FIRM DYNAMICS AND PRODUCTIVITY

Firm dynamics – the entry, growth, decline and exit of businesses – lie at the very heart of economies driven by creative destruction and productivity growth. This chapter shows that a lack of such dynamism is partly to blame for the recent slow-down in the EBRD region's productivity convergence. The region is home to many small firms, which remain small and relatively inefficient throughout their lives. Businesses in the EBRD region are finding it increasingly difficult to boost efficiency by importing existing technology as they approach the technological frontier. Instead, they should be aiming to extend the frontier through innovation. Increased competition from imports, access to export markets and integration into global value chains can all encourage firms to raise efficiency levels. Efficiency can be enhanced through innovation and investment in new capital where firms have sufficient access to credit.

4

AVERAGE STOCK OF PATENTS GRANTED PER 10,000 PEOPLE IN THE EBRD REGION IN 2015, COMPARED WITH AROUND 213 IN SOUTH KOREA

81%

AVERAGE PERCENTAGE OF FIRMS WITH FEWER THAN 10 EMPLOYEES IN CENTRAL AND EASTERN EUROPE

LESS THAN

1%

PERCENTAGE OF FIRMS INNOVATING AT THE TECHNOLOGICAL FRONTIER ACROSS THE EBRD REGION, EXCEPT IN SLOVENIA

Introduction

Developing economies typically experience a sharp slow-down in productivity growth as they reach middle-income levels (see Chapter 1). This chapter looks at the factors underlying differences in economies' growth rates as they move towards the technological frontier, examining the role that firms and industries play in the creation of jobs, technology and output.

It seeks to answer three related questions. First, what kinds of firm contribute to output and productivity growth across Europe? Second, how do the EBRD region's firm and industry growth dynamics differ from those of advanced economies? And third, what institutional factors and policies explain the variation observed in productivity growth across firms?

These questions are motivated by a growing body of evidence on the sluggishness of firms in developing economies. The analysis in this chapter highlights the abundance of small, non-innovative firms in the EBRD region. These firms have low productivity, and the convergence of their productivity levels with advanced-economy benchmarks is slower than in the case of large firms. These firms survive for many years, but fail to grow. As a result, economies become populated by small, mature firms that do not contribute to the country's productivity growth, leading to lower aggregate productivity levels.

This chapter also shows that cross-border integration can be a powerful driver of productivity convergence within individual industries. In particular, integration into global value chains (GVCs)[1] tends to significantly increase productivity.

Improving productivity requires costly investment in order to replace obsolete capital. However, investment alone is not enough. As a country's income per capita rises, there is an increasing need for investment to be accompanied by pioneering innovation.

Economic growth at firm level

What is "creative destruction"?

Neoclassical economic theory states that sustained long-term growth is a product of technological progress.[2] However, that theory does not explain the origins of technological progress itself. The Schumpeterian theory of economic growth, which seeks to fill that gap, is based on three main ideas.[3]

First of all, long-term growth is generated by innovations that extend the technological frontier. Innovation, in turn, is a product of many years of public and private investment in research and development (R&D) and human capital. It culminates in the introduction of products that are new to the global market (which are often protected by patents and licences) or improvements in production techniques.

Second, innovations respond to incentives shaped by market competition and economic institutions – the general rules of the game in the market. Initially, innovations are protected by patents that help innovators to recoup the fixed costs of developing new technology. Over time, however, technology dissipates and new firms challenge existing technology. Thus, high levels of product market competition and high firm entry rates encourage innovation.

Third, activities that become unprofitable need to be discontinued. If new firms with novel ideas fail to replace unproductive firms, economic growth suffers, as the economy's scarce resources are used inefficiently. In other words, growth involves creative destruction and constant conflict between incumbents and new entrants, resulting in turnover of firms and jobs.

An economy's aggregate productivity is ultimately determined by the number of innovative and non innovative firms. Economic growth occurs as existing firms innovate and become more productive or as resources move from less productive companies to more productive ones.

There are various studies documenting the importance of creative destruction and firm entry in advanced economies. Young businesses in those countries experience rapid productivity gains and make a substantial contribution to job creation.[4] Start-ups tend to experiment with new business models and products and thrive if successful, increasing their market share at the expense of less productive (and often larger) incumbent firms.

However, recent research suggests that the picture is less encouraging outside advanced economies.[5] First of all, there is an abundance of small firms in developing countries, with very few large, productive firms. Second, the majority of small firms fail to grow. Unlike in advanced economies, in developing countries there is no discernible relationship between firm size and age, and small firms exit the market less frequently. Lastly, developing countries suffer from persistent misallocation of factors of production, which hampers productivity and economic growth. As good firms do not expand and badly managed firms survive, scarce resources are not reallocated to more productive uses.

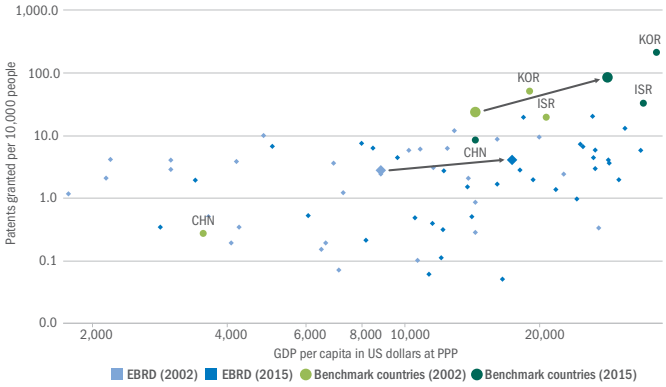
Implications for convergence

The Schumpeterian framework offers an important insight into how middle-income countries can catch up with advanced economies. It predicts three developments that will occur as a country becomes richer: innovative activity will become more ground-breaking; institutions will facilitate firm turnover, allowing innovative firms to enter the market and grow; and the reallocation of resources to more productive businesses will become ever more important.[6] In other words, middle-income countries need to pursue innovation-based growth if they want to become high-income countries. Relying solely on capital accumulation fostered by mature establishments and industries ceases to be a sustainable growth model in the long run.

