three-digit level of the Statistical Classification of Economic Activities in the European Community, Revision 2.) fixed effects and region-year fixed effects. Firm fixed effects are included in the fixed effects specification. The period considered covers 2006–23. The countries included in this analysis are Croatia, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Montenegro, Romania, Serbia, and Tajikistan.
* $p < .05$; ** $p < .01$; *** $p < .001$.

(spillovers), which have a positive effect on within-firm convergence, suggesting that the performance of lead firms has an influence on laggards. Although sectors with higher market concentration have greater efficiency growth, convergence in these sectors is slower, as evidenced by the negative interaction between concentration and distance to the frontier. Small and medium-sized enterprises converge faster than large firms, and private companies converge faster than SOEs. The effects of FDI and age are unclear, as the coefficients change between the ordinary least squares model and the firms' fixed effects model. Increasing capital intensity leads to slower energy efficiency growth: all else constant, higher capital stock is associated with higher energy consumption. The effect of changes in capital intensity on convergence is ambiguous. With other variables held equal, back-of-the-envelope estimates suggest that convergence would take 8.3 to 15.5 years, depending on the model (ordinary least squares or controlling for fixed effects) and the country. The next section discusses how the right policy mix can help accelerate this process.

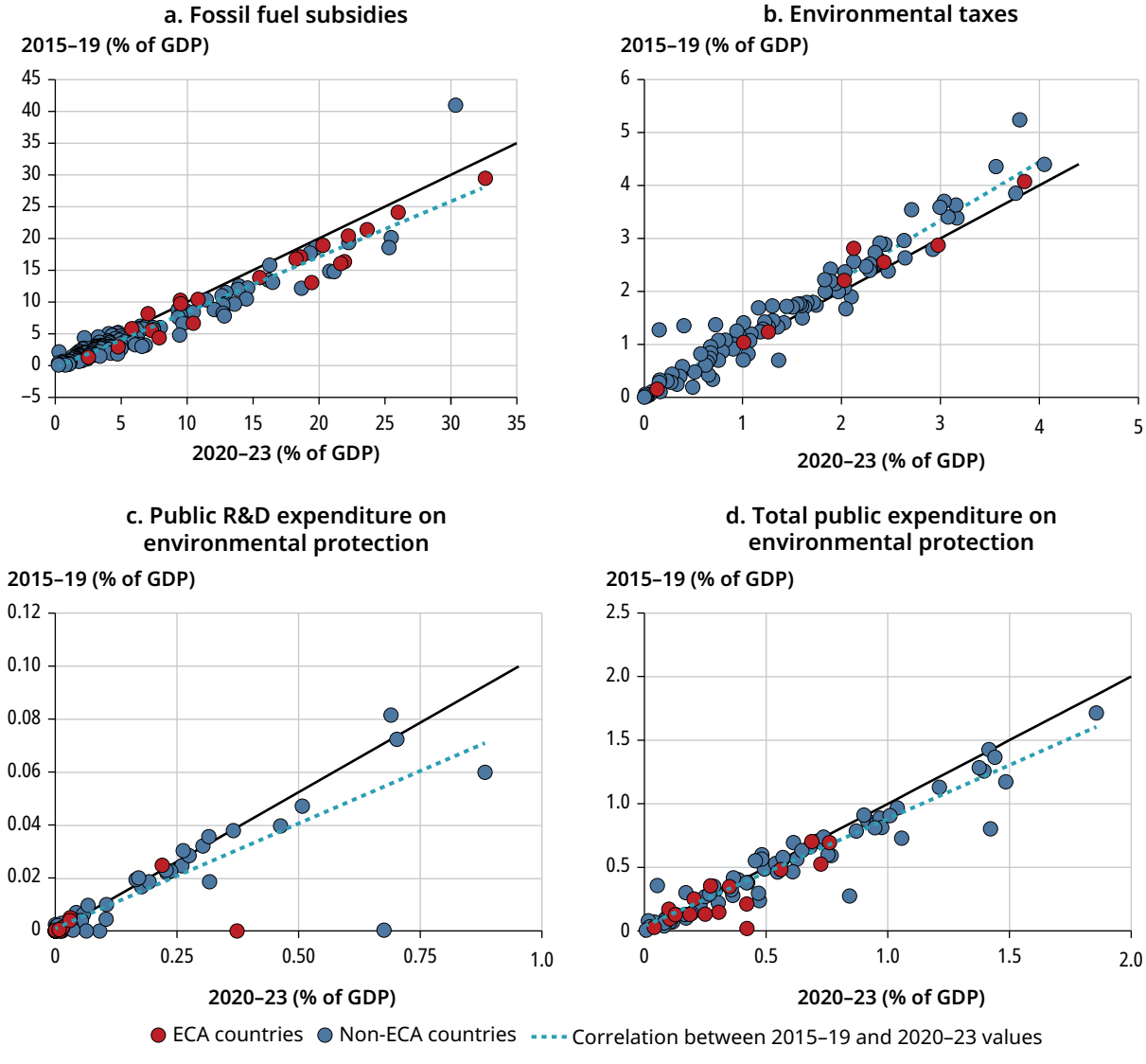
Changes Needed in Europe and Central Asia's Policy Mix to Foster More Resource-Efficient Technologies

The structural deficiencies in firms' performance and the energy supply have slowed efficiency gains in ECA; therefore, important policy reforms are required to alter firms' incentives. The good news is that solving ECA's productivity challenges and transitioning to low-carbon economies go together with productivity growth because they are correlated and often driven by similar factors. Improving market entry of young and foreign firms and reducing subsidies for SOEs will likewise benefit productivity and carbon efficiency. This section takes stock of ECA's energy and climate policies to address the following question: Given that sound energy and climate policies can shape firms' incentives to expedite the transition, are governments choosing the best policies to alter those incentives, or is there scope to improve? If so, where and how?

The climate policy mix in many ECA countries contains numerous elements that do not constitute a best practice and lower the incentives for a more efficient use of energy or the adoption of modern low-carbon technologies. A key best practice is to eliminate market distortions—such as fossil fuel subsidies—that discourage firms from shifting to low-carbon alternatives. Introducing instruments such as carbon pricing is also crucial to ensure that market decisions reflect the environmental costs of carbon-intensive goods and services. However, imposing high environmental taxes on firms and households without offering viable low-carbon alternatives may be regressive and lead to short-term welfare losses. To address this, carbon pricing should be complemented by upfront public support for innovation in low-carbon technologies.[6] Accelerating these investments is essential because technological path dependency and learning effects reinforce the dominance of existing high-emission technologies over time.[7]

Fossil fuel subsidies have increased since 2020, while environmental taxes have declined, indicating an imbalance of fiscal incentives in favor of carbon-intensive industries. Fossil fuel subsidies as a share of GDP have risen across ECA since 2020 (figure 4.10, panel a). The increase in fossil fuel subsidies was in part driven by governments' responses to the COVID-19 pandemic and the energy crisis. Nonetheless, ECA is home to some of the highest fossil fuel subsidies in the

FIGURE 4.10 Inconsistent fiscal spending: Increases in fossil fuel subsidies and decreases in environmental tax revenue, with parallel spending growth in environmental protection



Source: International Monetary Fund Climate Change Indicators Dashboard.

Note: The dashed 45-degree line indicates the same values for 2015–19 and 2020–23. Fossil fuel subsidies include implicit and explicit subsidies. The earliest year with data is 2015. For the second period, 2020 was chosen as the start date because of the COVID-19 pandemic. ECA = Europe and Central Asia; GDP = gross domestic product; R&D = research and development.

world, where increases have been particularly large. At the same time, revenue from environmental taxes (taxes collected on items with a negative impact on the environment) has fallen across most of ECA (figure 4.10, panel b). This means that carbon-intensive technologies and fossil fuels have benefited in two ways—through more subsidies and fewer taxes—making the growth of low-carbon alternatives less attractive.

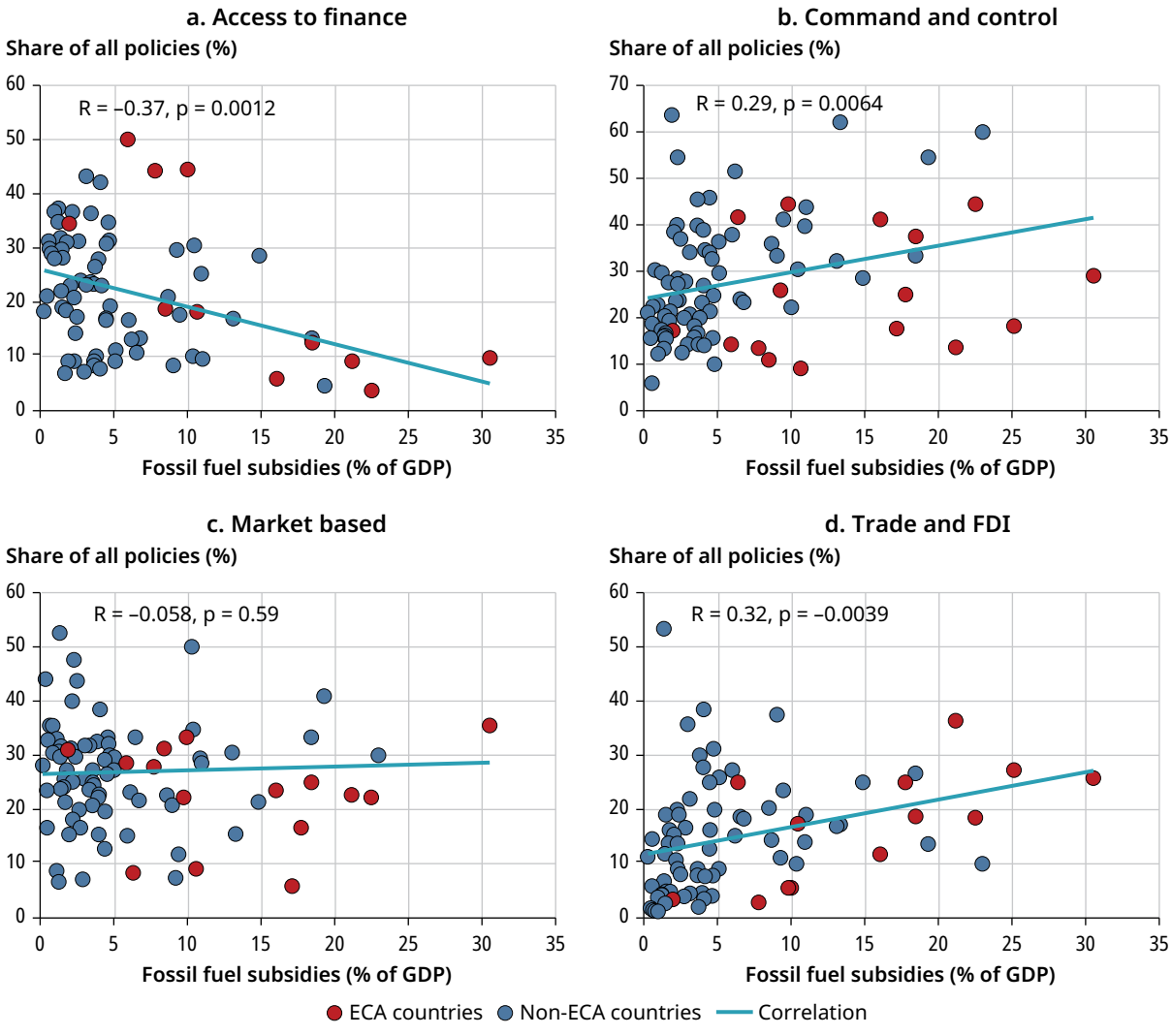
Public spending on environmental protection, including research and development (R&D) spending, has been increasing, showing governments' inconsistency in promoting fossil fuels and modern low-carbon technologies in parallel. Governments, including most in ECA, have raised public spending on environmental protection, which includes spending on pollution abatement, waste management, and biodiversity protection, as a share of GDP (figure 4.10, panel d). Public R&D spending on environmental protection has also risen, although the levels remain very small at less than 0.1% of GDP (figure 4.10, panel c). Similarly, public R&D budgets for low-carbon energy and energy efficiency have increased (IEA 2025).

Countries with high fossil fuel subsidies make more use of command-and-control policies to correct for subsidy-induced distortions. These countries have a larger share of command-and-control instruments, such as technical regulation and product and efficiency standards, in their climate policy mix (figure 4.11, panel b). Instead of moving financial incentives toward low-carbon alternatives, these countries use command-and-control policies—which are second best and costly to enforce. Policies on access to finance, such as loans, guarantees, and grants, are less prevalent among high-subsidy countries. This might be related to their developmental stage and fiscal space because many economies with high fossil fuel subsidies have lower GDP per capita. High-subsidy countries also use more trade and FDI policies, such as import or export restrictions (figure 4.11, panel d). There is no significant difference in the usage of market-based policies between high- and low-subsidy countries.

Conclusions and Policy Recommendations

Highly concentrated carbon dioxide emissions and energy use across sectors and strong heterogeneity in energy efficiency within sectors highlight the relevance of targeting. Indirect evidence on the dispersion of abatement costs—reflected in the variation of energy and CO_2 intensity—suggests that creating carbon markets is the most efficient policy choice. When abatement costs differ widely across firms or sectors, technological standards and carbon taxes represent second-best alternatives (Stavins 2022).[8] Public authorities could provide more support to introduce energy-efficient technologies, which would not only improve energy and carbon efficiency but also strengthen the long-term competitiveness of firms. In light of the introduction of the European Union's Carbon Border Adjustment Mechanism (CBAM), upgrading their production to more low-carbon processes becomes even more important. The European Union is one of the main markets

FIGURE 4.11 Climate policy instruments and fossil fuel subsidies: Less access to finance and trade policies and more command-and-control policies, 2015–23



Sources: International Energy Agency, International Renewable Energy Agency Renewable Energy Policies and Measures Database; International Monetary Fund data.

Note: Policies are classified based on keywords from titles and descriptions. ECA = Europe and Central Asia; FDI = foreign direct investment; GDP = gross domestic product; p = level of statistical significance; R = Pearson correlation coefficient.

for exporters in non-EU parts of ECA and firms might be required to upgrade their production in CBAM-affected industries to avoid additional charges on their products.

SOEs are not only a source of economic misallocation but also less energy efficient and may slow the transition to low-carbon technologies, underlining the need for sectoral and SOE reforms. Stagnant underperformance of SOEs in both

upstream and downstream sectors, in terms of productivity and energy efficiency, highlights the need for reforms in the energy and transport sectors. This includes removing fossil fuel subsidies, introducing cost-reflective tariffs, strengthening corporate governance, and attracting FDI.

Reforms should also reshape firms' incentives to become more productive. Derisking investments and facilitating technology adoption through credit guarantees and reimbursable financial services can encourage firms to become more efficient. Table 4.1 summarizes the policy recommendations from this chapter, with varying priority levels for each of the ECA country clusters.

TABLE 4.1 Priority level for policy recommendations, by country group

Recommendation	High-income and EMDE	EU accession	Central Asia	
			Resource-intensive	Non-resource-intensive
Reduce fossil fuel subsidies	Low	High	High	High
Introduce cost-reflective electricity tariffs	Low	Medium	High	High
Provide financial instruments to facilitate low-carbon technology adoption	High	High	High	High

Source: World Bank.

Note: High-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; EU accession comprises Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Moldova, Montenegro, North Macedonia, Serbia, and Ukraine; Central Asia, resource-intensive comprises Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan; Central Asia, non-resource-intensive comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan. Low, medium, and high = priority level. ECA = Europe and Central Asia; EMDE = emerging markets and developing economies; EU = European Union.

Notes

1. For a more comprehensive analysis of how the energy sector can foster economic growth in Europe and Central Asia, see chapter 4 of *Greater Heights: Growing to High Income in Europe and Central Asia* (Iacovone et al. 2025).
2. The values in figure 4.1 are natural logs, which equate to 3.6 ($e_{1.3}$) for the lowest energy efficiency (manufacturing) and 7.7 ($e_{2.05}$) for the highest (global innovator services).
3. Absolute decoupling describes a state where carbon dioxide emissions are declining despite continued output growth. Relative decoupling describes a state where carbon dioxide emissions are growing more slowly than output.
4. Old, large firms are the most established in the market and tend to have higher demand, which positively affects productivity (through value added). Young firms have less revenue but tend to use more modern assets, which positively affects energy efficiency compared to mature firms in the same sector.
5. The analysis estimates convergence speed—the relationship between changes in energy efficiency (EE) over a three-year period ($EE_t - EE_{t-3}$) and the firm's distance to the country frontier three years before ($distance\ (frontier)_{t-3}$). The outcome variable is set in log changes, and the distance to the frontier enters the equation in logs. In the absence of an appropriate instrument, the results are lower-bound (ordinary least squares model) and upper-bound (firms' fixed effects model) estimates. Therefore, years to convergence are estimated using both approaches, with the true value of the parameter lying between them.

6. These subsidies should be granted competitively to exploit the complementarities between industrial policy and competition. Further, governments should use industrial policies to nurture sectors or products in which countries have a latent comparative advantage but phase out that support as soon as the industry overcomes the constraints and can operate competitively in a self-sustainable manner.
7. Acemoğlu et al. (2023) showed that the shale gas revolution in the United States reduced carbon dioxide emissions in the short run by replacing coal-fired electricity; however, the resulting sharp slowdown in innovation for zero-carbon technologies might have negative long-term consequences.
8. Stavins, R. N. (2022). "The Relative Merits of Carbon Pricing Instruments: Taxes Versus Trading." *Review of Environmental Economics and Policy* 16 (1): 62–82.

References

Acemoğlu, D., P. Aghion, L. Barrage, and D. Hémous. 2023. "Climate Change, Directed Innovation, and Energy Transition: The Long-Run Consequences of the Shale Gas Revolution." NBER Working Paper 31657, National Bureau of Economic Research, Cambridge, MA.

Belacin, M., X. Cirera, L. Iacovone, and S. Reyes Ortega. Forthcoming. "The Impact of Higher Prices on Energy Consumption and Efficiency: Evidence from Georgia." World Bank, Washington, DC.

Cirera, X., D. A. Comin, and M. Cruz. 2024. "Anatomy of Technology and Tasks in the Establishment." NBER Working Paper 32281, National Bureau of Economic Research, Cambridge, MA.

Cusolito, A. P., R. N. F. Jaef, F. P. Peña, and A. V. Singh. 2024. "The Financial Premium and Real Cost of Bureaucrats in Businesses." World Bank, Washington, DC.

Iacovone, L., I. Izvorski, C. Kostopoulos, et al. 2025. *Greater Heights: Growing to High Income in Europe and Central Asia*. Europe and Central Asia Studies. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-2206-3.

IEA (International Energy Agency). 2025. "Energy Technology RD&D Budgets Data Explorer." IEA, Paris. https://www.iea.org/data-and-statistics/data-tools/energy-technology-rdd-budgets-data-explorer.

Stavins, R. N. 2022. "The Relative Merits of Carbon Pricing Instruments: Taxes versus Trading." *Review of Environmental Economics and Policy* 16 (1): 62–82.

5

From Learning to Earning: How Skills Power Productivity in Europe and Central Asia

Introduction

Workforce skills play a pivotal role in driving productivity growth, accounting for significant shares of the differences in gross domestic product (GDP) per capita across countries (Hsieh and Klenow 2010) and gaps in productivity among firms (Criscuolo et al. 2021). Since 1980, improvements in learning and skills have contributed to half of global economic growth (Gethin 2025). This chapter emphasizes the importance of human capital, recognizing that skill development is a lifelong process, with the workplace serving as a key environment for continuous learning. Productivity growth hinges not only on the availability of skills but also on the opportunities workers have to develop and apply them throughout their careers.

Skills influence productivity through three key dimensions. First, the supply of skills enhances firm productivity, technological adoption, and innovation. Foundational skills, like literacy and numeracy, are essential for higher labor productivity and for further learning and on-the-job skill development. Second, demand-side factors affect how well skills are utilized. Even highly skilled workers may be underutilized if firms lack the capacity to integrate those skills effectively. Third, efficient labor markets are crucial for matching workers with suitable jobs, minimizing skills mismatches that can hinder productivity.



Online annexes for this report are available at https://hdl.handle.net/10986/43788.

The chapter examines how skills gaps have constrained productivity in Europe and Central Asia (ECA) across the three key dimensions. It focuses on foundational skill deficits in the workforce and explores how skills influence productivity through job matching and on-the-job learning. The chapter explores how skills gaps restrain productivity in ECA by looking at whether workers, given their skills, land in the right jobs; assessing the size of the productivity losses arising from poor skill proficiency and inefficient skills-to-jobs matching; and analyzing the roles that labor demand and labor market characteristics play in allocation of skills.

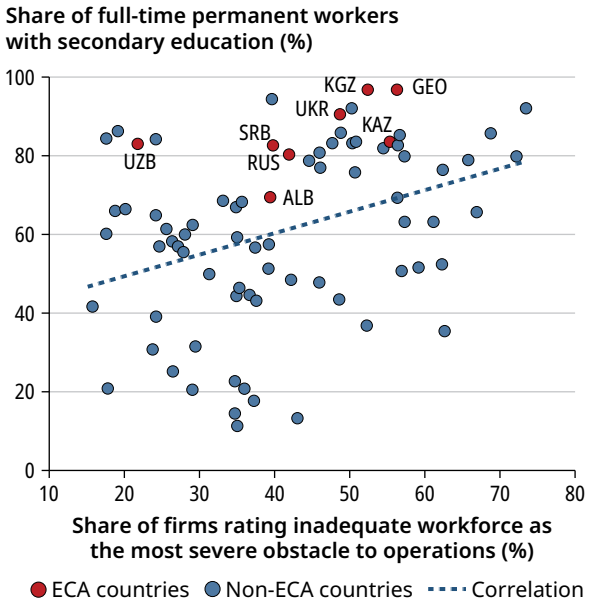
How Well Is Talent Allocated in Europe and Central Asia?

Are skilled individuals working in jobs and firms where their capabilities can be fully used? Are the most productive firms able to attract the most proficient workers? These questions are critical because misallocating talent can depress productivity, even in settings with a large stock of human capital.

Across ECA, firms consistently report that a shortage of skills is one of the main constraints to their growth. This holds across firm sizes and countries and is perceived as a structural barrier to expansion, innovation, and productivity gains (figure 5.1). This finding is puzzling because educational attainment has increased considerably in ECA over the past three decades, with steady gains in secondary and tertiary education enrollment and completion. Labor force survey data show an increase in the share of the workforce that has completed tertiary education, from around 10 percent in 1997 to more than 30 percent in 2022 (refer to figure 5A.1 in online annex 5A), suggesting that the population is more educated than previous generations (Izvorski et al. 2024).

That firms report skills to be a constraint to growth in the context of an increasingly educated workforce suggests that the allocation of skills is not optimal. A starting point for understanding this issue is to look at patterns of skill allocation across firms, using information from international assessments such as the Organisation for Economic Co-operation and Development's (OECD's) Programme for the International Assessment of Adult Competencies (PIAAC) and the World Bank's Skills Toward Employment and Productivity (STEP) initiative. In Germany and the United States, the relationship between firm size and worker proficiency follows a clear and intuitive pattern: Literacy increases steadily with firm size (figure 5.2). On average, workers in larger firms are more skilled than those in smaller ones. This alignment could reflect several factors: Larger firms typically offer higher wages, better working conditions, and more opportunities for career advancement and training, making them more attractive to skilled workers. Moreover, in economies with well-functioning labor markets, productive firms are more likely to grow and attract the talent they need. This creates a reinforcing cycle in which skills are concentrated in firms with the highest capacity to use them intensively, boosting overall economic efficiency.

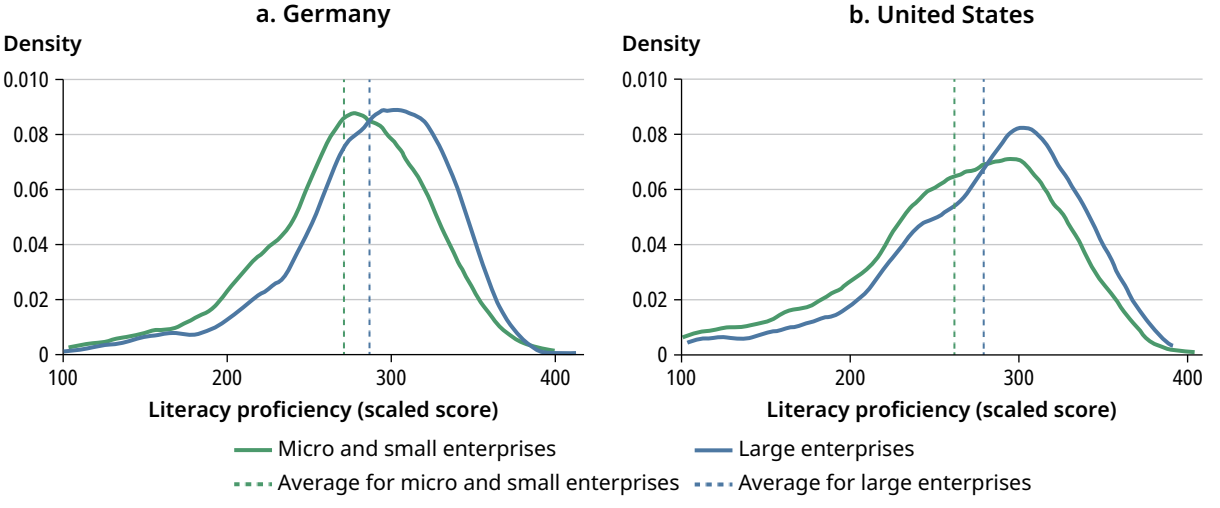
FIGURE 5.1 Lack of workforce skills remains an obstacle to firm growth



Source: Honorati, Santos, and Gomez Tamayo 2024, based on data from World Bank Enterprise Surveys.

Note: Only the latest survey in each country is included. The surveys cover 78 countries from 2010 to 2019 and include subjective assessments of the degree to which each element of the business environment is an obstacle to the firm's operations. The surveys include only formal firms with five or more employees in all manufacturing sectors and selected services. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia.

FIGURE 5.2 Literacy increases steadily with firm size in Germany and the United States



Source: Calculations based on data from cycle 2 of the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

Note: Micro and small enterprises are those with 1–50 employees, and large enterprises are those with 250 or more employees. The data correspond to 2023. *** $p < .001$.

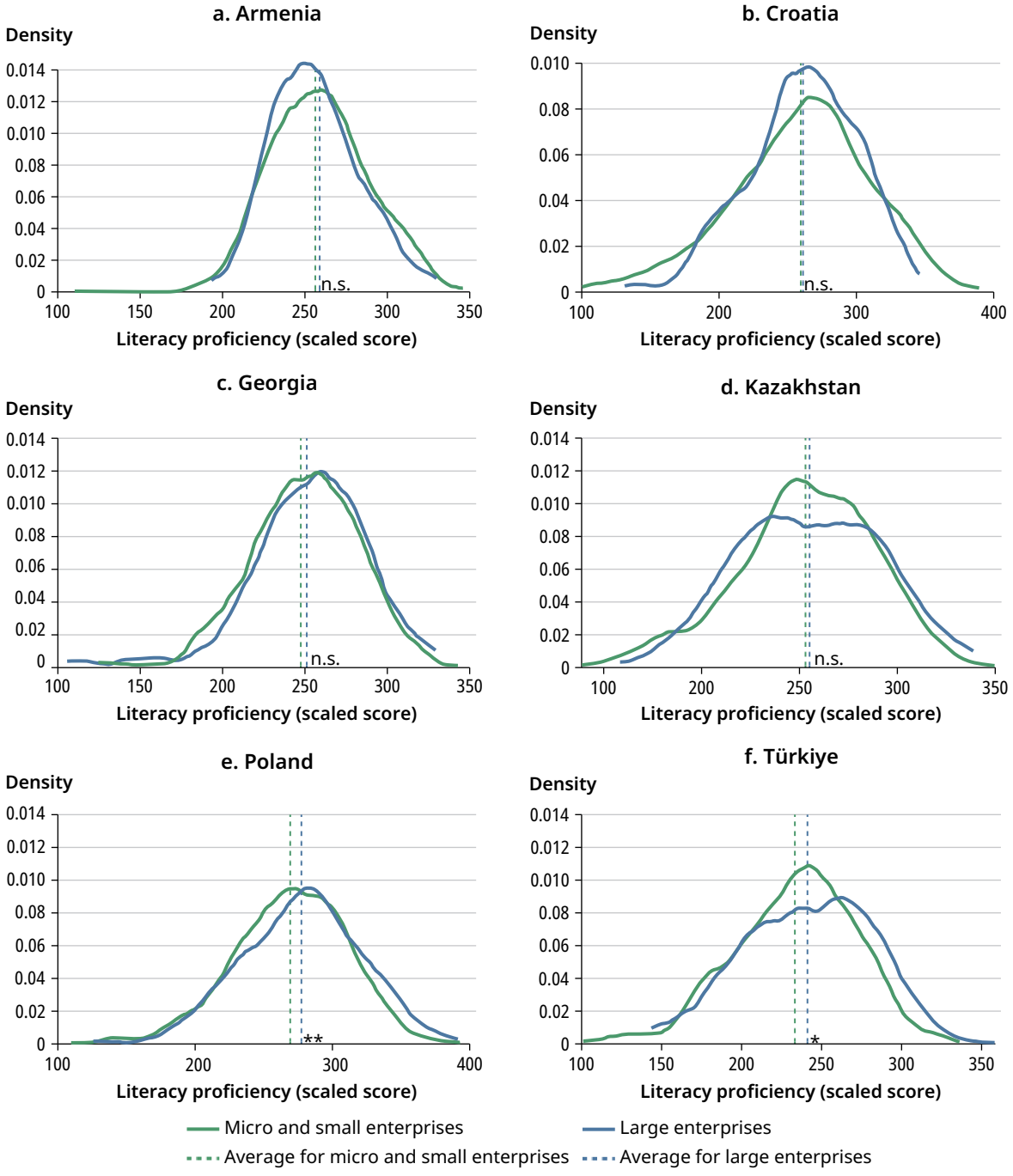
In contrast, data from ECA countries show a much weaker—and in some cases entirely absent—relationship between firm size and skill proficiency. In ECA there is little to no upward trend in literacy proficiency as firms grow in size (figure 5.3). In several cases, large firms do not have significantly more-skilled workforces than micro and small firms. The distribution of skills is flat, fragmented, or even slightly reversed in some countries. This points to a breakdown in the expected sorting of talent. In well-functioning markets, it would be expected that a larger share of the region's skilled workforce would be concentrated in more-productive firms. Yet, this does not appear to be happening in ECA. Instead, skilled workers may be underemployed in small firms or locked into less productive segments of the economy because of structural barriers.

One consequence of skill misallocation is skills mismatch. Skills mismatch is a specific type of misallocation in which there is a difference between the skills needed for the job and the skills possessed by the individual who is employed in that job. Skills mismatch is a multidimensional concept involving cognitive, noncognitive, and job-specific skills. Because directly measuring these multiple dimensions is difficult, most empirical work relies on proxies. This chapter estimates the incidence of skills mismatch in ECA countries, along with its direction (overqualification versus underqualification). It uses a vertical mismatch framework, defined by discrepancies between workers' educational attainment and the education required by their job (box 5.1). This approach, although imperfect, is useful especially when detailed skill assessments are unavailable, as is the case in many ECA countries.

The prevalence of vertical mismatch is heterogeneous across ECA. In some countries—Albania, Bulgaria, Croatia, and Romania—more than 75 percent of workers appear well-matched to their jobs (figure 5.4). Their rates are comparable to or even higher than those in high-income settings, but they are far from universal. In Bosnia and Herzegovina, North Macedonia, Tajikistan, and Uzbekistan, more than half of the employed population is mismatched with their jobs.

Overqualification is a particularly prevalent form of mismatch. Some 39 to 53 percent of the workforce in the ECA countries with the highest incidence of skills mismatch are overqualified, compared to 20 percent in high-income countries (figure 5.4). As educational attainment in ECA rose over the past decade, overqualification also increased. Between 2011 and 2023, the share of workers categorized as overqualified for their occupation increased from 5 percent to 18 percent in Serbia and from 34 percent to 42 percent in Bosnia and Herzegovina. A related fact is that in all but one ECA country, vertical skills mismatch is more common among tertiary-educated workers than among lower-skilled workers (refer to figure 5A.2 in online annex 5A). This suggests that there are specific challenges to finding well-matched jobs for higher-skilled workers in ECA countries, or that businesses discount the value of certain degrees.

FIGURE 5.3 In ECA, there is little to no upward trend in literacy proficiency as firms grow in size



Sources: Calculations based on data from the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies; the World Bank's Skills Toward Employment and Productivity initiative.

Note: Micro and small enterprises are those with 1–50 employees, and large enterprises are those with 250 or more employees. The data correspond to 2012 (Poland and Türkiye), 2013 (Armenia and Georgia), 2018 (Kazakhstan), and 2023 (Croatia). ECA = Europe and Central Asia.

n.s. = not significant. * $p < .10$; ** $p < .05$; *** $p < .01$.