Innovations that extend the technological frontier are often protected by patents.[7] The rate of patenting can therefore be used to assess whether countries in the EBRD region have increased their innovation rates over the past two decades. While EBRD countries of operations have, like other middle-income

[1] The term "global value chains" refers to arrangements in which the various stages that are required to create and sell a product or service are located in different countries.
[2] See Solow (1956).
[3] See Aghion et al. (2015) and Aghion (2017).
[4] See Haltiwanger et al. (2013) for the USA and Criscuolo et al. (2014) for OECD member countries. Recent research by Hsieh and Klenow (2017) for the USA suggests that most innovation comes from existing firms improving their products rather than from new entrants.
[5] See Hsieh and Klenow (2009), Bloom et al. (2013), Hsieh and Klenow (2014), Akcigit et al. (2016) and Peters (2016).
[6] See Acemoğlu et al. (2006).

CHART 2.1. Growth in the EBRD region has been relatively "innovation-light"



Source: World Development Indicators (WDI), World Intellectual Property Organization (WIPO) and authors' calculations.
Note: Larger diamonds indicate cross-country averages for the EBRD region. Larger circles indicate averages for China, Israel and South Korea.

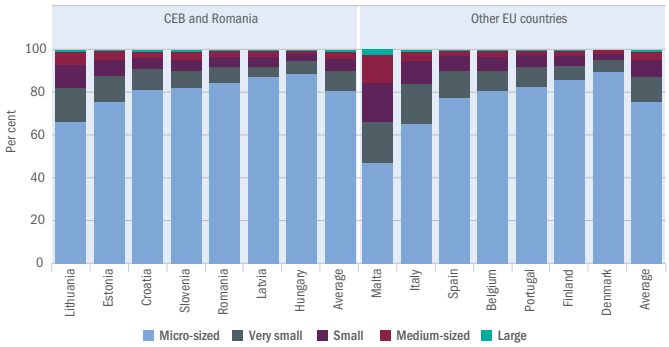
countries (such as China, Israel and South Korea), experienced significant increases in GDP per capita, they do not seem to have increased their innovation rates to the same extent (see Chart 2.1). In the EBRD region, the average stock of patents granted per 10,000 people grew by less than 50 per cent between 2002 and 2015, rising from 2.8 to 4.0. In China, meanwhile, that indicator rose from 0.27 in 2002 to 8.4 in 2015, while in South Korea it rose from 51.09 to 213.31 over the same period.

This may potentially explain the recent slow-down in productivity growth in the EBRD region following the productivity convergence observed prior to the 2008-09 financial crisis (see Chapter 1). Thus far, the region's productivity convergence has been driven primarily by the reallocation of resources from inefficient state-owned enterprises to more efficient private ones, a process that has not relied on ground-breaking innovation. In China, the entry of new firms with above-average productivity and the exodus of inefficient incumbents has made a major contribution to aggregate productivity growth following China's accession to the World Trade Organization (WTO) in 2001, according to recent research.[8] In the EBRD region, in contrast, the innovation rate has increased more slowly. A detailed look at the region's innovation patterns reveals only limited success when it comes to developing products that are new to global markets (see Box 2.1). If the Schumpeterian framework is right, this puts the region's productivity convergence at risk.

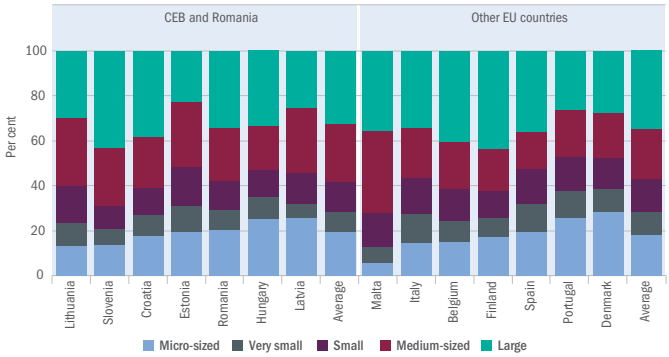
The remainder of this chapter examines the lack of dynamism in the region using firm-level data and discusses the role that GVCs and investment play in boosting productivity growth.

CHART 2.2. There is an abundance of small firms accounting for less than half of all economic activity

Panel A: Breakdown of firms by size



Panel B: Breakdown of employment



Source: CompNet and authors' calculations.
Note: For the purposes of this analysis, micro-sized firms are defined as having fewer than 10 employees in a given year, very small firms 10-19 employees, small firms 20-49, medium-sized firms 50-249, and large firms 250 or more employees.

Microeconomic sources of growth

This section builds on a comprehensive database established by the Competitiveness Research Network (CompNet).[9] That database includes harmonised indicators based on firm-level data, which are aggregated at various levels for 20 European countries (of which 9 are EBRD countries of operations), mainly over the period 2002-13.[10] Those firm-level data come from administrative sources such as censuses or registers of firms and capture around 70 per cent of the EU's GDP.

A snapshot of firms across Europe

A breakdown of the total number of firms in each country by firm size shows that most countries of central Europe and the Baltic states (CEB),[11] and Romania, are home to many small firms and very few large firms (see Panel A of Chart 2.2). On average, around 80 per cent of firms in those countries have fewer than

[7] As discussed in the *Transition Report 2014*, not all innovations are patented, and the extent to which patents are commercialised may depend on local legal systems, local practices and the sectors in which a country specialises. Nevertheless, patents have the advantage of being universally comparable and are a common indicator of innovation at the technological frontier.
[8] See Brandt et al. (2012).
[9] CompNet was established in 2012 by the European Central Bank and now includes the European Commission, the EBRD, the European Investment Bank, a number of national central banks and national statistical institutes, and think-tanks such as the Halle Institute for Economic Research.
[10] The database covers Austria, Belgium, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, the Slovak Republic, Slovenia and Spain. For some of these countries, data go back to 1995.
[11] CompNet data are not available on micro-sized and very small firms in Poland and the Slovak Republic.

10 employees, compared with around 75 per cent of firms in the western European countries indicated. This is consistent with broader evidence on the prevalence of small firms in developing economies, even when sole proprietors are excluded.[12]

The distribution of employment across firms of different sizes matters. Smaller firms tend to invest less in human and physical capital and intellectual property. As a result, they tend to be less productive than larger firms.[13] Thus, having larger firms account for a larger percentage of employment can increase aggregate productivity.

While smaller firms in CEB and Romania employ a larger percentage of the labour force relative to the other EU countries, the differences are fairly small (see Panel B of Chart 2.2). On average, 32 per cent of the workforce are employed by the largest companies in this region, compared with an average of 35 per cent in the other EU countries.

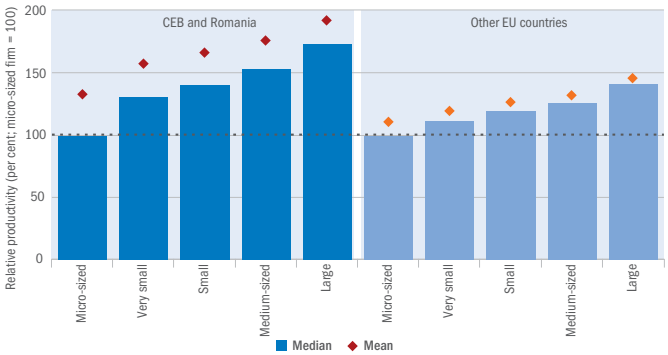
These differences are reflected in relative productivity figures. CompNet provides revenue-based data on total factor productivity (TFP) that are comparable across firm sizes and countries.[14] Strikingly, the median large firm in CEB and Romania is around 70 percentage points more productive than the median micro-sized firm, while the median medium-sized firm is around 50 percentage points more productive than its micro-sized counterpart (see Chart 2.3). The equivalent figures for the other EU countries are considerably smaller: 40 and 25 percentage points respectively.

Variation in terms of productivity within firm size classes is also greater in CEB and Romania, particularly for smaller firms. For instance, the mean productivity of micro-sized firms is 32 percentage points higher than that of the median micro-sized firm in these countries. In other EU countries, this differential stands at only 10 percentage points. This holds for other firm sizes as well. This pattern suggests that although a few highly productive firms within each size category boost the averages for these countries in CEB, and for Romania, their economies are dominated by unproductive firms, resulting in lower aggregate productivity.

A similar pattern can be observed at industry level, using Germany – an advanced economy with the highest TFP level in the CompNet database for most industries – as a benchmark. CEB countries and Romania have a high percentage of industries with low productivity (relative to Germany) and a low percentage of industries with high productivity (see Chart 2.4).

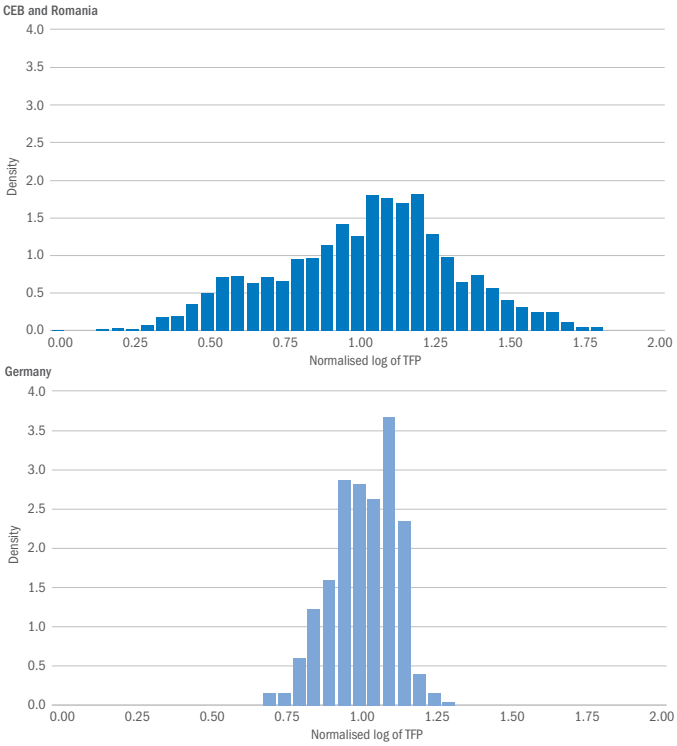
Chart 2.4 indicates that firms in CEB and Romania are, on average, less productive than those in Germany (as the distribution is skewed to the left) and productivity levels are more varied (as the distribution is less compressed). This, in turn, means that the median firm lags further behind the most efficient firms in its industry relative to Germany. This can be a result of both a lack of competition and insufficient diffusion of technology. In the absence of competition, firms may lack incentives to improve efficiency. In addition, firms with insufficient access to capital may not be able to undertake productivity-enhancing investment.

CHART 2.3. Smaller firms are less efficient, especially in CEB and Romania



Source: CompNet and authors' calculations.
Note: Productivity levels are normalised to 100 per cent for the median micro-sized firms in CEB and Romania and the other EU countries respectively. Ratios relative to those median micro sized firms are calculated for each size class, country and year, before calculating simple averages across countries and years.

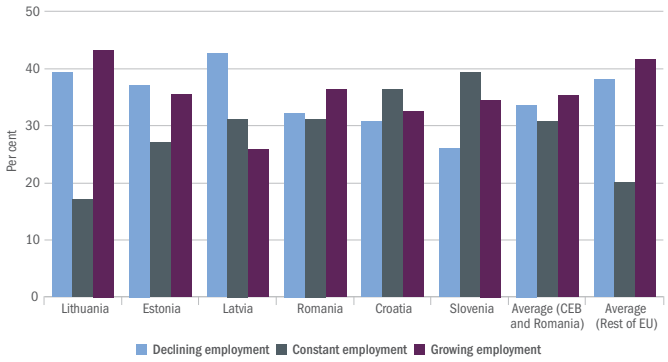
CHART 2.4. Considerable variation in productivity across industries



Source: CompNet and authors' calculations.
Note: Based on a combined industry-level sample, controlling for cross-country differences in industry composition. Density is calculated by dividing the relative frequency by the width of the class.