BOX 5.1 Measuring the incidence and nature of skills mismatch in Europe and Central Asia

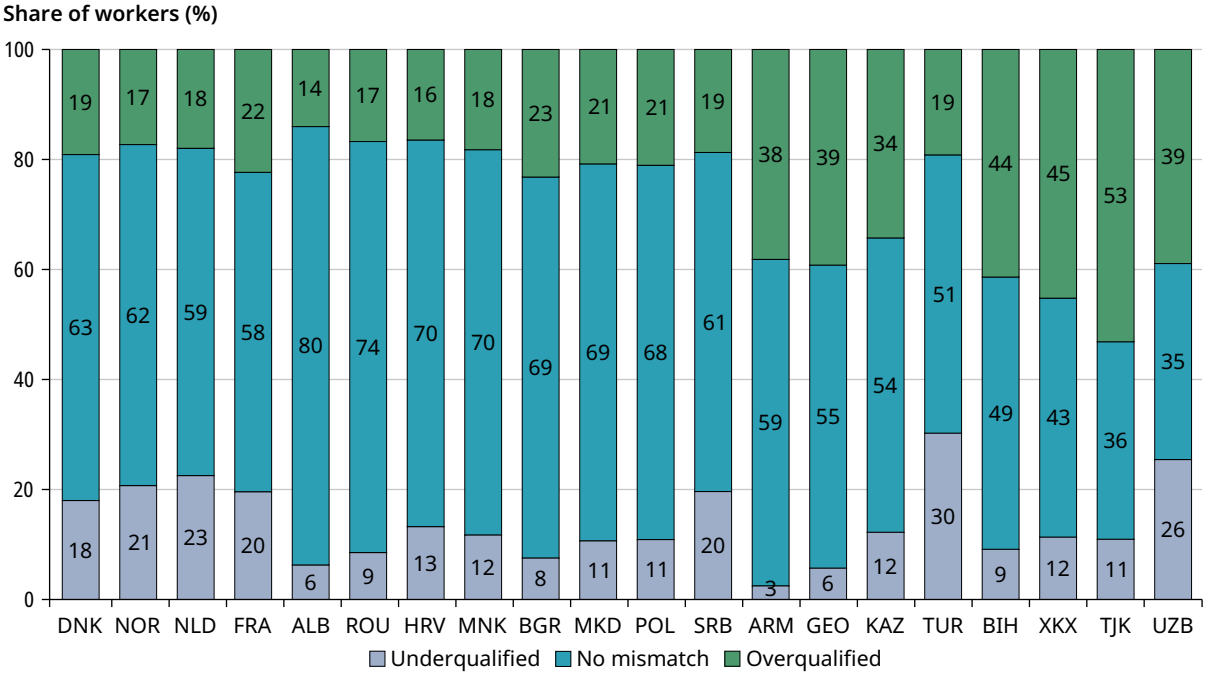
A range of empirical approaches are used to measure skills mismatch, all of which come with advantages and limitations. Some use qualification-based measures; others use measures of actual skills (such as cognitive and noncognitive abilities) and abilities that are specific to a particular job, occupation, or sector (OECD 2017). There are three main approaches to measuring mismatch (McGuinness, Pouliakas, and Redmond 2018). One is the subjective assessment method in which workers compare the education or skills required for their job (based on self-assessment) to their actual qualifications. Another is the empirical method, which compares workers' education or skills to the mean education or skill level in their occupation. A third is the job evaluation method, a measure of vertical mismatch that evaluates the skill or education requirements of jobs and compares them to the actual skills or education qualifications of the individuals in those jobs.[a]

This chapter uses the job evaluation method, a qualification-based measure of skills mismatch. The International Standard Classification of Occupations (ISCO), which links job roles to four levels of education, was used to identify jobs' education requirements. Workers whose educational attainment was higher than the ISCO-based requirement were classified as overqualified, and those whose educational attainment was lower were classified as underqualified.

The job evaluation method has the advantage of allowing for cross-country comparability and efficient use of existing labor force data, which are critical for this chapter. However, like the other approaches, the job evaluation method comes with several assumptions and limitations. First, it uses education as a proxy for skills relevant to labor market productivity. As a result, it does not capture skills acquired through informal training or on-the-job experience, and it assumes uniformity in occupational requirements across countries (Adalet McGowan and Andrews 2015). Second, in contexts where the quality of education is poor, education can be a noisy proxy for skills. As a result, mismatch identified using this measure may reflect issues beyond skill allocation, including the quality of education—for example, when more-educated workers work in lower-skilled jobs because their education did not equip them with the skills required for higher-skilled occupations.

a. In contrast, horizontal measures of mismatch are based on the fit of individuals' field of study to the occupation in which they are employed (Abdulla 2025).

FIGURE 5.4 The prevalence of vertical skills mismatch is heterogeneous across ECA



Source: Bossavie and Torre 2025, based on data from national labor force surveys.

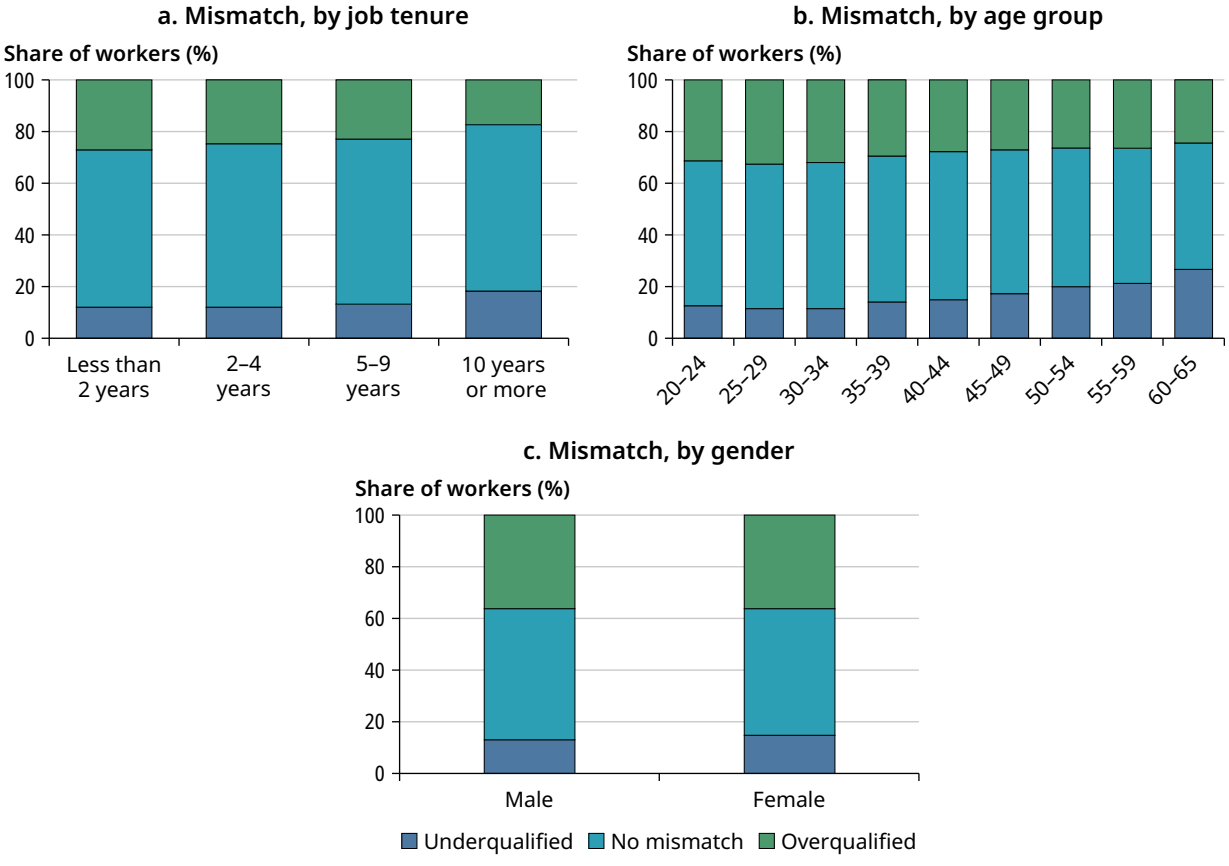
Note: The figure includes only wage employees. Mismatch is based on whether the skill or education requirements of a job match the actual skills or education qualifications of the individuals in the job. Percentages may not sum to 100 because of rounding. The data correspond to 2023 or the latest year available. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. Denmark (DNK), Norway (NOR), Netherlands (NLD), and France (FRA) are included for comparative purposes. ECA = Europe and Central Asia.

Underqualification appears to be less important in ECA. The rate of underqualification in most ECA countries is lower than in high-income countries and has declined over the past decade. However, a few countries, including Türkiye and Uzbekistan, still exhibit high rates of underqualification. About 30 percent of the workers in these countries lack the formal education typically required for their jobs, compared to 20 percent in high-income countries.

The relationships between skills mismatch and workers' job tenure, age, and gender provide insights on the implications of mismatch for productivity and human capital formation. Overqualification declines with job tenure in ECA (figure 5.5, panel a). This may result from internal (within-firm) mobility as workers gain more experience, or from mobility across firms. Mismatched workers may leave a firm earlier to find a better match elsewhere

(Guvenen et al. 2020). In contrast, underqualification increases with job tenure. Instead of indicating that more-experienced workers lack the skills required to carry out their job, this may reflect the accumulation of job- and firm-specific skills that are valuable to firms but not captured by qualification-based measures of mismatch (this is discussed in the next section). Younger workers with less work experience are more likely to be mismatched, and they are especially likely to be overqualified (figure 5.5, panel b). This suggests that labor market information asymmetries play a role in skills mismatch because they tend to be more pronounced for younger workers with little or no labor market experience. Finally, mismatch rates are similar for male and female workers (figure 5.5, panel c).

FIGURE 5.5 Overqualification is lower (and underqualification is higher) for older workers and those with long tenures



Source: Bossavie and Torre 2025, based on data from national labor force surveys.

Note: Mismatch is based on whether the skill or education requirements of a job match the actual skill or education qualifications of the individuals in the job. The data correspond to the latest year available up to 2023.

Static and Dynamic Productivity Consequences of Skill Misallocation

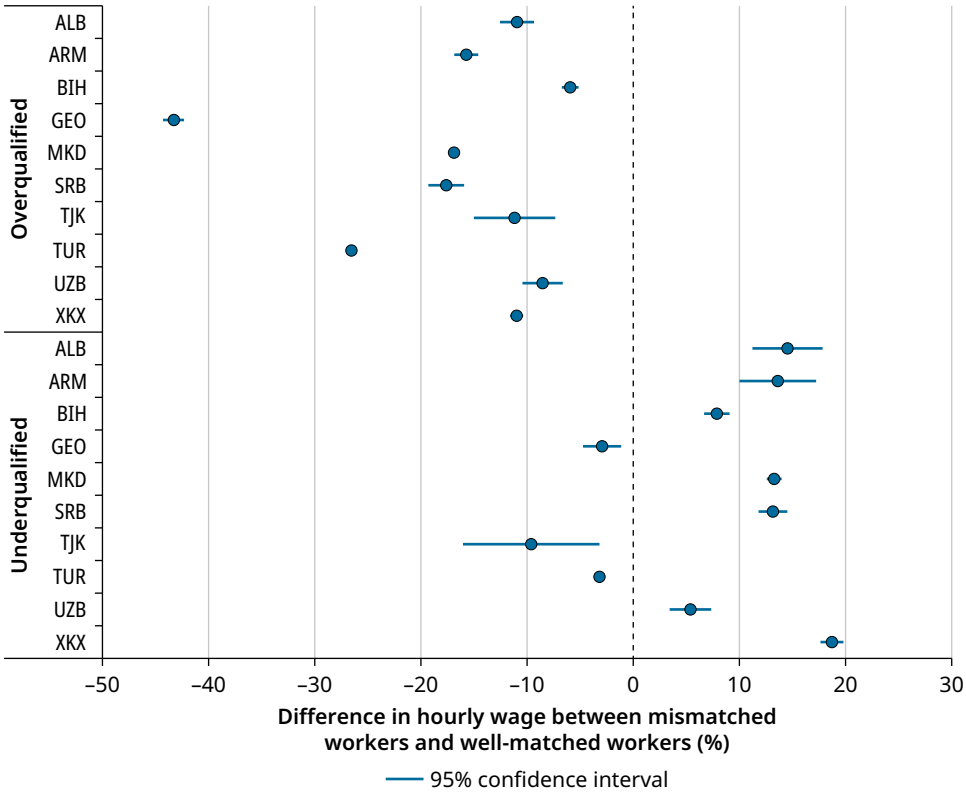
Skill misallocation can have both static and dynamic effects on workers' wages and productivity. Static productivity loss occurs because mismatched workers could be more productive if their job matched their skills, and dynamic loss occurs because mismatch impedes learning and human capital accumulation over time (Guvenen et al. 2020). Recent analysis of a longitudinal sample of respondents from the OECD's PIAAC showed that proficiency in cognitive skills—literacy and numeracy—declines strongly after age 40 for individuals who do not use those skills at work. For individuals who do use them regularly, there is no age-related decline (Hanushek et al. 2025). This implies that skill misallocation compounds itself by leading to poor skill development throughout workers' professional lives.

This section explores the association between misallocation and productivity, distinguishing between static and dynamic effects. The section examines the relationship between misallocation and productivity by separately estimating static and dynamic effects using a conventional Mincer regression framework. The static effect is identified by including vertical mismatch as the main regressor, capturing how mismatched skills relate to productivity at a given point in time.[1] To explore the implications of different types of vertical skills mismatch, both a binary indicator and a directional measure (overqualification or underqualification) are employed. The dynamic effect is estimated through a flexible specification of years of experience, allowing for variation in returns to experience across individuals. Both estimations rely on data from a subsample of ECA countries, with labor productivity proxied by hourly wages, and the analysis is restricted to wage employees. Firm-level productivity is not considered, as it may not be fully reflected in wages.

Static effects

There is a statistically significant negative relationship between skills mismatch—especially overqualification—and hourly wages. Overqualified workers earn about 12 percent less than their well-matched counterparts, an effect comparable to losing three to four years of work experience. The loss ranges from 8 percent in Bosnia and Herzegovina to more than 40 percent in Georgia (figure 5.6). Conversely, underqualification is associated with slightly higher wages. This does not mean that underqualification enhances productivity, but that underqualified workers earn a higher wage than workers with a similar qualification working in less skill-intensive occupations. From the worker's point of view, underqualification may be associated with slightly higher productivity, but from the employer's point of the view, it could indicate a productivity loss because the employer could hire a similarly skilled worker (with an equivalent formal qualification) at a lower wage to carry out the same task.

FIGURE 5.6 There is a statistically significant relationship between skills mismatch—especially overqualification—and hourly wages



Source: Bossavie and Torre 2025, based on data from national labor force surveys.

Note: Values are from Mincer regressions of workers' hourly wages on the mismatch variable, with controls for gender, level of education, potential experience, potential experience squared, sector of activity fixed effects, and year fixed effects. The sample includes only wage employees. The data correspond to 2010–23 (different periods for different countries). For a list of country codes, refer to https://www.iso.org/obp/ui/#search.

Dynamic effects

Skills mismatch may have dynamic and cumulative implications for workers' wages and productivity beyond contemporaneous effects. For example, the negative wage effects of skills mismatch may compound over time, leading to greater detrimental effects on productivity with a longer duration of mismatch (Guvenen et al. 2020). To assess the dynamic effects of mismatch on wages, an interaction between skills mismatch and job tenure, available for a subset of countries, is added to the Mincer estimations as a regressor. In ECA, the negative association between overqualification and wages weakens with job tenure for all but one country (Türkiye) in the sample (refer to figure 5A.3 in online annex 5A). This suggests that skill gaps can be closed over time through job-specific learning,

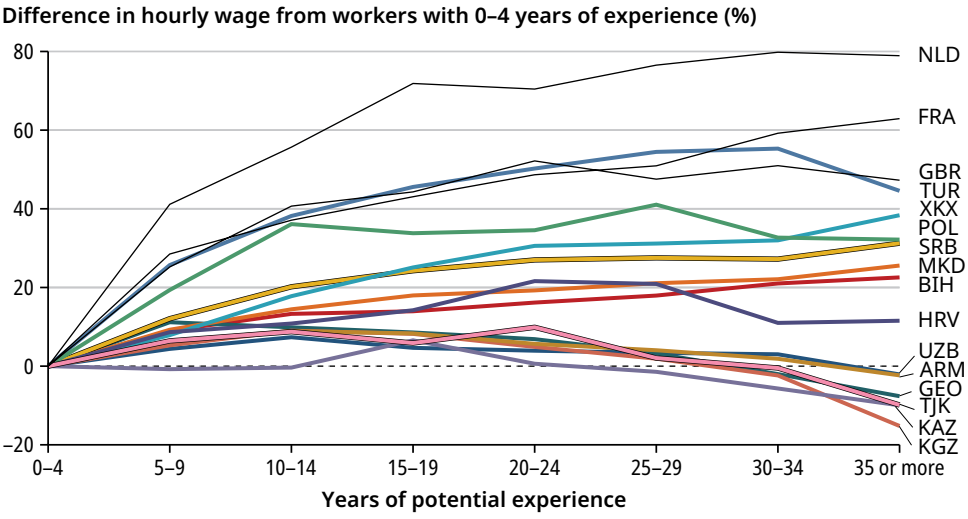
which is not captured by education-based measures of mismatch.[2] In other words, an initial vertical mismatch on education level becomes less important for workers' wages and productivity as they gain experience in the firm and accumulate firm-specific human capital. In addition, the rate at which the gap diminishes differs widely across ECA countries, which could reflect a different pace of on-the-job learning. This cumulative effect underscores the importance of skill accumulation in the workplace—and of policies that promote skill accumulation—in mitigating the costs of long-term mismatch.

A major aspect of the relationship between skills and productivity is the degree to which skills are developed on the job throughout workers' professional lives. Human capital formation does not stop with schooling—it continues in the workplace (World Bank 2025). The development of skills in the workplace can take place passively (through learning by doing) or actively (through on-the-job training). The bulk of human capital formation in the workplace likely emerges from learning by doing because on-the-job training is negligible in most countries (Jedwab et al. 2023).