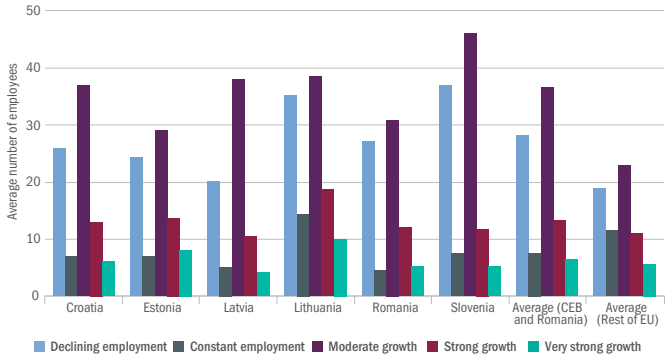
[12] See Bloom et al. (2014).
[13] See Hsieh and Klenow (2009), Bartelsman et al. (2013) and Restuccia and Rogerson (2008).
[14] These measures are based on the methodology employed by Wooldridge (2009) and Levinsohn and Petrin (2003). TFP measures the efficiency with which factors of production are combined to produce one unit of output.

CHART 2.5. Firms in CEB and Romania lack dynamism



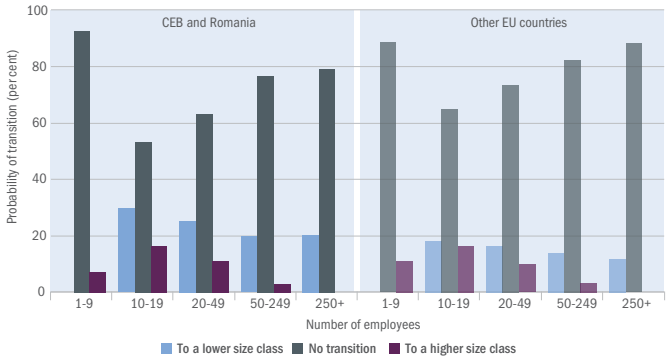
Source: CompNet and authors' calculations.
Note: Based on data for the period 2002-13. Growth rates are calculated on the basis of the number of full time employees over a three-year period for surviving firms. "Declining employment" means an average decline of more than 1 per cent per year, while "growing employment" means average growth of more than 1 per cent per year. All other cases are regarded as "constant employment". Data for Hungary are not available.

CHART 2.6. That lack of dynamism particularly affects smaller firms



Source: CompNet and authors' calculations.
Note: Based on data for the period 2002-13. Growth rates are calculated on the basis of the number of full-time employees over a three-year period for surviving firms. "Declining employment" means an average decline of more than 1 per cent per year; "moderate growth" means average growth of between 1 and 10 per cent per year; "strong growth" means average growth of between 10 and 20 per cent per year; and "very strong growth" means average growth in excess of 20 per cent per year. All other cases are regarded as "constant employment". These data are not available for Hungary.

CHART 2.7. Larger firms have a relatively high probability of declining in size in CEB and Romania



Source: CompNet and authors' calculations.
Note: Probabilities of transition are estimated for surviving firms in rolling three-year windows over the period 2002-13. These data are not available for Hungary.

Lack of dynamism

Where jobs are created matters for growth, particularly in the presence of very large differences in terms of firms' productivity levels, since a job at a more productive firm will contribute more to growth in value added. Thus, if more productive firms employ a larger percentage of the labour force, aggregate productivity will be higher.

Innovative and productive small firms should ideally be able to expand rapidly, replacing inefficient incumbents and putting competitive pressure on other large firms (which may have a greater ability to draw on retained earnings and external sources of funding in order to finance large-scale R&D projects).

This kind of dynamism seems to be missing from the EBRD region when compared with more advanced European economies. Chart 2.5 divides firms into three categories depending on whether the number of full-time employees declines, rises or remains broadly unchanged over a three-year period. Many firms in the EBRD region do not grow even if they are able to withstand market competition and survive for a number of years. In the six countries shown in Chart 2.5, the chances of an average firm increasing, reducing or maintaining its headcount in a given year are almost identical. In the other EU countries, by contrast, only one firm in five remains the same size. Of those firms that survive, more than 40 per cent increase their headcount, pointing to a much higher level of business turnover.

The lack of dynamism in CEB and Romania is greater among smaller firms. On average, firms in CEB and Romania that maintain their headcount employ fewer than 8 people, compared with 12 people in the other EU countries (see Chart 2.6). Thus, many firms in those countries never graduate from the micro-sized bracket. Consequently, larger firms make the biggest contribution to job creation. Indeed, firms with moderate headcount growth – that is to say, growth of between 1 and 10 per cent per year – employ an average of 37 people in CEB and Romania, compared with 23 in the other EU countries. Only 7 per cent of micro-sized firms grow to employ at least 10 people in a given year in CEB and Romania, compared with 11 per cent in the other EU countries (see Chart 2.7).

Chart 2.7 suggests that while micro-sized firms in CEB and Romania have a lower probability of growing in size relative to other EU countries, larger firms have a higher probability of declining in size. In each of the four relevant categories – very small, small, medium-sized and large firms – the likelihood of a firm moving to a lower category is higher in those EBRD countries of operations than in the other EU countries. Firms employing 10-19 people have, for instance, a 30 per cent chance of employing fewer than 10 people three years later, compared with only 18 per cent in the other EU countries. The tendency for larger firms in CEB and Romania to decline in size over time may, in part, be driven by emigration and population ageing, exacerbated by low employment rates for older workers.[15]

Why do small firms fail to grow? Recent evidence from India points to a few possible answers.[16] First of all, the majority of small firms are family-owned and run. A lack of trust and weak rule of law may prevent company owners from delegating tasks or hiring external managers – which is a prerequisite in order to grow beyond a certain size.[17] A lack of delegation often leaves firms with inadequate management and technical skills.

Second, defective infrastructure and imperfections in the credit market may also play a role. Small, innovative firms will find it especially difficult to access external capital given their lack of credit histories with lenders. Consequently, they may be particularly affected by credit market imperfections.