ECA countries display moderate returns to experience at best, especially compared to countries in Western Europe. Returns to experience—a measure of the degree to which human capital and skills are developed in the workplace—are estimated from a simple Mincer regression that includes education and sample fixed effects as control variables.[3] Experience is measured as years of potential experience, defined as the number of years elapsed since completing the highest level of education.[4] In France, the Netherlands, and the United Kingdom, wages tend to rise sharply and consistently with experience, and workers in these countries can expect to earn 70–80 percent more with 35 or more years of experience compared to workers who are starting their careers (figure 5.7). In contrast, in Kosovo, Poland, and Serbia, wages rise more gradually, leveling off at 30–40 percent above entry-level wages by the time workers reach the highest experience bracket. Bosnia and Herzegovina, Croatia, and North Macedonia show even flatter profiles, where returns to experience are positive but more limited and tend to plateau after 15–20 years of work. These patterns may reflect a mix of institutional structure, labor market inefficiencies, poor initial foundational skills, or slower wage progression.

Countries in Central Asia and the South Caucasus—Armenia, Georgia, Kazakhstan, the Kyrgyz Republic, and Uzbekistan—exhibit the weakest returns to experience. In several of these countries, wages increase modestly in the early stages of a worker's career but then stagnate or even decline with further experience. For example, in the Kyrgyz Republic, the most experienced workers earn less than those with just a few years of experience. The low returns to experience may not stem from low returns to job tenure, which can differ substantially (box 5.2). Instead, returns to experience are best understood as returns to work experience that are rewarded across the entire labor market.

FIGURE 5.7 ECA countries display moderate returns to experience at best, especially compared to countries in Western Europe



Sources: Bossavie, de Hoyos, and Torre 2025, based on data from national labor force surveys; the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

Note: The figure includes only wage employees. The data correspond to 2010–23 (different periods for different countries). For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia.

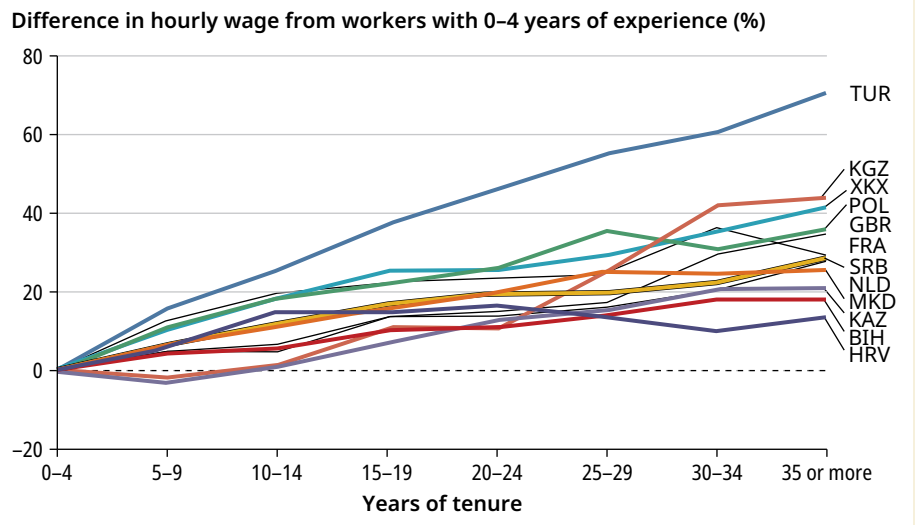
BOX 5.2 Returns to experience and returns to tenure

The difference between returns to experience and returns to tenure has been a topic of research among labor economists since Gary Becker's seminal work on the role of general and specific human capital accumulation in explaining wage growth (Becker 1964). General human capital can be used across occupations, while specific human capital is best used and developed in specific occupations. Returns to experience measure the returns to additional years of work experience across all occupations, whereas returns to tenure measure the returns to additional years of work experience with a given employer. Data from labor force surveys and the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies show that, unlike the patterns of returns to experience, the patterns of returns to tenure are similar for high-income countries in Europe and countries in Europe and Central Asia (ECA) (figure B5.2.1). However, in European high-income countries, the returns to tenure are smaller than the returns to experience, but in ECA countries, the returns to tenure are larger than the returns to experience.

Continued

BOX 5.2 Returns to experience and returns to tenure *(Continued)*

FIGURE B5.2.1 The patterns of returns to tenure are similar for high-income countries in Europe and countries in ECA



Sources: Bossavie, de Hoyos, and Torre 2025, based on data from national labor force surveys; the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

Note: The figure includes only wage employees. The data correspond to 2010–23 (different periods for different countries). For a list of country codes, refer to https://www.iso.org/obp/ui/#search.

These patterns are partly expected given the different levels of development because there is evidence that experience plays a larger role in wage growth in higher-income countries than in middle-income countries (Marinescu and Triyana 2016). The literature suggests that this can be explained by many factors. One is job complexity and technology: In jobs with high routineness and low complexity, workers benefit from repetition and gradual improvement—tenure yields productivity gains as workers master the routine. In jobs with fast-changing or complex tasks, much of the skill comes from formal training or outside knowledge and firm-specific learning is less crucial. Different technological regimes produce divergence: Tenure is rewarded in stable, traditional technological contexts, whereas experience across firms is key in innovative sectors. A similar logic can apply across skill levels: Workers with higher skill levels have larger returns to experience, while those with lower skill levels have larger returns to tenure (Dustmann and Meghir 2005). That ECA countries are behind the technological frontier—or at least trailing the technological progress of European high-income countries (chapter 2)—could result in larger returns to tenure than to experience.

Continued

BOX 5.2 Returns to experience and returns to tenure *(Continued)*

Labor mobility might also explain the difference between returns to experience and returns to tenure. In fluid labor markets, workers frequently change jobs to obtain higher wages or better matches. As a result, a substantial part of wage growth occurs at the point of job switches rather than within one job. This tends to make returns to observed tenure smaller. In contrast, in markets where mobility is limited (due to fewer outside options, cultural factors, or stronger internal labor markets), workers are more likely to stay and climb a tenure-wage ladder. ECA countries have traditionally had lower labor market mobility than European high-income countries, but mobility may have shifted over time. In particular, average job tenure (a proxy for labor market mobility) in ECA has fallen considerably for the cohorts of workers born since 1980 (Bussolo et al. 2024). Still, higher levels of education in ECA are associated with longer tenure (and possibly less mobility), in contrast to European high-income countries, where individuals with tertiary education have shorter tenure (and possibly greater mobility) than individuals with less education.

Women tend to have slightly larger returns to experience than men—particularly in the later stages of their professional lives. Moreover, the difference in returns to experience between European high-income countries and ECA countries is smaller for women (refer to figure 5A.4 in online annex 5A). The patterns for women in Poland and Türkiye are similar to those for women in France and the United Kingdom. Occupational and sector segregation by gender, as well as differences in labor market participation, may explain the difference.

What Factors Explain Skill Misallocation?

Countries in ECA show substantial skill misallocation, which limits productivity and human capital accumulation in the workplace. This section discusses the roles that four factors play in skill misallocation in the region:

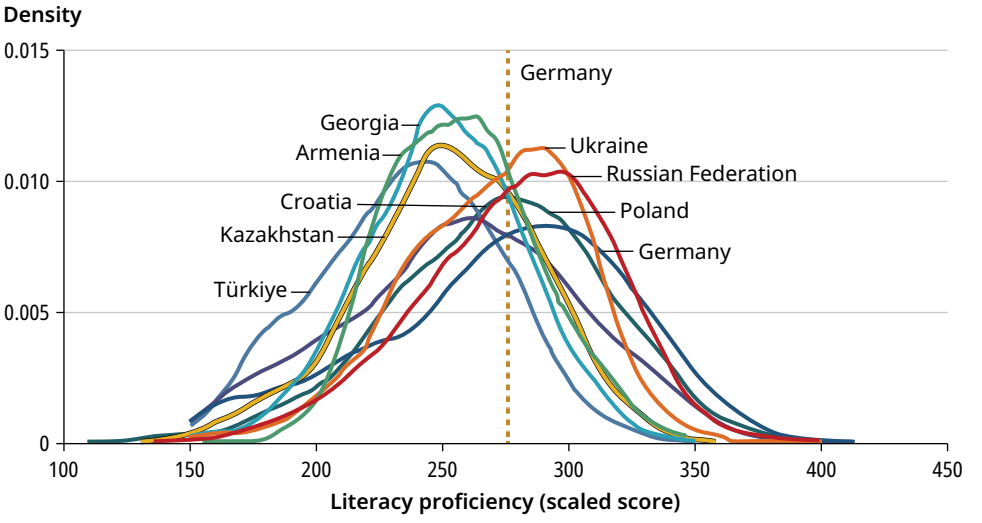
- Deficiency in the supply of skills—particularly in foundational skills—among the population
- Constraints from the labor demand side that lead to insufficient demand for an increasingly educated workforce
- Poor managerial skills that contribute to suboptimal skill allocation and productivity losses
- Institutional and structural features of the labor market, which create friction in employer-employee matching.

All four factors play a role, meaning that multipronged policy responses are needed to address skill misallocation.

Deficiency in foundational skills

The people of ECA are receiving more years of education than ever, but the increase in educational attainment has not necessarily translated into higher skills. The distribution of literacy proficiency in Armenia, Croatia, Georgia, Kazakhstan, and Türkiye lies considerably below the distribution in Germany (figure 5.8). Although a subset of high-performing individuals in ECA overlaps with the German distribution, the majority of adults in the ECA countries perform below the German median—and far below the German mean—on international literacy assessments. This shows that, despite improvement in educational attainment, skill levels across the current workforce in ECA are much lower than those in high-income benchmark countries.

FIGURE 5.8 Skill levels across the current workforce in ECA are lower than those in high-income benchmark countries



Sources: Calculations based on data from the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies (PIAAC); the World Bank's Skills Toward Employment and Productivity (STEP) initiative.

Note: The sample corresponds to the adult population interviewed in PIAAC cycle 1 (Kazakhstan, Poland, the Russian Federation, and Türkiye), PIAAC cycle 2 (Croatia and Germany), and STEP (Armenia, Georgia, and Ukraine). The data correspond to 2012 for PIAAC cycle 1 (except for Kazakhstan, which corresponds to 2018), 2023 for PIAAC cycle 2, and 2013 for STEP. ECA = Europe and Central Asia.

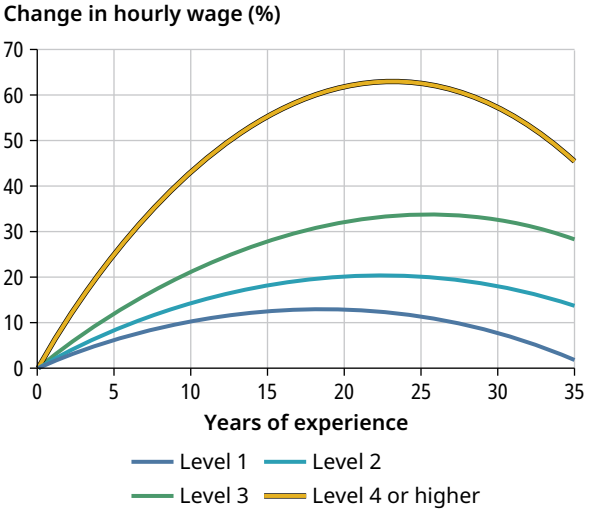
The poor quality of education—particularly vocational and higher education—explains the poor skill proficiency despite the increase in educational attainment. ECA is characterized by a large footprint of vocational education: almost half of upper secondary students are enrolled in a vocational program, more than twice the share in the rest of the world (Izvorski et al. 2024). These students perform poorly in basic subjects such as reading and math, and any labor market advantage they have at the beginning of their professional lives quickly dissipates (Dalvit et al. 2023; Hanushek et al. 2017). Another characteristic of ECA is the large enrollment in higher education, exceeding what would be expected given the region's income levels (Iacovone et al. 2025). However, the quality of universities is poor compared to global standards, and this underperformance is associated with poor cognitive skills among tertiary education graduates in the region (refer to figure 5A.5. in online annex 5A).

Proficiency in foundational skills—especially literacy and numeracy—has a direct impact on productivity. Extensive evidence in academic literature has shown that workers with higher levels of cognitive skills are more productive in their jobs (Hanushek and Woessmann 2008; Heckman, Stixrud, and Urzúa 2006). This also extends to socioemotional, noncognitive skills, which have become more relevant over time (Deming and Silliman 2024). The fact that a substantial share of ECA's workforce has a lower skill proficiency than that of high-income countries is already an important explanatory factor for the region's underperformance in productivity.

The gaps in foundational skills also constrain productivity indirectly, by limiting workplace learning, reducing the impact of training, and weakening labor market matching. Foundational skills are the building blocks for acquiring job-specific skills, adapting to new technologies, and accumulating human capital over time. This dynamic effect is clear in ECA. On average, controlling for education, gender, job tenure, occupation, and sector, workers with higher levels of proficiency in foundational skills have considerably larger returns to experience than those with lower levels of proficiency. For instance, based on data from cycle 1 of the OECD's PIAAC in Poland, an individual with level 1 proficiency in literacy (very basic) had a 10 percent increase in wages with the first 10 years of work experience, compared to a 40 percent increase for a worker with level 4 or a higher level of proficiency in literacy (the highest level) (figure 5.9). This pattern—a steeper wage-experience profile for individuals with higher proficiency in foundational skills than for those with lower proficiency—is observed, with different magnitudes, across all ECA countries with data.

More recent data have shown that foundational skills among younger generations are not improving—and in many cases are declining—compounding the challenge of low skills. Results from the OECD's Programme for International Student Assessment reveal flat or deteriorating learning outcomes among 15-year-olds across many ECA countries (refer to figure 5A.6 in online annex 5A). This signals a troubling trend: Not only is the stock of foundational skills among adults low, but the pipeline of future skilled workers is also weakening.

FIGURE 5.9 In Poland, individuals with lower literacy receive a lower increase in wages at all levels of work experience, compared to individuals with higher literacy



Source: Calculations based on data from cycle 1 of the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

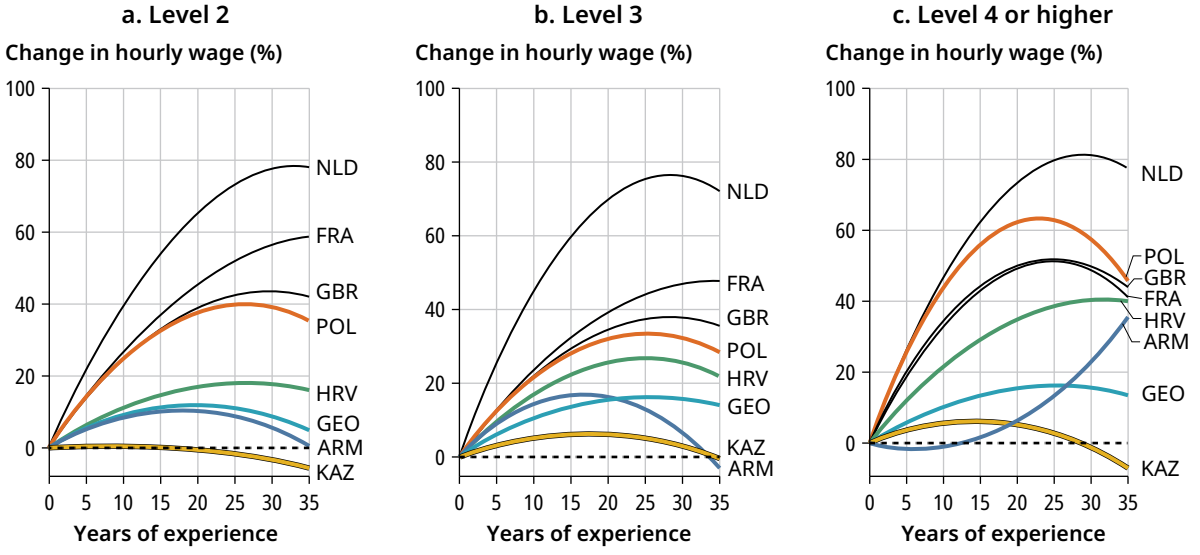
Note: Values are the fitted results of a Mincer regression with a quadratic polynomial on potential experience interacted with the proficiency level indicator and controls for gender, education level, job tenure, occupation (at the one-digit level of the International Standard Classification of Occupations), and sector (agriculture, manufacturing, or services). Level = literacy proficiency. The figure includes only wage employees. The data correspond to 2012.

In short, the quality of foundational skills explains part of the skills puzzle in ECA. Many graduates may hold formal qualifications but lack the cognitive competencies required for productive employment. However, this is not the whole story—for two reasons.

First, vertical skills mismatch does not appear to be exclusively the result of underlying differences in skill proficiency—at least for the subset of countries with more granular skills data. No ECA country with data except Poland shows a significant difference in cognitive skill proficiency between unmatched and well-matched workers (refer to figure 5A.7 in online annex 5A).[5] This contrasts with advanced European economies, where vertical mismatch is associated with differences in foundational skills—particularly for overqualified workers. The pattern in ECA is particularly worrying from a productivity perspective because it means that skilled workers may be in jobs that are not objectively aligned with their skill level, and that individuals in advanced European economies who appear overqualified may actually be underskilled, with their occupation matching their objective skill level.

Second, there are significant differences in returns to experience for workers with the same foundational skills. The wage-experience profiles for individuals with level 2, 3, or 4 proficiency in literacy are substantially lower in ECA countries (except for those with level 4 proficiency in Poland) than in European high-income countries (figure 5.10).[6] This suggests that there is substantial productivity loss among equally skilled workers employed in similar occupations and sectors. For instance, bringing the productivity of the workers with the highest literacy proficiency (level 4) in Armenia, Croatia, Georgia, and Kazakhstan to the level of those in Poland, which is on par with European high-income countries, would result in cumulative wage increases of 20–40 percent. For workers with lower proficiency (level 2 or 3), the productivity losses with respect to European high-income countries are also substantial.