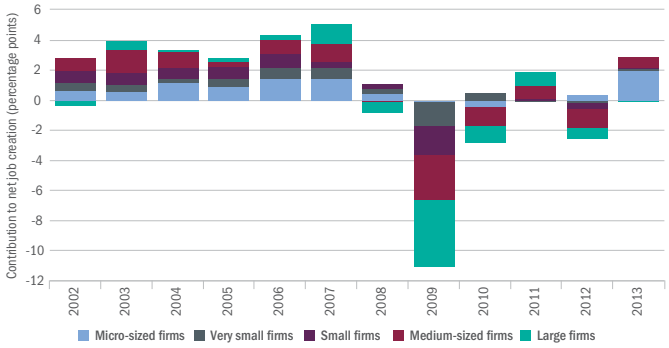
Third, institutional distortions also play a role. For instance, where business regulations are strict and enforcement is linked to the size of the company, productive firms may choose to forgo growth and remain "beneath the radar".

The fact that small firms lack dynamism does not mean that they are unimportant to the economy. On the contrary, small firms have made a substantial contribution to net job creation in CEB and Romania over the past two decades (see Panel A of Chart 2.8).[18] Up until the 2008-09 financial crisis, these firms typically contributed more than half of all growth in aggregate employment and around 40 per cent of all growth in aggregate value added. This points to robust levels of firm creation in the region during periods of rapid economic growth.

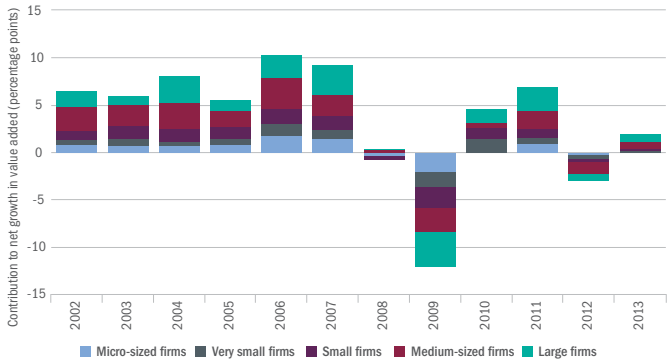
This is encouraging, since start-ups and young businesses have been shown to be the main drivers of job creation in advanced economies such as the United States of America (USA).[19] However, smaller firms have struggled to contribute to net job creation since the 2008-09 crisis, despite continuing to contribute to growth in value added in most years. At the same time, medium-sized and large firms contributed less to net job creation prior to the 2008-09 crisis, and they have contributed more to net job destruction since the crisis. Since economic growth is partly a result of the shifting of resources from less to more productive firms, this trend may have contributed to the slow-down observed in both aggregate productivity growth and overall growth in the region.

CHART 2.8. Smaller firms create jobs, while larger firms create value added

Panel A: Breakdown of net job creation



Panel B: Breakdown of net growth in value added

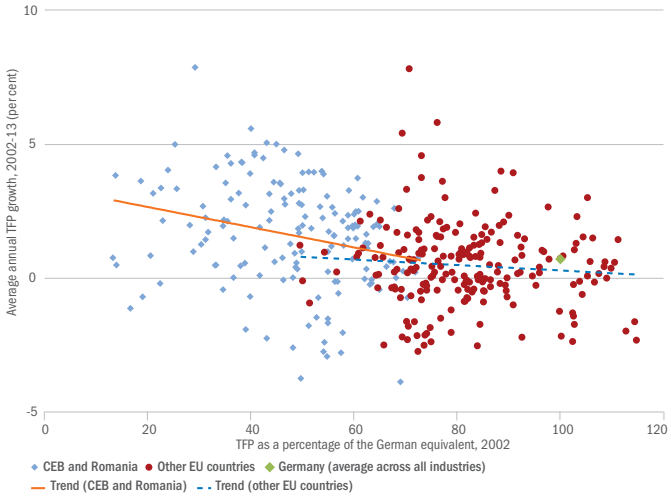


Source: CompNet and authors' calculations.

AROUND **70** PERCENTAGE POINTS THE RELATIVE PRODUCTIVITY ADVANTAGE THAT LARGE FIRMS HAVE OVER MICRO-SIZED FIRMS IN CEB AND ROMANIA, COMPARED WITH 40 PERCENTAGE POINTS IN OTHER EU COUNTRIES

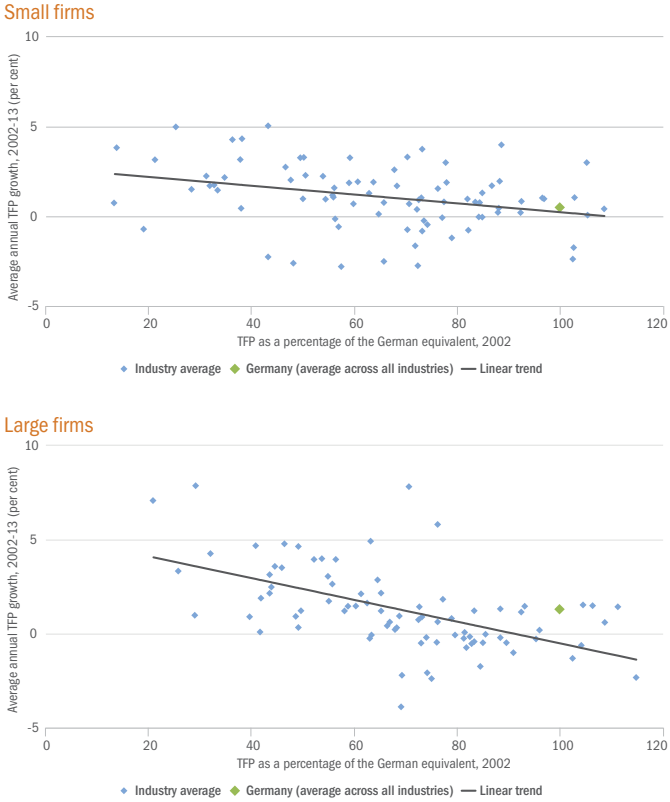
[15] See OECD (2014).
[16] See Bloom et al. (2013) and Akcigit et al. (2016).
[17] See Akcigit et al. (2016).
[18] In line with the approach adopted by Haltiwanger et al. (2013), net job creation and growth in real value added for country and firm size *i* in year *t* are calculated as $g_{it} = (E_{it} - E_{i,t-1})/X_{it}$, where $X_{it} = 0.5 * (E_{it} + E_{i,t-1})$. This approach is immune to mean-reversion dynamics. The contribution that each firm size *i* makes to total growth in value added or employment is calculated as $Contribution_{it} = \left(\frac{X_{it}}{X_t}\right) * g_{it}$
[19] See Haltiwanger et al. (2013).