FIGURE 5.10 In most countries in ECA, the wage-experience profile for individuals with lower literacy proficiency is substantially below that in European high-income countries



Sources: Calculations based on data from the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies (PIAAC); the World Bank's Skills Toward Employment and Productivity (STEP) initiative.

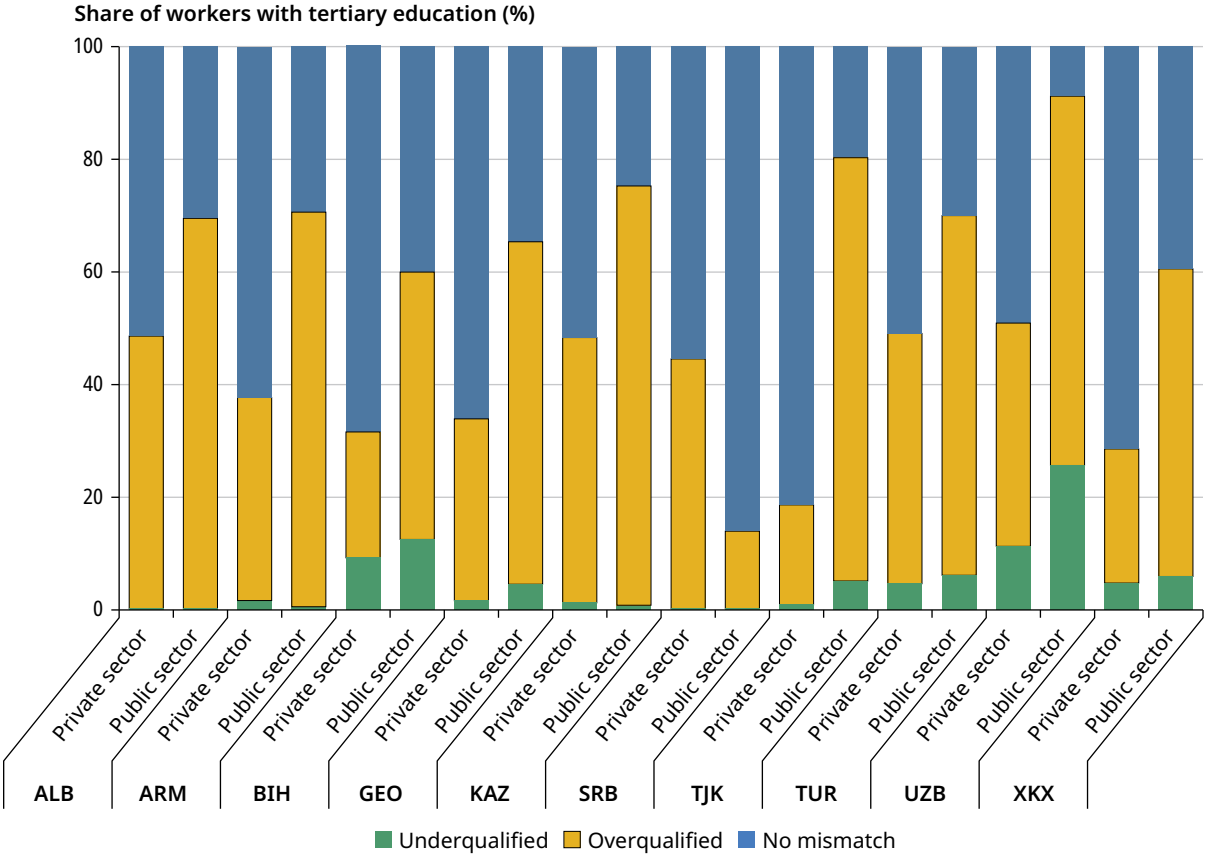
Note: The European high-income countries in the sample are France, the Netherlands, and the United Kingdom. The sample corresponds to the adult population interviewed in PIAAC cycle 1 (France, Kazakhstan, the Netherlands, Poland, and the United Kingdom), PIAAC cycle 2 (Croatia), and STEP (Armenia and Georgia). Values are the fitted results of a Mincer regression with a quadratic polynomial on potential experience interacted with the proficiency level indicator and controls for gender, education level, job tenure, occupation (at the one-digit level of the International Standard Classification of Occupations), and sector (agriculture, manufacturing, or services), except for Croatia, which controls only for gender and education level because of data limitations. The figure includes only wage employees. The data correspond to 2012 for PIAAC cycle 1 (except for Kazakhstan, which corresponds to 2018), 2023 for PIAAC cycle 2, and 2013 for STEP. ECA = Europe and Central Asia.

Constraints in labor demand

That vertical mismatch is not necessarily correlated with differences in foundational skills and that returns to experience are low even for highly skilled individuals suggest that employment characteristics—particularly the nature of labor demand—also play a role in skill misallocation in ECA.

One major aspect of labor demand is the public sector's role. The public sector footprint in terms of total wage employment, especially among those with tertiary education, is large in many ECA countries—with potentially large implications for skills mismatch. Among higher-skilled individuals, skills mismatch and overqualification are much more pronounced for those employed in private enterprises than for those employed in the public sector (figure 5.11). This may reflect the relative attractiveness of public employment for high-skilled workers, together with the limited supply of high-skilled employment in the private sector of most ECA countries.

FIGURE 5.11 Among higher-skilled individuals, skills mismatch and overqualification are much more pronounced for those employed in private enterprises than for those employed in the public sector in ECA

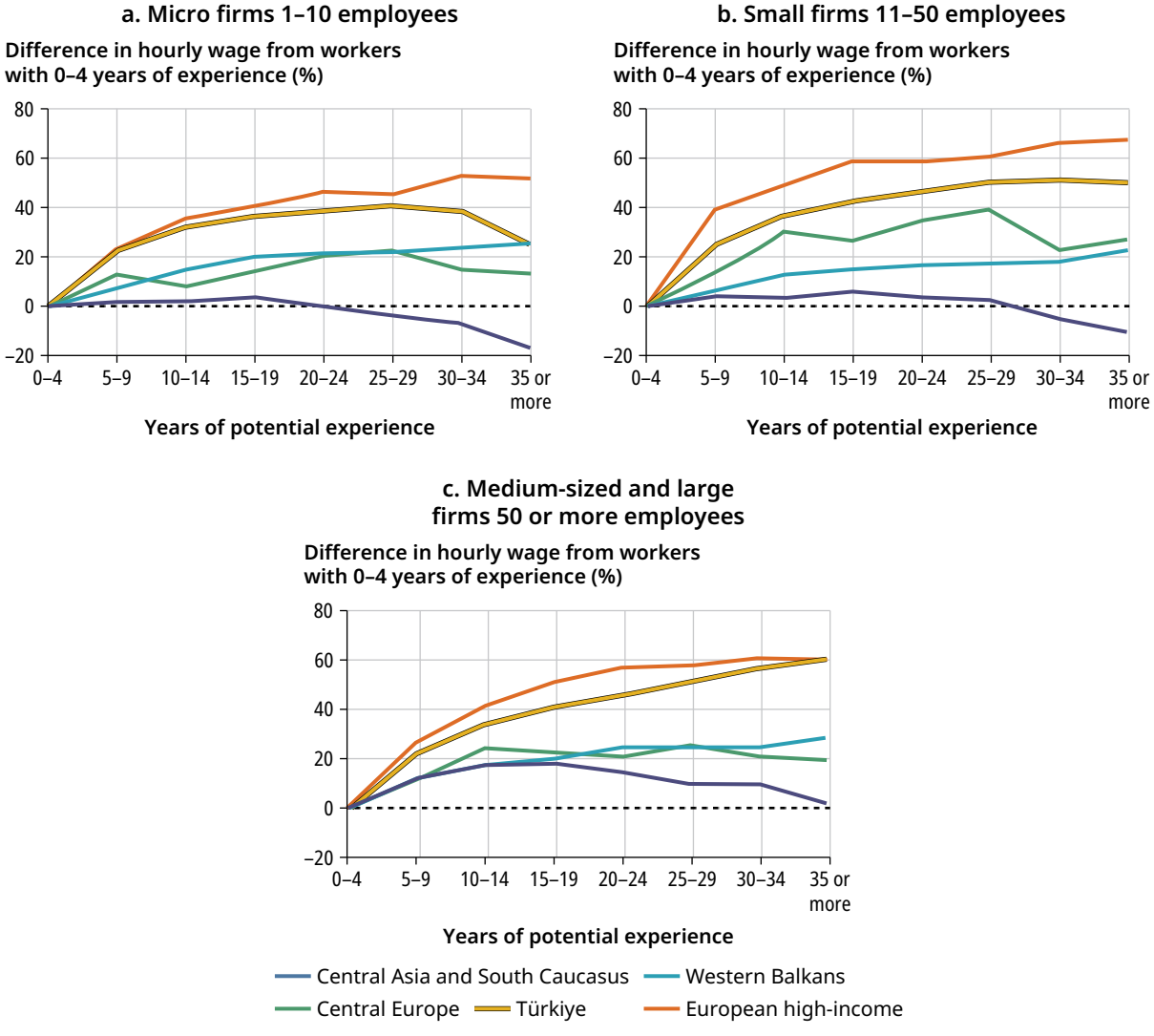


Source: Bossavie and Torre 2025, based on data from national labor force surveys.

Note: The figure includes only wage employees. The data correspond to the latest year available up to 2023. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia.

Mismatch patterns vary little by firm size. This could indicate weak sorting mechanisms or rigid labor markets in ECA countries, where firm productivity does not always correspond to better job matches. Returns to experience are very small for small firms (11–50 employees) in ECA (figure 5.12). Most countries exhibit small or even negative returns to experience in micro firms (1–10 employees), starkly contrasting with the strong upward trajectories in European

FIGURE 5.12 Returns to experience are very low for small firms in ECA, but as firm size increases, returns to experience become more aligned with those in European high-income countries



Sources: Bossavie, de Hoyos, and Torre 2025, based on data from national labor force surveys; Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

Note: The figure includes only wage employees. The data correspond to 2010–23 (different periods for different countries). ECA = Europe and Central Asia.

high-income economies. For example, in Georgia, Kazakhstan, and Uzbekistan, wages decline steeply or stagnate with more experience, although a few countries—including Kosovo and Türkiye—show moderate gains. As firm size increases, returns to experience become more aligned with those in European high-income countries. In small firms and especially medium-sized and large firms (50 or more employees), most countries show substantially improved and upward-sloping earnings profiles. Kosovo, Poland, and Türkiye demonstrate returns to experience that approach or even match the those in European high-income contexts. Even countries with initially weak returns, such as Kazakhstan and Serbia, show positive wage growth in larger firms. One reason individuals working in large firms have larger returns to experience could be that those firms invest more in on-the-job training (box 5.3). International evidence has shown that the difference in returns to experience between small and large firms cannot be fully explained by worker selection, but partly reflect causal effects of firm characteristics (World Bank 2025).

BOX 5.3 Does on-the-job training improve wages and productivity?

Skill development in the workplace does not occur only through learning by doing. An important part of skill accumulation can also happen through formal or informal training provided by the employer, also called on-the-job training. Compared to firms in European high-income countries, private firms in Europe and Central Asia (ECA) invest in much less on-the-job training (refer to figure 5A.8 in online annex 5A). According to data from the latest World Bank Enterprise Surveys, on average, 22.9 percent of firms in ECA offer formal training, compared to almost 50 percent in European high-income countries. The gap is roughly unchanged across firm size: The average for firms with fewer than 20 employees is 18.5 percent in ECA and 43.2 percent in European high-income countries, and the average for firms with more than 100 employees is 50.3 percent in ECA and 75.7 percent in European high-income countries.

The academic literature has found that on-the-job training increases worker productivity, with effects ranging from 6 percent (Dearden, Read, and Van Reenen 2006) to more than 20 percent (Adhvaryu, Kala, and Nyshadham 2023). Globally, the higher prevalence of firm-provided training in richer countries accounts for an estimated 38 percent of the differences in cross-country wage growth and 12 percent of the differences in cross-country income (Ma, Nakab, and Vidart 2024). The productivity effects of on-the-job training usually complement investment in physical capital and information and communications technology (Dostie 2018), a feature that can account for higher productivity effects among larger firms than smaller firms. The difference in productivity effects by firm size might explain the lower offering of training among small firms, which face sunk costs that cannot be overcome without high enough productivity returns (Almeida and Reyes 2010).

Continued

BOX 5.3 Does on-the-job training improve wages and productivity? *(Continued)*

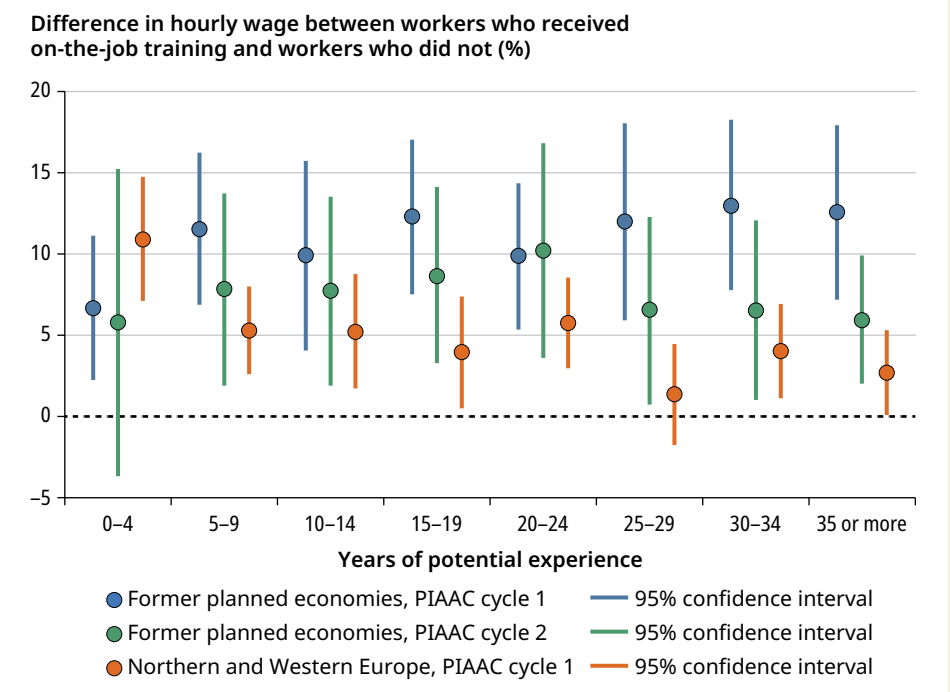
However, productivity gains do not necessarily accrue to the workers in the form of increased wages. Many studies find that the productivity gains of on-the-job training exceed the wage gains (for instance, refer to Konings and Vanormelingen 2015). This can be explained by labor market frictions (such as surplus labor, weaker worker bargaining power, or contractual rigidities) that allow firms to retain a substantial part of the productivity gains. The surplus can also be an incentive for firms to invest in training.

There is limited evidence on the productivity and wage effects of on-the-job training in ECA. Nevertheless, the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies (PIAAC) survey includes data from many European economies that share an important structural characteristic with most ECA countries: being former planned economies. Apart from Kazakhstan and Poland (only in PIAAC cycle 1), PIAAC data include countries in Central Europe (Czechia, the Slovak Republic, and Slovenia) and the Baltics (Estonia, Latvia, and Lithuania). In these former planned economies, the difference in hourly wages between workers who received formal on-the-job training in the previous year and workers who did not is positive—between 5 percent and 10 percent—and significant across their whole professional lives (figure B5.3.1). The difference is net of wage effects attributed to worker and firm characteristics, such as gender, education, literacy proficiency, job tenure, occupation, economic sector, and firm size. The wage differential due to on-the-job training is smaller in high-income economies in Northern and Western Europe. Given that fewer firms provide on-the-job training in former planned economies, this suggests that firms in ECA invest in on-the-job training only when the returns are particularly high—higher than for comparable firms in Northern and Western Europe. Liquidity constraints and concerns about worker turnover are among the market failures that may prevent firms from investing in on-the-job training despite expected positive returns in ECA (Arias et al. 2014).