CHART 2.9. Firms experience stronger productivity growth away from the technological frontier



Source: CompNet and authors' calculations.
Note: Each observation is an average across firms of a certain size in a given sector in a given country. The German benchmarks are for the same industries and size classes. Estimates for Hungary and Romania are based on 2003 data.

CHART 2.10. Larger firms experience stronger convergence



Source: CompNet and authors' calculations.
Note: Each observation is an average across firms of a certain size in a given sector in a given country in CEB and Romania. The German benchmarks are for the same industries and size classes. Estimates for Hungary and Romania are based on 2003 data.

Productivity convergence by firm size

The Schumpeterian model suggests that productivity growth should be stronger away from the technological frontier, where it can be facilitated by the imitation and adoption of existing technology (see Box 2.1). Consequently, productivity growth should be stronger at earlier stages of a firm's development. Data from CompNet support this hypothesis (see Chart 2.9). The technological frontier in a given sector is defined here as the productivity level of firms of the relevant size in the relevant sector in Germany.[20] Thus, a firm's productivity level can be expressed as a percentage of the productivity of firms of the same size operating in the same sector in Germany. For instance, a proximity to the frontier of 0.5 indicates a TFP level that is half of that observed in Germany.

Between 2002 and 2013, average annual productivity growth was indeed stronger for firms that were further away from the technological frontier at the start of that period. In other words, less efficient firms moved more quickly towards the level of TFP observed in Germany, where productivity grew at an average rate of 1 per cent per year (see green diamond in chart). Chart 2.9 indicates that average productivity rises faster than in Germany in industries where TFP is less than 60 per cent of the level observed in Germany. Once industry-level productivity passes that point, average annual productivity growth falls below the rate seen in Germany and convergence ceases. In fact, there was, on average, little or no convergence between the most productive industries in CEB and Romania and their German counterparts in the period 2002-13.

Firms of different sizes adopt technology and improve their efficiency levels at different rates. In fact, the productivity levels of larger firms in CEB and Romania converged more quickly with those of their German counterparts relative to smaller firms in the period 2002-13 (see Chart 2.10). For instance, medium-sized and large firms which began that period at 40 per cent of Germany's TFP level experienced an average annual TFP growth rate of around 3 per cent, while very small and small firms in an equivalent position relative to their German counterparts experienced average growth of only 2 per cent per year. Raising productivity levels at small firms can be especially challenging, as a number of studies show.[21] A lack of capital investment is one of the main challenges facing the smallest firms (see Box 2.2).

[20] CompNet collects data on nine sectors, including manufacturing and wholesale and retail trade (see Box 2.3 for the full list).

[21] See Bloom et al. (2014).

What drives productivity convergence?

Convergence at industry level

Why do some firms and some countries experience faster convergence with the technological frontier than others? Do certain policies help to foster convergence? We can answer these questions with the aid of industry-level data from the World Input-Output Database (WIOD), in combination with CompNet data. WIOD data are now available for 40 countries around the world (including Poland, the Slovak Republic, and other EU countries where the EBRD works, plus Russia and Turkey) and 35 different industries.

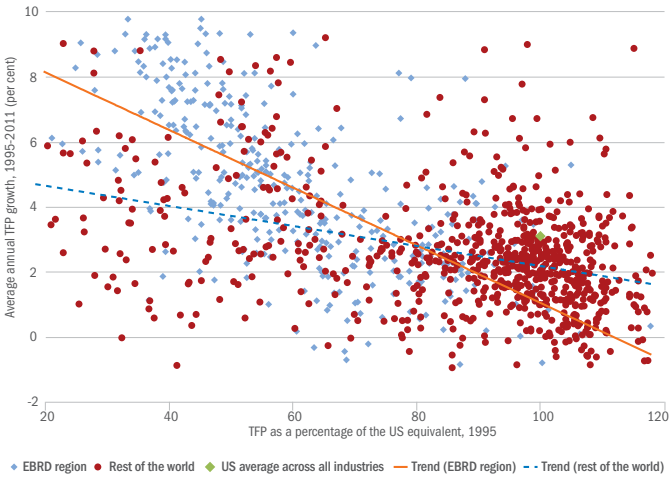
The relationship between industry-level productivity growth and proximity to the relevant industry's technological frontier also holds for this dataset (see Chart 2.11). Here, the technological frontier is defined on the basis of the TFP observed in the USA for each industry in 1995, as the country tends to enjoy the highest levels of productivity. In this case, average annual TFP growth is calculated over a longer period of time – the period from 1995 to 2011.

As before, industries further away from the technological frontier experienced higher rates of TFP growth over this period. This relationship is particularly strong in EBRD countries of operations, where industries with productivity levels between 40 and 60 per cent of the US benchmark experienced high rates of convergence, underpinning the strong growth performance that was seen in the region between the mid-1990s and 2008 (as discussed in Chapter 1). Productivity growth in these industries was not only stronger than in the USA (where growth averaged 3.1 per cent per year), it was also stronger than in most other emerging markets.

Regression analysis can be used to investigate this relationship in greater detail, using industry-level panel data for individual countries covering the period 1995-2001 (see Box 2.3 for details of the methodology). This takes account of unobserved characteristics of individual countries and industries, as well as shocks affecting all industries and all countries in a given year (such as the 2008-09 financial crisis).

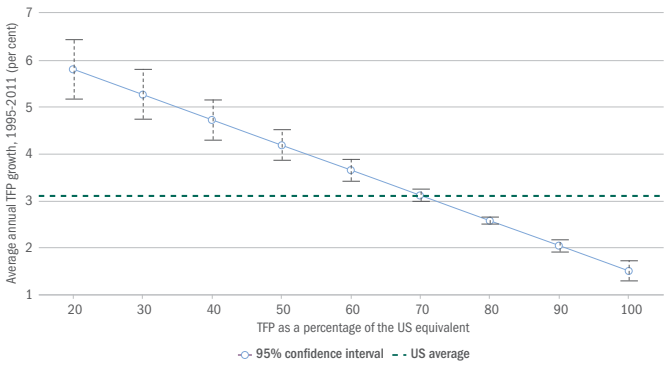
The results of this analysis suggest that an emerging market industry with a productivity level of just 40 per cent of the US equivalent in any given year experienced average annual TFP growth of 4.7 per cent over the next year, compared with 3.1 per cent in the USA. The differential between the two is the rate of productivity convergence. That rate remains positive for industries with productivity levels of up to 70 per cent of their US counterparts. At higher levels of productivity, convergence with the USA ceases, although industries continue to experience positive TFP growth.

CHART 2.11. Industries experience stronger productivity growth when they are further away from the technological frontier



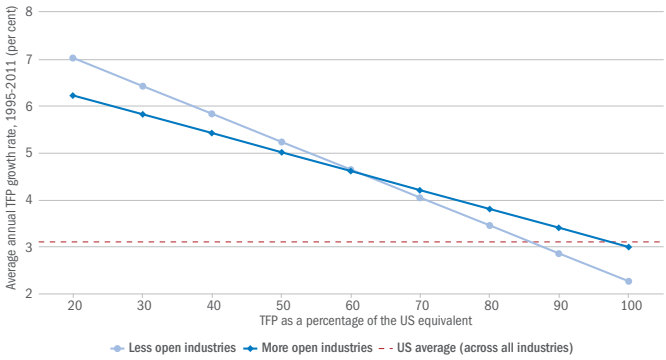
Source: WIOD and authors' calculations.
Note: Each observation is for a given industry in a given country. The US benchmarks are for the same industries.

CHART 2.12. Productivity convergence ceases when an industry reaches 70 per cent of US TFP



Source: WIOD and authors' calculations.
Note: These results represent average predicted TFP growth rates derived from a country and industry-level panel regression of TFP growth on TFP relative to the USA, with a lag of one period. Regressions control for country, industry and year fixed effects. Estimates below the line corresponding to average US productivity growth imply an absence of convergence.

CHART 2.13. Productivity convergence becomes more reliant on openness to trade as an industry approaches the technological frontier



Source: WIOD and authors' calculations.
Note: These results represent average predicted TFP growth rates derived from a country and industry-level panel regression of TFP growth on TFP relative to the USA, openness to trade and their interaction term, all with a lag of one period. Regressions control for country, industry and year fixed effects. "Less open industries" are industries where exports and imports have a combined total of less than 10 per cent of output, while "more open industries" are industries where they total more than 110 per cent of output. These figures correspond to the bottom and top deciles of the distribution of openness to trade. Estimates below the line corresponding to average US productivity growth imply an absence of convergence.

AROUND
1 IN 3
THE NUMBER OF FIRMS EMPLOYING ROUGHLY THE SAME NUMBER OF PEOPLE THREE YEARS FROM TODAY IN CENTRAL AND EASTERN EUROPE, COMPARED WITH 1 IN 5 IN OTHER EU COUNTRIES

Cross-border integration as a catalyst for productivity growth

This econometric analysis can be extended to study institutional settings that are more conducive to sustained productivity convergence as countries approach the technological frontier – potentially enabling industries to keep their annual TFP growth rates above 3.1 per cent until they reach the technological frontier, thereby completing the convergence process (see Box 2.3 for details). Analysis suggests that, within a given country, only industries that are sufficiently integrated into the global economy and have higher rates of investment manage to sustain convergence for longer.

According to the Schumpeterian framework, competition is the key to innovative activity – and thus productivity growth. Firms and industries that do not face competition from imports have fewer incentives to increase efficiency. In addition, the extent to which firms can reap the benefits of innovation may differ across industries and countries. If domestic markets are small and firms cannot increase their sales by reaching out to new markets abroad, they may be reluctant to undertake the costly investment projects needed to boost productivity.[22] Openness to trade fosters discipline as a result of competition from imports and provides access to export markets, both of which encourage firms to increase their productivity.

Regression analysis confirms that greater openness to trade – as measured by the ratio of exports and imports to total industry output – is associated with productivity convergence being sustained for longer (see Chart 2.13). Less open industries experience stronger productivity growth far away from the technological frontier, but they soon start to lag behind more open industries. This happens as their productivity reaches 60 per cent of the US equivalent. After this point, industries that are more open to international trade maintain stronger productivity growth and continue to converge with US productivity levels as they approach the frontier. In less open industries, by contrast, convergence ceases entirely at around 85 per cent of US productivity. A similar result is observed for average income per capita: the speed of income convergence decreases more rapidly as a country approaches the frontier where openness to trade is low.[23]

These results are indicative of associations in the data, rather than causal relationships. However, recent research confirms a causal link between exporting and productivity growth in Egypt.[24] In that study, a randomly selected group of rug producers were given the opportunity to export to high income countries. Those producers increased the quality of their products, their technical efficiency and their profitability relative to a similar group of producers that only served the domestic market. This suggests that access to export markets does have an immediate impact on productivity.

Following the rise of GVCs over the last few decades, international commerce today is dominated by trade in intermediate (as opposed to final) goods, with many firms sourcing numerous inputs from abroad and in turn exporting intermediate inputs. Greater import penetration is therefore an

[22] See Bustos (2011).
[23] See Acemoğlu et al. (2006).
[24] See Atkin et al. (2017).

indication not only of competition for domestic producers, but also of access to cheaper and higher quality production inputs.