Continued

BOX 5.3 Does on-the-job training improve wages and productivity? *(Continued)*

FIGURE B5.3.1 In former planned economies, workers who received formal on-the-job training in the previous year had 5–10 percent higher wages than workers who did not receive such training

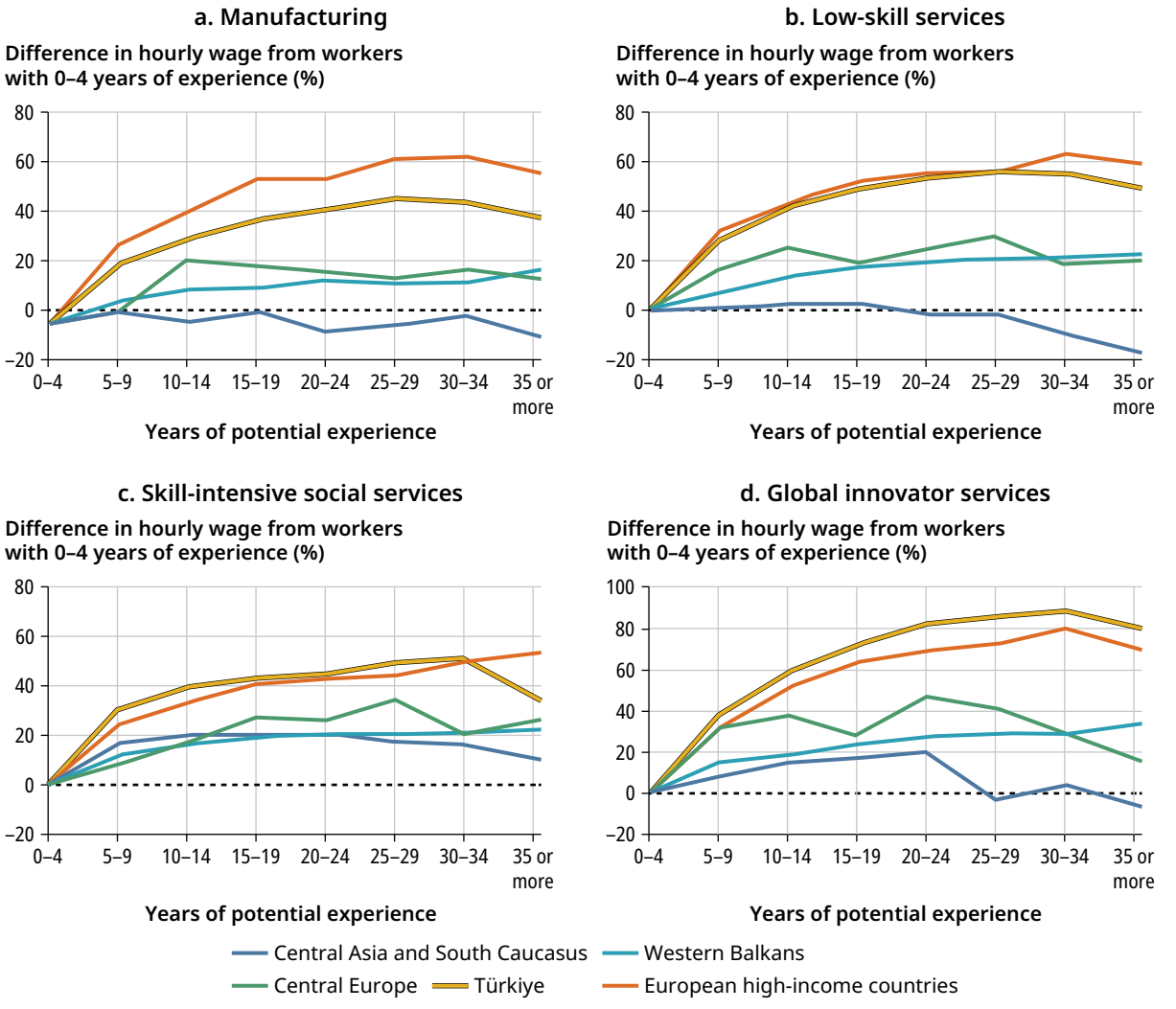


Source: Calculations based on data from the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies (PIAAC).

Note: On-the-job training is defined as participating in any job-related training during paid working hours. Values are from a standard Mincer regression with controls for gender, education, quartile of literacy proficiency, job tenure, occupation, economic sector, and firm size. The former planned economies in the sample are Czechia, Estonia, Kazakhstan, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia. The countries in Northern and Western Europe are Belgium, Denmark, Finland, France, Ireland, the Netherlands, Norway, and the United Kingdom. The data correspond to 2012 for PIAAC cycle 1 (except for Kazakhstan, which corresponds to 2018) and 2023 for PIAAC cycle 2.

Returns to experience are slightly smaller in low-skilled services and manufacturing, and higher in skill-intensive social services and particularly in global innovator services. ECA countries are farthest from the European high-income benchmark in manufacturing and, except for Türkiye, in all types of services (figure 5.13). Among countries in Central Asia and the South Caucasus,

FIGURE 5.13 Countries in ECA are far from the European high-income benchmark for returns to experience in manufacturing and, except for Türkiye, in all types of services



Sources: Bossavie, de Hoyos, and Torre 2025, based on data from national labor force surveys; the Organisation for Economic Co-operation and Development's Programme for the International Assessment of Adult Competencies.

Note: The sample for Central Asia and the South Caucasus includes Armenia, Georgia, Kazakhstan, the Kyrgyz Republic, and Uzbekistan. Western Balkans includes Bosnia and Herzegovina, Kosovo, North Macedonia, and Serbia. Central Europe includes Croatia and Poland. European high income includes France, the Netherlands, and the United Kingdom. The samples include only wage employees. The data correspond to 2010–23 (different periods for different countries). ECA = Europe and Central Asia.

returns to experience are similar to those for the rest of ECA in skill-intensive social services but substantially smaller in other sectors. The small returns to experience in low-skilled services are particularly worrying from a productivity perspective, as this sector has had the largest increase in employment in ECA during the past decade (chapter 1). This finding indicates that a growing share of workers may be employed in jobs in which they accumulate few transferable skills that are rewarded in the labor market.

Sectoral differences in returns to experience are positively correlated with total factor productivity across most of the countries in ECA with data, particularly in the earlier stages of professional life. The sectors with the lowest productivity show the smallest returns to experience (refer to figure 5A.9 in online annex 5A). Although it is not possible to disentangle the direction of causality, the effects likely run in both directions. As shown in the previous chapters, numerous factors explain the lower productivity of the service sectors in ECA—including distortions in the product market, poor adoption of digital technology, and limited access to finance—that are unrelated to the skills of the workforce. These factors may in turn lead to a poor environment for developing transferable skills in the workplace. In turn, low cognitive skills across the population and their misallocation across sectors may constrain productivity.

In sum, the nature of labor demand can drive skill misallocation. For instance, a large public sector may crowd out the skill demand of the private sector, increasing reservation wages to levels that exceed what private firms can afford. The low accumulation of human capital in the workplace across ECA, as proxied by returns to experience, is explained by the dynamics observed among micro and small firms in the service sectors—especially for low-skilled occupations. In these sectors, firms, and occupations, the returns to experience are flat and even negative in many ECA countries—particularly in countries in Central Asia and the South Caucasus. Countries that are geographically closer to the economic center of the European Union—Croatia, Poland, Türkiye, and the Western Balkans countries—perform better in skill development in the workplace. This East-West divide indicates that integration with the European Union and global markets more broadly, with the corresponding trade and foreign investment flows, might also shape the demand for skills and partly explain the misallocation of skills in the region.

Poor managerial skills

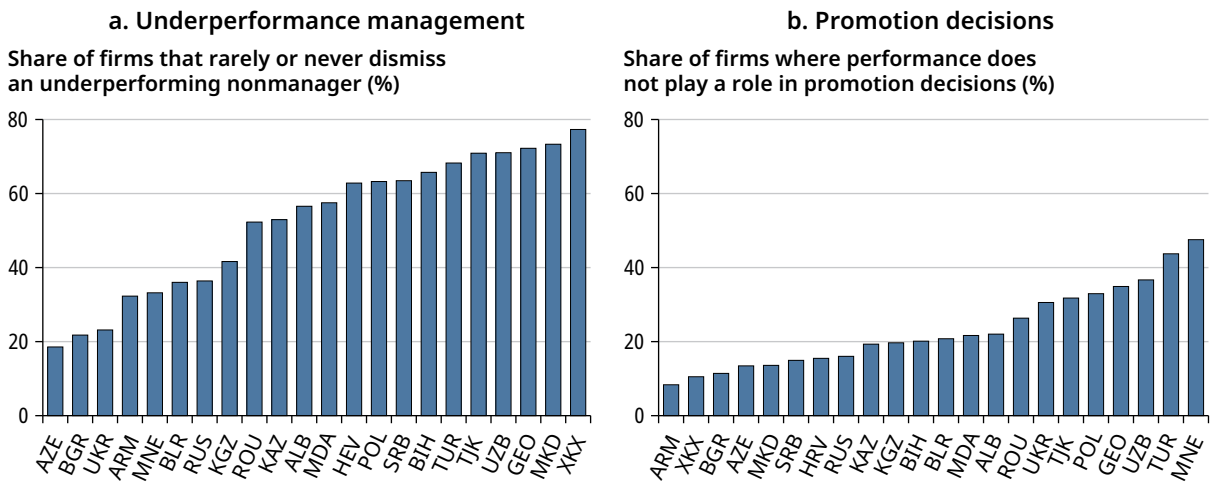
Poor management practices may also be a factor behind skill misallocation. Evidence from World Bank Enterprise Surveys suggests that human resource management underperforms in many firms across ECA. For instance, about

50 percent of firms in ECA rarely or never dismiss an underperforming nonmanagerial worker, with the share exceeding 70 percent in Georgia, Kosovo, and North Macedonia (figure 5.14, panel a). This indicates that "bad" job matches could be particularly persistent in the region. On average, 27 percent of firms in ECA report that performance does not play any role in promoting employees, with the share exceeding 40 percent in Montenegro and Türkiye (figure 5.14, panel b). These findings reveal that employment decisions in the region may generally be driven not by performance but by unrelated factors.

Poor managerial skills not only affect the allocation of labor within firms but also have particularly negative productivity consequences. About a third of the unexplained differences in total factor productivity across countries can be attributed to differences in management practices (Bloom, Sadun, and Van Reenen 2016). Adopting modern managerial practices—such as key performance indicators, a proactive problem-solving process, and an effective human resource management system, among others—is associated with better firm performance.

ECA countries are lagging in firm management quality. One study of management practices across 10 ECA countries found a notable East-West divide (Bloom, Schweiger, and Van Reenen 2012). On average, firms in countries in Central Asia

FIGURE 5.14 About half of the firms in ECA rarely or never dismiss an underperforming nonmanagerial worker, and more than a quarter of firms report that performance does not play any role in promotion decisions



Source: World Bank Enterprise Surveys.

Note: The sample includes only formal firms operating in sectors that are represented in the World Bank Enterprise Surveys. The data correspond to 2023 or the latest available year. For a list of country codes, refer to https://www.iso.org/obp/ui/#search. ECA = Europe and Central Asia.

had very poor management practices, with management scores on par with those of India, an economy with substantially lower income. Firms in countries closer to the European Union had much better practices, with management scores similar to those of firms in Germany. One possible reason firms in ECA lack good management practices is that the market dynamics are not "selecting out" firms with poor management. More-detailed studies in Croatia (Grover, Iacovone, and Chakraborty 2019) and the Russian Federation (Grover and Torre 2019) have found that these countries show no (positive) relationship between firm age and management quality—in contrast to advanced economies. This means that firm survival is not related to the adoption of good management practices, a feature linked to the poor productivity of older firms in the region (chapter 1).

A starting point for better managerial practices in firms is hiring a professional manager. Many small and medium-sized enterprises in ECA are family managed, and there is much evidence that family management (which differs from family ownership) is usually associated with worse firm performance (Bloom and Van Reenen 2007; Lemos and Scur 2018). In Europe, lack of interpersonal trust and poor contracting environments are associated with family-owned firms appointing a family member as chief executive or general manager as opposed to hiring a professional manager (Iacovone, Maloney, and Tsivanidis 2019). Across ECA, professionalization of management—as measured by the share of individuals employed in managerial occupations who have a university degree—varies considerably both across and within countries (refer to figure 5A.10 in online annex 5A). More than 90 percent of administrative and commercial managers in Montenegro have a university degree, compared to less than 40 percent in neighboring Kosovo. Among production and specialized services managers, the shares range from 40 percent to 70 percent across ECA, and for hospitality, retail, and other services managers, the shares range from 24 percent to 58 percent.

The underperformance in management practices may be a result of a poorly developed "management layer" within firms. As firms increase their value added, they add hierarchical layers to their organization—in particular, they add management layers. This practice allows firms to economize on the total cost of knowledge, a key input of production, by having many layers of knowledgeable managers at the top and much less knowledgeable ones at the bottom (Caliendo and Rossi-Hansberg 2012). Firms that do not add management layers find a limit to how much they can expand their output because they need to employ more-knowledgeable (and thus more-expensive) workers in the existing layers. Firms that add layers as they expand can employ less experienced workers at the bottom of the organization and promote the most experienced ones to the new, higher layers (Caliendo, Monte, and Rossi-Hansberg 2015). Evidence from labor force surveys in ECA has shown that the prevalence of workers in senior staff or top management positions increases between micro and small firms but plateaus for medium-sized and large firms (refer to figure 5A.11, panel a,

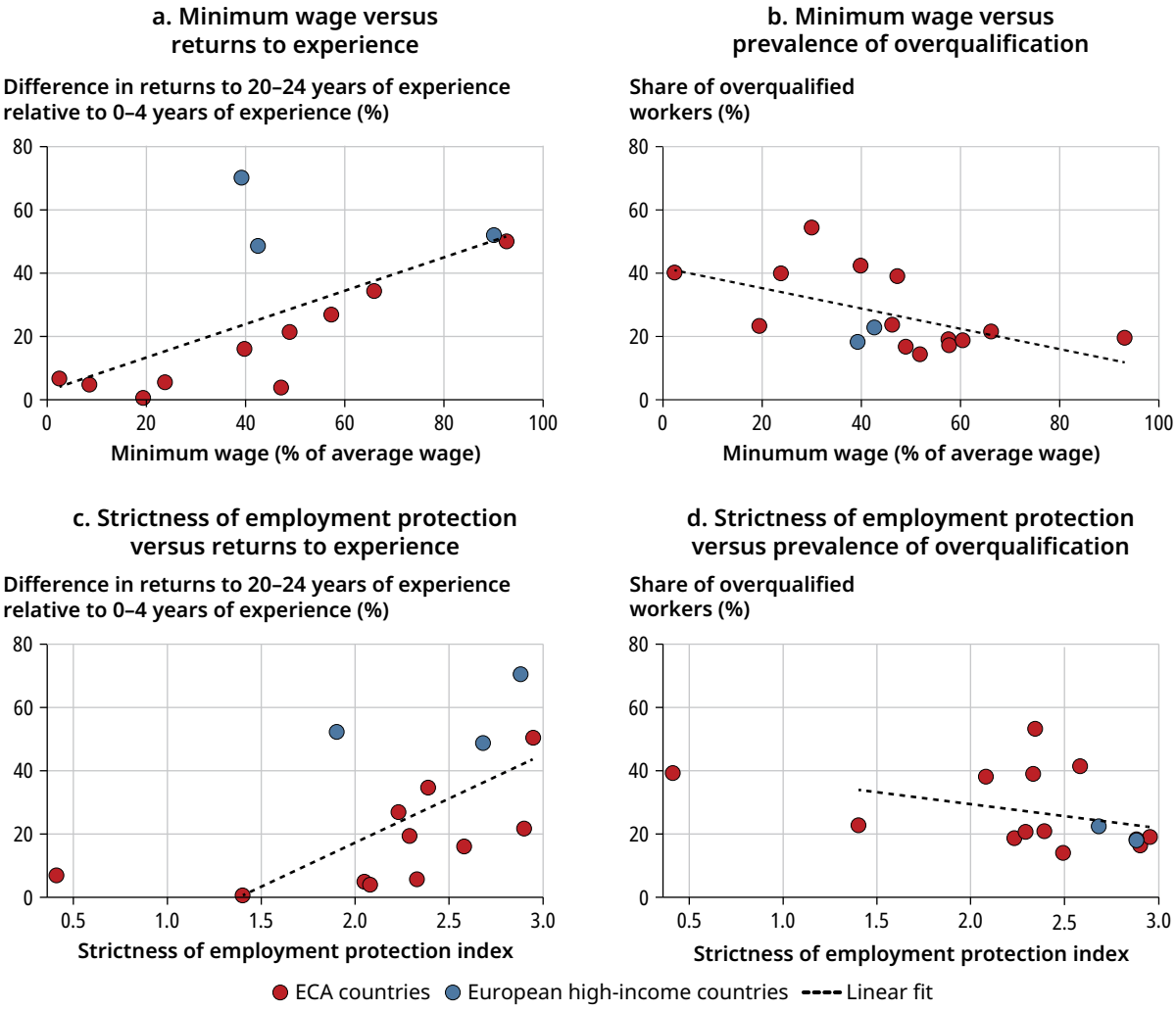
in online annex 5A). This differs from European high-income countries, where the prevalence of those occupations is highest among workers in medium-sized and large firms. Supervisory positions are more prevalent across all firm sizes in ECA, compared to European high-income countries (refer to figure 5A.11, panel b, in online annex 5A). These patterns suggest that as firms in ECA become larger, they do not increase the number of managerial layers but expand the lower layers. This feature of firm organization may both reflect productivity limitations and constrain output expansion.

Friction-creating institutional and structural features of the labor market

Skill misallocation could be the result of frictions derived from institutional and structural features of the labor market. Workers can have the right skills and firms may be able to use them and reward them at the right prices, but frictions could still prevent a successful match. One such friction is the minimum wage, which from a theoretical perspective could constrain labor demand in contexts of low labor productivity. If this were a binding constraint, a higher minimum wage would be associated with a larger share of overqualified workers (because employers would prefer to hire overqualified workers to ensure that their productivity matches the high minimum wage they need to pay) and, most likely, small returns to experience (because wages are artificially set above productivity levels and overqualified workers do not accumulate useful skills on the job). Yet in ECA, the minimum wage is positively correlated with returns to experience and negatively correlated with the prevalence of overqualification (figure 5.15, panels a and b). This suggests that, a priori, the minimum wage does not constrain labor demand but rather reflects how well the labor market functions—with markets where skills mismatch is lower allowing for a higher minimum wage. However, these cross-country correlations do not preclude that, at the country level, large increases in the minimum wage could have detrimental effects on labor market outcomes (Bossavie, Acar, and Makovec 2019).

The strictness of employment protection does not appear to constrain effective skill allocation in ECA. As with the minimum wage, the countries with the strictest employment protection also show the largest returns to experience and the lowest prevalence of overqualification (figure 5.15, panels c and d). In this sense, a more efficient skill allocation could allow for stricter employment protection. However, evidence from country case studies has found that a decrease in employment protection could also be associated with greater labor mobility and, a priori, more efficient allocation of labor (Boeri and Garibaldi 2019; Boeri and Jimeno 2005).

FIGURE 5.15 In ECA, the minimum wage is positively correlated with returns to experience and negatively correlated with the prevalence of overqualification, and the countries with the strictest employment protection show the largest returns to experience and the lowest prevalence of overqualification



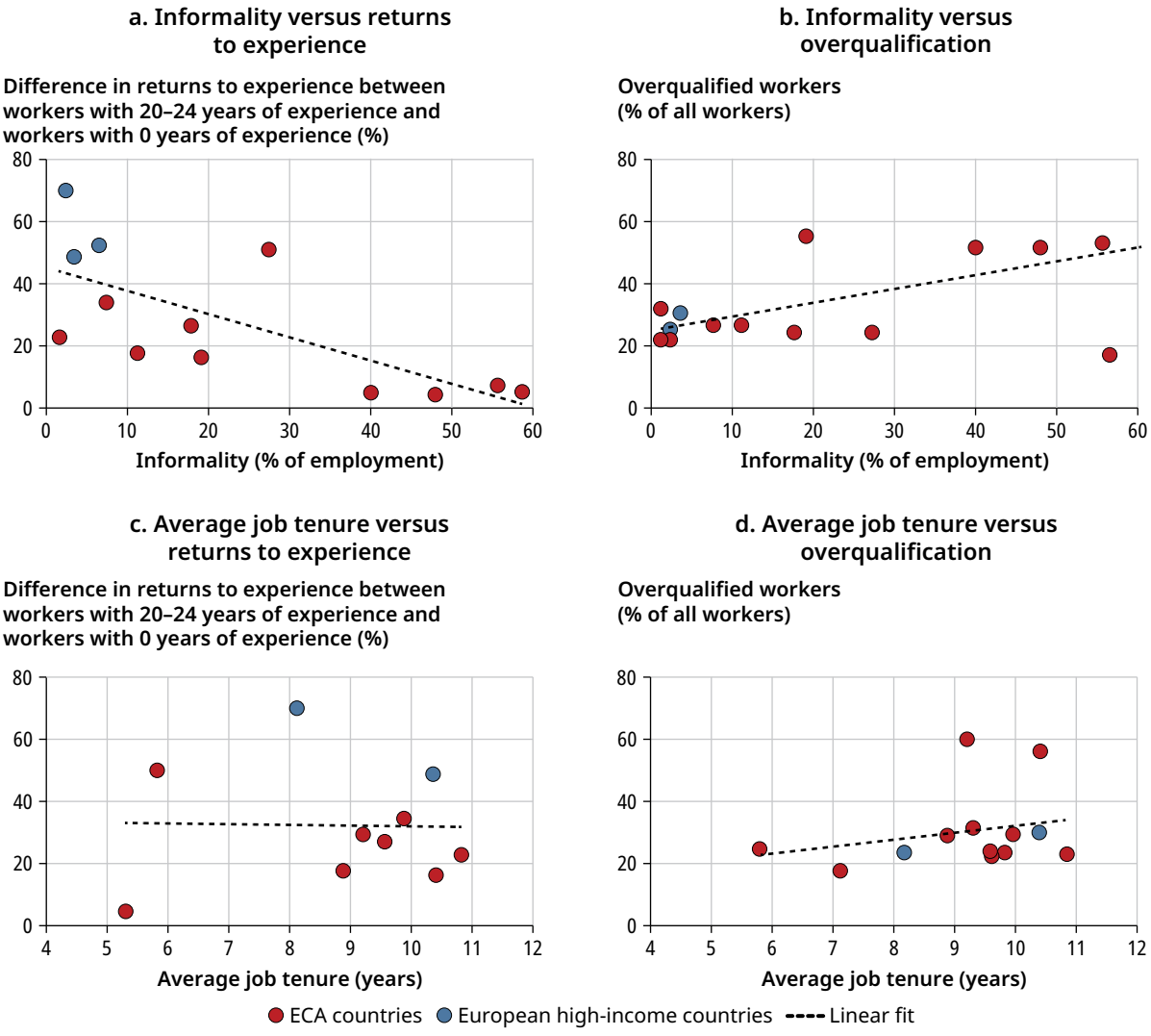
Sources: Data from the International Labour Organization; the Organisation for Economic Co-operation and Development and its Programme for the International Assessment of Adult Competencies; national labor force surveys.

Note: The data for minimum wage, employment protection, and prevalence of overqualification correspond to 2023 or the latest available year. The data for returns to experience were calculated from a panel covering 2010–23 (different periods for different countries). Panels a and c: ECA comprises Armenia, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, the Kyrgyz Republic, Poland, Serbia, Türkiye, and Uzbekistan. European high-income comprises France, the Netherlands, and the United Kingdom. ECA = Europe and Central Asia.

Informality is a structural feature of the labor market that might affect skill allocation. Workers in informal jobs and workers in self-employment (particularly in developing countries, where self-employment is mostly informal) accumulate little human capital in the workplace (Jedwab et al. 2023; Marinescu and Triyana 2016). This has consequences for wage employees in the formal sector—the focus of this chapter's analysis. The scale of informality in some economies implies that workers who are currently in formal jobs may have alternated between formal and informal jobs throughout their professional lives, with negative consequences for their human capital accumulation. Indeed, the rate of informal employment is negatively correlated with returns to experience among wage employees across ECA (figure 5.16, panel a). The extent of informality limits the possibilities for skilled individuals to find productive jobs—in economies with large informal sectors, the job opportunities for highly skilled workers may be limited. Informality is positively correlated with overqualification across ECA (figure 5.16, panel b).

Limited labor mobility for idiosyncratic reasons could be another source of friction that leads to inefficient skill allocation. "Bad" matches may persist where workers tend not to change jobs frequently. Yet, the cross-country evidence shows that this does not appear to be a binding friction in ECA. There is no correlation between average job tenure (a proxy for how frequently workers change jobs) and returns to experience, and there is a slightly positive correlation between average job tenure and the prevalence of overqualification (figure 5.16, panels c and d). Although labor mobility in ECA is generally considered limited, average job tenure among the younger generations has declined substantially over the past two decades, more than in European Union countries (Bussolo et al. 2024). This strong generational decrease might have removed what was previously a binding friction. Greater cross-border mobility might also have provided an alternative for workers who would have otherwise been mismatched (box 5.4). Other labor mobility measures, such as the share of workers who have ever changed firms, sectors, or occupations, show a nonsignificant relationship with returns to experience and a tenuous negative relationship with overqualification (refer to figure 5A.12 in online annex 5A).

FIGURE 5.16 High prevalence of informality is a structural feature of the labor market that might affect skill allocation in ECA, but limited labor mobility does not appear to be a binding friction



Sources: Data from the International Labour Organization (ILO); the Organisation for Economic Co-operation and Development and its Programme for the International Assessment of Adult Competencies; national labor force surveys.

Note: The data for informality, average job tenure, and prevalence of overqualification correspond to 2023 or the latest available year. The data for returns to experience were calculated from a panel covering 2010–23 (different periods for different countries). Informality rates are ILO modeled estimates. Panels a and c: ECA comprises Armenia, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, the Kyrgyz Republic, Poland, Serbia, Türkiye, and Uzbekistan. European high-income comprises France, Netherlands, and the United Kingdom. ECA = Europe and Central Asia.

BOX 5.4 International labor mobility and skills mismatch in ECA

Several countries in Europe and Central Asia (ECA) exhibit some of the highest rates of emigration globally. In countries in the Western Balkans, an estimated 30 percent of the working-age population lives abroad (Bossavie, Garrote Sánchez, and Makovec 2024). The incidence of labor migration from countries in Central Asia is also very high: In Tajikistan, close to 30 percent of the male working-age population works abroad, and remittances accounted for over 40 percent of national gross domestic product in 2024. Large emigration flows from ECA countries, combined with the selectivity of migration, have important implications for the labor supply and skills available to employers in the domestic labor market. The relationship between emigration and skills mismatch in origin countries' labor markets is a priori ambiguous. Selective emigration may contribute to greater skills mismatch in domestic labor markets by reducing the supply of specific skills for which domestic demand exists. Alternatively, emigration could help reduce skills mismatch by allowing workers who would otherwise be mismatched because of insufficient labor demand at home to access employment opportunities abroad. The latter channel is expected to be more prominent in economies where domestic job creation has not kept pace with new entries in the labor market.

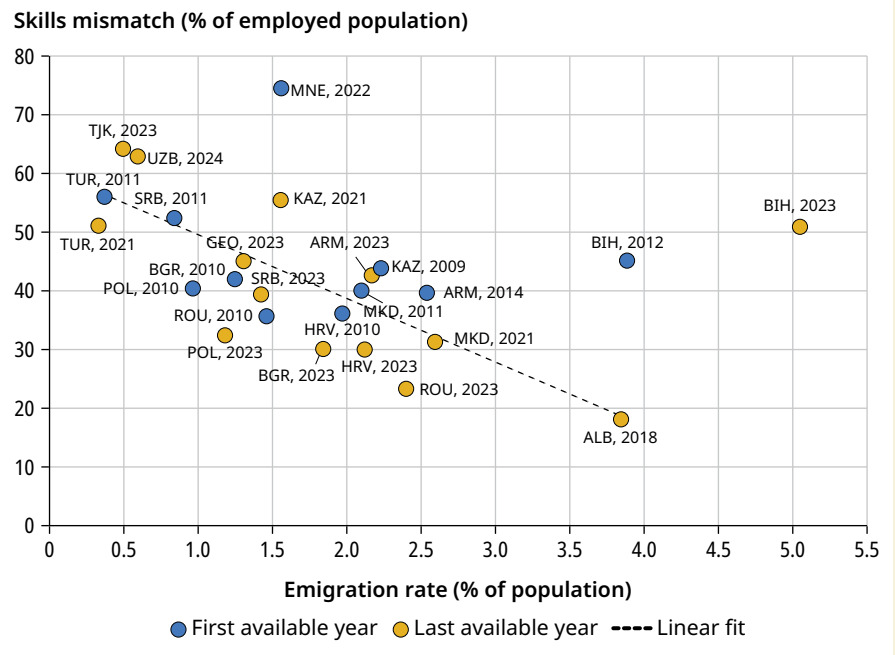
Descriptive evidence for a subset of ECA countries shows a strong negative relationship between emigration and skills mismatch in domestic labor markets (figure B5.4.1). Although this finding is descriptive, it is compatible with the hypothesis that, by enabling labor reallocation across borders, international labor mobility in ECA could alleviate labor imbalances and skills mismatch in countries of origin.

Although emigration is associated with lower mismatch in countries of origin, labor migrants from ECA are more likely than native workers in the destination country and nonmigrants in the origin country to be mismatched (especially to be overqualified) (Bossavie, Garrote Sánchez, and Makovec 2024). Frequent occupational downgrading among migrants might be explained by the imperfect transferability of skills across borders, which can occur in the presence of imperfect recognition of foreign credentials, disparities in the quality of education between origin and destination, and language barriers. Such frictions are exacerbated by greater information asymmetries between domestic employers and foreign workers. The extent of occupational downgrade among migrants varies across origin and destination countries. For example, migrants from within the European Union experience less occupational downgrading than workers moving from other parts of ECA to the European Union. This suggests that the policies in origin and destination countries, together with local contexts and migrants' profiles, play a role in occupational downgrading among migrant workers.

Continued

BOX 5.4 International labor mobility and skills mismatch in ECA *(Continued)*

FIGURE B5.4.1 There is a strong negative relationship between emigration and skills mismatch in ECA domestic labor markets



Sources: Calculations based on data form national labor force surveys; United Nations Department of Economic and Social Affairs.

Note: The linear fit line excludes the values for Bosnia and Herzegovina. For a list of country codes, refer to https://www.iso.org/obp/ui/#search.

Beyond these factors, the overall size and composition of the labor force, influenced by labor force participation trends and demographic dynamics in the region, can also affect skill allocation. Workers with the right skills—particularly women and youth—may not participate in the labor market for reasons unrelated to their skill proficiency, thus constraining the effective supply of skills. Social norms and lack of childcare support may prevent women from actively looking for a job, and misperceptions about their productivity may prevent firms from hiring youth for the right jobs. The extent to which these factors play a role in skill misallocation in the region is beyond the scope of this chapter. Statistical evidence has shown that women's labor force participation rate has increased and the share of youth not in employment, education, or training has decreased in ECA over the past two decades (refer to figure 5A.13 in online annex 5A). However, these indicators remain at critical levels in Türkiye and the Western Balkans.

Conclusions and Policy Recommendations

This chapter has demonstrated that poor skill proficiency and skill misallocation are prevalent across ECA, resulting in substantial productivity losses, both static and dynamic. Overqualified workers who engage in low-productivity tasks have limited opportunities to accumulate human capital over time, which diminishes long-term productivity. These findings underscore the urgent need to enhance the supply of foundational skills and the conditions necessary to apply them in the labor market. Table 5.1 lists the chapter's policy recommendations.

The first policy objective is to ensure that workers have a universal mastery of foundational skills, including socio-emotional and digital skills. Education reforms should guarantee that all students master essential competencies such as literacy and numeracy at an early stage. This is especially critical given the rise of automation, AI, and increasing task complexity impacting labor market dynamics. Possible interventions include high-dosage tutoring, personalized instruction, and strategies designed to enhance teacher effectiveness, especially in underperforming school systems (Akyeampong et al. 2023). The importance of foundational skills should be emphasized throughout all levels of education, including postsecondary education and professional training.

Second, the quality of education should be improved at all levels, including vocational and higher education. ECA countries should develop strong foundational skills among students in vocational education and involve the private sector in providing work-based learning and apprenticeships (Dalvit et al. 2023). Large university systems should be consolidated to make better use of resources and improve the management and accountability of higher education institutions (Izvorski et al. 2024).

Third, the credentialing systems in ECA should be reformed so that they more accurately reflect actual competencies. Excessive reliance on formal degrees obscures vast disparities in skill proficiency among graduates and contributes to overqualification. Transitioning to modular, competency-based certification frameworks that acknowledge both formal and informal learning could enhance labor market signaling and promote lifelong learning.[7] These frameworks should be integrated into public and private employment services. Such reforms would not only mitigate skills mismatch but also enable workers to acquire and demonstrate their skills in more flexible and job-relevant ways.

Fourth, policies should enhance workplace learning by increasing access to training opportunities. Most firms in ECA provide limited on-the-job training, but where such training is available, productivity has risen significantly, particularly for workers with stronger foundational skills. Moreover, apart from boosting technical skills, on-the-job training can also help consolidate socio-emotional skills. Governments can play a crucial role by supporting cost-sharing initiatives for training, promoting skill diagnostic assessments to tailor programs to workers'

TABLE 5.1 Priority level for policy recommendations, by country group

Recommendation	High-income and EMDE	EU accession	Central Asia	
			Resource-intensive	Non-resource-intensive
Investing in foundational skills	Medium	Medium	High	High
Reforming vocational and higher education	High	High	Medium	Medium
Improving credentialing systems	High	High	High	High
Promoting on-the-job training	High	Medium	Low	Low
Improving firms' managerial practices	Medium	High	Medium	Medium
Strengthening employment services and labor market information systems	Low	High	Medium	Medium

Source: World Bank.

Note: High-income and EMDE comprises Croatia, Poland, Romania, and Türkiye; EU accession comprises Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Moldova, Montenegro, North Macedonia, Serbia, and Ukraine; Central Asia, resource-intensive comprises Azerbaijan, Kazakhstan, the Russian Federation, and Turkmenistan; Central Asia non-resource-intensive comprises the Kyrgyz Republic, Tajikistan, and Uzbekistan. EMDE = emerging markets and developing economies; EU=European Union. Low, medium, and high = priority level.

specific needs, and ensuring that foundational skill gaps are addressed prior to investing in more advanced technical training. When implementing these policies, it is important to include mechanisms such as retention incentives and strong certification systems, as without them, firms' investment in broad-based training will be limited (Alfonsi et al. 2020; Carranza and McKenzie 2024). Other promising approaches to enhance lifelong learning include sector- or economy-wide training funds or individual learning accounts, as well as employer-driven active labor market programs designed to incentivize investments in industry-specific and transferrable skills. These initiatives should also be accessible to workers in the informal sectors.

Fifth, improving managerial practices can enhance skill allocation and firm performance. Global experiences indicate that governments can assist firms in enhancing their managerial practices cost-effectively, especially by using group-based consulting services (Iacovone, Maloney, and McKenzie 2022).

Finally, labor markets in ECA require better tools to address mismatch between worker skills and job requirements. Enhancing labor market observatories that monitor skill demand and wage returns—together with modern, data-driven public and private employment services—can assist job seekers, especially young people, in making more informed decisions on training and employment opportunities (Rutkowski and de la Paz 2018). These observatories should focus on using timely data integrating different information sources such as labor force surveys, skills assessments, and vacancy analytics. Implementing better

matching mechanisms is crucial for reducing both the prevalence and persistence of skills mismatch and overqualification. Additionally, mobility assistance measures that help workers in job transitions across sectors, regions, and countries can help improve talent allocation.

More broadly, policies that promote firm growth and those that enhance labor force participation each play a vital role in improving skill allocation and development in the workplace. On the one hand, more productive firms tend to allocate skills more efficiently and foster skill enhancement—whether through experiential learning in dynamic environments or through structured on-the-job training. Crucially, these firms are also better positioned to reduce overqualification by aligning workers' skills with job requirements more effectively. On the other hand, upgrading skills and increasing the employment and participation rates of underutilized groups—particularly women, youth, and disadvantaged groups—broadens the pool of available skills, so that firms can better match talent to tasks. Supporting the emergence and expansion of "good firms" is therefore essential to advancing human capital accumulation at work (World Bank 2025).

Notes

1. The functional form of the equation is

   $\text{Ln}(\textit{Hourly wage})_i = \alpha + \beta \cdot \textit{Experience}_i + \gamma \cdot \textit{Education}_i + \mu \cdot \textit{Mismatch} + \theta_{c,t} + \varepsilon_i$

   where $\textit{Experience}_i$ is an individual's years of potential experience, which corresponds to age minus years of schooling minus six (the age at which education is assumed to start); $\textit{Education}_i$ is a set of three dummy variables that indicate the level of education of the individual—whether lower secondary or less (assumed to correspond to 8 years of schooling), upper secondary (assumed to correspond to 12 years of schooling), or higher education (assumed to correspond to 16 years of schooling); and *Mismatch* is a dummy variable for whether an individual is employed in an occupation that does not match their educational attainment (vertical mismatch).
2. In addition to on-the-job learning, selective job switching could play a role in the observed patterns.
3. This approach follows Jedwab et al. (2023). The functional form of the equation is

   $\text{Ln}(\textit{Hourly wage})_i = \alpha + \beta \cdot \textit{Experience}_i + \gamma \cdot \textit{Education}_i + \theta_{c,t} + \varepsilon_i$

   where $\textit{Experience}_i$ is either continuous or decomposed into seven seven-year bins.
4. Three levels of education are considered: lower secondary or less (assumed to correspond to 8 years of schooling), upper secondary (assumed to correspond to 12 years of schooling), and higher education (assumed to correspond to 16 years of schooling). An individual's years of potential experience correspond to age minus years of schooling minus six (the age at which education is assumed to start). Following Jedwab et al. (2023), for individuals with lower secondary or less, it is assumed that experience before age 18 is inconsequential and therefore their potential experience corresponds to their age minus 18.
5. Based on literacy data from the OECD's PIAAC and the World Bank's STEP initiative.
6. Based on literacy data from PIAAC and net of the effects of gender, level of education, occupation, job tenure, and economic sector.
7. See, for instance, the options for micro-credentials in vocational education discussed in World Bank, UNESCO, and ILO 2023.

References

Abdulla, K. 2025. "Quantifying the Productivity Effects of Education-Job Mismatch: A Cross-Country Analysis." *Education Economics* 33 (4): 595–612. https://doi.org/10.1080/09645292.2024.2378728.

Adalet McGowan, M., and D. Andrews. 2015. "Labour Market Mismatch and Labour Productivity: Evidence from PIAAC Data." OECD Economics Department Working Paper No. 1209, Organisation for Economic Co-operation and Development, Paris. https://doi.org/10.1787/5js1pzx1r2kb-en.

Adhvaryu, A., N. Kala, and A. Nyshadham. 2023. "Returns to On-the-Job Soft Skills Training." *Journal of Political Economy* 131 (8): 2165–220. https://doi.org/10.1086/724320.

Alfonsi, L., O. Bandiera, V. Bassi, R. Burgess, I. Rasul, M. Sulaiman, and A. Vitali. 2020. "Tackling Youth Unemployment: Evidence From A Labor Market Experiment in Uganda." *Econometrica* 88 (6): 2369–2414.

Akyeampong, K., T. Andrabi, A. Banerjee, et al. 2023. *Cost-Effective Approaches to Improve Global Learning: What Does Recent Evidence Tell Us Are "Smart Buys" for Improving Learning in Low- and Middle-Income Countries?* London; Washington, DC; and New York: Foreign, Commonwealth and Development Office (FCDO); World Bank; UNICEF, and USAID.

Almeida, R., and A. Reyes. 2010. "The Investment in Job Training: Why Are SMEs Lagging So Much Behind?" IZA Discussion Paper No. 4981. Institute of Labor Economics, Bonn, Germany. https://ssrn.com/abstract=1631116.

Arias, O., C. Sánchez-Páramo, M. E. Dávalos, et al. 2014. *Back to Work: Growing with Jobs in Europe and Central Asia.* Washington, DC: World Bank. https://doi.org/10.1596/978-0-8213-9910-1.

Becker, G. S. 1964. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education,* first edition. Cambridge, MA: National Bureau of Economic Research.

Bloom, N., R. Sadun, and J. Van Reenen. 2016. "Management as Technology?" NBER Working Paper 22327, National Bureau of Economic Research, Cambridge, MA. https://doi.org/10.3386/w22327.

Bloom, N., H. Schweiger, and J. Van Reenen. 2012. "The Land That Lean Manufacturing Forgot? Management Practices in Transition Countries." *Economics of Transition and Institutional Change* 20 (4): 593–635. https://doi.org/10.1111/j.1468-0351.2012.00444.x.

Bloom, N., and J. Van Reenen. 2007. "Measuring and Explaining Management Practices across Firms and Countries." *Quarterly Journal of Economics* 122 (4): 1351–408. https://doi.org/10.1162/qjec.2007.122.4.1351.

Boeri, T., and P. Garibaldi. 2019. "A Tale of Comprehensive Labor Market Reforms: Evidence from the Italian Jobs Act." *Labour Economics* 59 (August 2019): 33–48. https://doi.org/10.1016/j.labeco.2019.03.007.

Boeri, T., and J. Jimeno. 2005. "The Effects of Employment Protection: Learning from Variable Enforcement." *European Economic Review* 49 (8): 2057–77. https://doi.org/10.1016/j.euroecorev.2004.09.013.

Bossavie, L., A. Acar, and M. Makovec. 2019. "The Impact of the Minimum Wage on Firm Destruction, Employment, and Informality." Policy Research Working Paper 8749, World Bank, Washington, DC.

Bossavie, L., R. de Hoyos, and I. Torre. 2025. "Human Capital Accumulation at Work: Insights from Returns to Experience in Europe and Central Asia." Background paper for this report. World Bank, Washington, DC.

Bossavie, L., D. Garrote Sánchez, and M. Makovec. 2024. *The Journey Ahead: Supporting Successful Migration in Europe and Central Asia.* Europe and Central Asia Studies. Washington, DC: World Bank. https://hdl.handle.net/10986/42224.

Bossavie, L., and I. Torre. 2025. "Skill Mismatches and Wages: Evidence from Europe and Central Asia." Background paper for this report. World Bank, Washington, DC.

Bussolo, M., M. Lokshin, N. Oviedo, and I. Torre. 2024. "The Evolution of Job Tenure in Transition Economies." *Economics of Transition and Institutional Change* 32 (2): 449–71. https://doi.org/10.1111/ecot.12394.

Caliendo, L., F. Monte, and E. Rossi-Hansberg. 2015. "The Anatomy of French Production Hierarchies." *Journal of Political Economy* 123 (4): 809–52. https://doi.org/10.1086/681641.

Caliendo, L., and E. Rossi-Hansberg. 2012. "The Impact of Trade on Organization and Productivity." *Quarterly Journal of Economics* 127 (3): 1393–1467. https://doi.org/10.1093/qje/qjs016.

Carranza, E., and D. McKenzie. 2024. "Job Training and Job Search Assistance Policies in Developing Countries." *Journal of Economic Perspectives* 38 (1): 221–44. https://doi.org/10.1257/jep.38.1.221.

Criscuolo, C., P. Gal, T. Leidecker, and G. Nicoletti. 2021. "The Human Side of Productivity: Uncovering the Role of Skills and Diversity for Firm Productivity." OECD Productivity Working Papers, No. 29, Organisation for Economic Co-operation and Development, Paris. https://doi.org/10.1787/5f391ba9-en.

Dalvit, N., R. de Hoyos, L. Iacovone, I. Pantelaiou, A. Peeva, and I. Torre. 2023. "The Future of Work Implications for Equity and Growth in Europe." World Bank, Washington, DC.

Dearden, L., H. Read, and J. Van Reenen. 2006. "The Impact of Training on Productivity and Wages: Evidence from British Panel Data." *Oxford Bulletin of Economics and Statistics* 68 (4): 397–421. https://doi.org/10.1111/j.1468-0084.2006.00170.x.

Deming, D., and M. Silliman. 2024. "Skills and Human Capital in the Labor Market." NBER Working Paper 32908, National Bureau of Economic Research, Cambridge, MA. https://doi.org/10.3386/w32908.

Dostie, B. 2018. "The Impact of Training on Innovation." *Industrial and Labor Relations Review* 71 (1): 64–87. https://doi.org/10.1177/0019793917701116.

Dustmann, C., and C. Meghir. 2005. "Wages, Experience and Seniority." *Review of Economic Studies* 72 (1): 77–108. https://doi.org/10.1111/0034-6527.00325.

Gethin, A. 2025. "Distributional Growth Accounting: Education and the Reduction of Global Poverty, 1980–2019." *Quarterly Journal of Economics* 140 (4): 2571–618. https://doi.org/10.1093/qje/qjaf033.

Grover, A., L. Iacovone, and P. Chakraborty. 2019. "Management Practices in Croatia: Drivers and Consequences for Firm Performance." Policy Research Working Paper 9067, World Bank, Washington, DC. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/521611574453619743.

Grover, A., and I. Torre. 2019. "Management Capabilities and Performance of Firms in the Russian Federation." Policy Research Working Paper 8996, World Bank, Washington, DC. http://documents.worldbank.org/curated/en/954881567618753375.

Guvenen, F., B. Kuruscu, S. Tanaka, and D. Wiczer. 2020. "Multidimensional Skill Mismatch." *American Economic Journal: Macroeconomics* 12 (1): 210–44. https://doi.org/10.1257/mac.20160241.

Hanushek, E., L. Kinne, F. Witthöft, and L. Woessmann. 2025. "Age and Cognitive Skills: Use It or Lose It." *Science Advances* 11 (10). https://doi.org/10.1126/sciadv.ads1560.

Hanushek, E., and L. Woessmann. 2008. "The Role of Cognitive Skills in Economic Development." *Journal of Economic Literature* 46 (3): 607–68. https://doi.org/10.1257/jel.46.3.607.

Hanushek, E., G. Schwerdt, L. Woessmann, and L. Zhang. 2017. "General Education, Vocational Education, and Labor-Market Outcomes Over the Lifecycle." *Journal of Human Resources* 52 (1): 48–87.

Heckman, J., H. Stixrud, and S. Urzúa. 2006. "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior." *Journal of Labor Economics* 24 (3): 411–82. https://doi.org/10.1086/504455.

Honorati, M., I. Santos, and S. Gomez Tamayo. 2024. "Investing in Skills to Accelerate Job Transitions." Social Protection and Jobs Discussion Paper No. 2409, World Bank, Washington, DC. https://hdl.handle.net/10986/42103.

Hsieh, C.-T., and P. J. Klenow. 2010. "Development Accounting." *American Economic Journal: Macroeconomics* 2 (1): 207–23. https://doi.org/10.1257/mac.2.1.207.

Iacovone, L., I. Izvorski, C. Kostopoulos, et al. 2025. *Greater Heights: Growing to High Income in Europe and Central Asia*. Europe and Central Asia Studies. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-2206-3.

Iacovone, L., W. Maloney, and D. McKenzie. 2022. "Improving Management with Individual and Group-Based Consulting: Results from a Randomized Experiment in Colombia." *Review of Economic Studies* 89 (1): 346–71. https://doi.org/10.1093/restud/rdab005.

Iacovone, L., W. Maloney, and N. Tsivanidis. 2019. "Family Firms and Contractual Institutions." Policy Research Working Paper 8803, World Bank, Washington, DC. https://hdl.handle.net/10986/31532.

Izvorski, I., S. Kasyanenko, M. Lokshin, and I. Torre. 2024. *Europe and Central Asia Economic Update, Fall 2024: Better Education for Stronger Growth.* Washington, DC: World Bank. https://hdl.handle.net/10986/41997.

Jedwab, R., P. Romer, A. R. Islam, and R. Samaniego. 2023. "Human Capital Accumulation at Work: Estimates for the World and Implications for Development." *American Economic Journal: Macroeconomics* 15 (3): 191–223. https://doi.org/10.1257/mac.20210002.

Konings, J., and S. Vanormelingen. 2015. "The Impact of Training on Productivity and Wages: Firm-Level Evidence." *Review of Economics and Statistics* 97 (2): 485–97. https://doi.org/10.1162/REST_a_00460.

Lemos, R., and D. Scur. 2018. "All in the Family? CEO Choice and Firm Organization." CEP Discussion Paper 1528, Centre for Economic Performance, London School of Economics, London. https://cep.lse.ac.uk/_new/publications/abstract.asp?index=5740.

Ma, X., A. Nakab, and D. Vidart. 2024. "Human Capital Investment and Development: The Role of On-the-Job Training." *Journal of Political Economy: Macroeconomics* 2 (1). https://doi.org/10.1086/728667.

Marinescu, I., and M. Triyana. 2016. "The Sources of Wage Growth in a Developing Country." *IZA Journal of Labor & Development* 5 (2). https://doi.org/10.1186/s40175-016-0047-9.

McGuinness, S., K. Pouliakas, and P. Redmond. 2018. "Skills Mismatch: Concepts, Measurement, and Policy Approaches." *Journal of Economic Surveys* 32 (4): 985–1015. https://doi.org/10.1111/joes.12254.

OECD (Organisation for Economic Co-operation and Development). 2017. *Getting Skills Right: Skills for Jobs Indicators*. Paris: OECD. https://doi.org/10.1787/9789264277878-en.

OECD (Organisation for Economic Co-operation and Development). 2024. *Data Indicators: Mathematics Performance (PISA)*. Paris: OECD. https://www.oecd.org/en/data/indicators/mathematics-performance-pisa.

Rutkowski, J., and C. de Paz. 2018. "Labor Market Observatories—Critical Success Factors." World Bank Policy Briefs, Jobs Notes, issue no. 4. Washington, DC: World Bank.

World Bank. 2025. *Human Capital Policy for Development*. Washington, DC: World Bank.

World Bank, UNESCO (United Nations Educational, Scientific and Cultural Organization), and ILO (International Labour Organization). 2023. *Building Better Formal TVET Systems: Principles and Practice in Low- and Middle-Income Countries*. Washington, DC; Paris; and Geneva: World Bank, UNESCO, and ILO.

Europe and Central Asia (ECA) is at a turning point. After a period of convergence and reform-driven growth during the first decade of the 2000s, the region's productivity engine has lost momentum. Total factor productivity growth has halved since the global financial crisis, and the gains from capital deepening and labor expansion are no longer sufficient to sustain economic growth. If pre-2008 trends in productivity growth had continued, average incomes would be around 60 percent higher today. Instead, misallocated resources, incomplete integration into global markets, and weak firm capabilities during a period of stalled reforms have left the region below its potential.

This report lays out a new agenda for boosting productivity. Drawing on unique firm-level data from across the region, it shows how deeper trade integration, smarter investment, and adoption of technology, coupled with improved firm capabilities and investments in workers' skills, can unlock significant productivity gains. The report highlights the need to face the challenges of the unrealized potential of exports and foreign direct investment, insufficient level of digital technology adoption, and limited investment in skills training (offered by only one in five firms in ECA today), coupled with weak foundational skills. The evidence is clear: Addressing these challenges through targeted reforms in improving market functioning, technology adoption, export promotion, and skills development is crucial for unlocking the region's productivity potential.

The path forward is captured by the policy framework of trade, investment, digitalization, efficiency, and skills (TIDES)—the levers that can help boost the region's productivity. This flagship report is not just a diagnosis of what went wrong; it is a call to action for what must come next. Focusing on TIDES, with the right policies and political will, ECA can reclaim its momentum and deliver a new era of shared prosperity.

Sustained economic growth can't happen without productivity growth, and this report explains in detail where it has happened, where it has not (yet), and—importantly—what can be done to improve it for a broad set of economies in the Europe and Central Asia region.

— *Chad Syverson, Professor of Economics, University of Chicago*

Productivity growth requires seizing trade and investment opportunities at a time of rapid digital transformation that needs efficient institutions and life-long skill development. This report lays out how countries in Europe and Central Asia can ride the TIDES to turn their lagging productivity growth.

— *Kalina Manova, Professor of Economics, University College London*

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