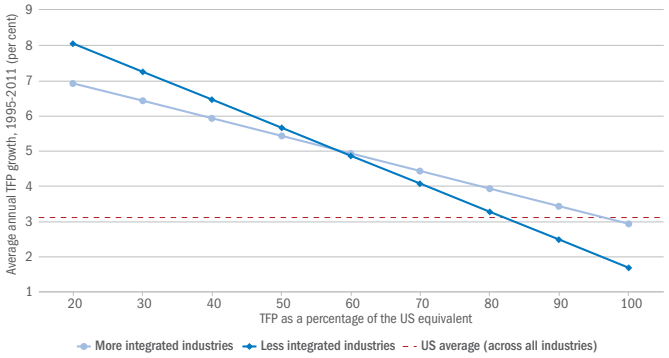
Indeed, greater integration into GVCs can help firms to raise their productivity in a number of ways. First of all, it incentivises firms' managers to upgrade production processes or acquire new technology in order to satisfy the strict requirements regarding quality and efficiency within those chains. The resulting innovation can help industries further away from the technological frontier to increase efficiency in a fast and cost-effective manner. Second, the upgrading of infrastructure to help meet just-in-time production targets and increased interaction with multinational companies can have positive spillover effects in terms of learning about new technology and customer preferences. Third, firms can gain access to new markets, thereby making it easier for them to recoup the fixed costs of investment aimed at expanding their productive capacity.

Regression analysis shows that industries that are more integrated into GVCs sustain productivity convergence for longer (see Chart 2.14). As a country enters middle-income territory, industries that rely primarily on domestic inputs start to experience much weaker productivity growth relative to other industries. This slow-down usually occurs at around 50-60 per cent of the productivity level of the relevant industry in the USA. On the other hand, an industry that sources the majority of its inputs from abroad is able to maintain productivity growth in excess of 3.1 per cent per year (that is to say, the US average) even as it approaches the technological frontier. In other words, the ability to source inputs globally becomes a key determinant of productivity convergence as countries climb the income ladder.

Although the extent of industries' integration into GVCs is partly a reflection of their geographical location, resource endowment and other factors that lie beyond the reach of economic policy, policy measures can help to support this process (for instance by improving the quality of roads, ports, airports and telecommunications systems). More generally, better infrastructure translates into greater market connectivity and increases competition between suppliers. It also enables firms to specialise more and achieve greater economies of scale.

As Chapter 3 shows, upgrading Turkey's transport network has significantly increased trade between the country's various regions and helped Turkey's firms to expand their markets (both domestically and internationally) and improve their performance. Another recent study has found that the upgrading of infrastructure in India has helped to boost aggregate productivity in the economy by directing more business towards more productive firms.[25] By the same token, better mobile and broadband connectivity enables consumers to learn about firms outside their local area, helping productive firms to gain market share at the expense of less productive competitors.

CHART 2.14. Integration into GVCs fosters productivity convergence

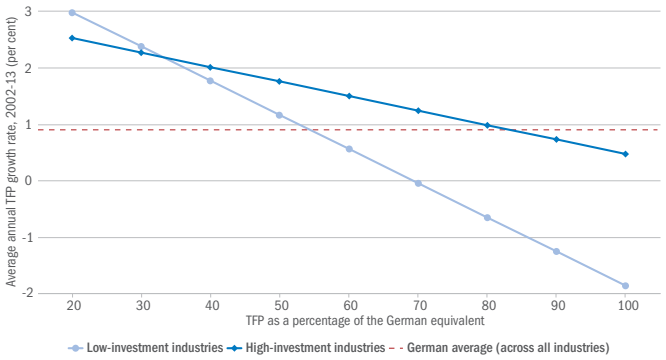


Source: WIOD and authors' calculations.
Note: These results represent average predicted TFP growth rates derived from a country and industry-level panel regression of TFP growth on TFP relative to the USA, the share of domestic value added and their interaction term, all with a lag of one period. Regressions control for country, industry and year fixed effects. "Less integrated industries" are industries that source less than 40 per cent of inputs from abroad. "More integrated industries" are industries where more than 80 per cent are sourced from abroad. These figures correspond to the bottom and top deciles of the distribution of reliance on non-domestic value added. Estimates below the line corresponding to average US productivity growth imply an absence of convergence.

ONLY
7%
OF MICRO-SIZED FIRMS GROW TO EMPLOY AT LEAST 10 PEOPLE IN A GIVEN YEAR IN CEB AND ROMANIA, COMPARED WITH 11 PER CENT IN OTHER EU COUNTRIES

[25] See Jensen and Miller (2017).

CHART 2.15. Capital investment is key to maintaining high levels of productivity growth



Source: CompNet and authors' calculations.
Note: These results represent average predicted TFP growth rates derived from a country and industry-level panel regression of TFP growth on TFP relative to Germany, the average investment rate and their interaction term, all with a lag of one period. Regressions control for country, industry and year fixed effects. "Low investment" and "high-investment" industries are industries with investment rates of less than 5 per cent and more than 20 per cent respectively. Estimates below the line corresponding to average German productivity growth imply an absence of convergence.

BANK LENDING
REMAINS THE MAIN SOURCE OF FUNDING UNDERPINNING BOTH INNOVATIVE ACTIVITY AND CAPITAL INVESTMENT IN THE EBRD REGION

The role of investment and access to credit

Greater access to international markets will only help firms to raise their productivity levels if they are able to make the necessary investment in machinery, equipment and intellectual property. The need for such costly investment applies to both innovating and non-innovating firms alike. For innovators, this is part of developing or adopting new technology. Even with an unchanged product, firms periodically need to replace physical capital that becomes worn out or obsolete.

The econometric framework from the previous subsection can be extended in order to study the role that investment plays in supporting firms' productivity growth. Imagine two hypothetical industries – one with a low average investment rate (5 per cent) and one with a high rate (20 per cent).[26] These figures correspond to the 25th and 75th percentiles of the distribution of investment rates across industries in the CompNet sample over the period 2002-13. Average TFP growth varies considerably across these industries, particularly as countries approach the technological frontier, which in this case is determined by the relevant German industry (see Chart 2.15).

In an industry with a low investment rate, productivity convergence ceases at around 55 per cent of the German industry's TFP level. However, in an industry with a high investment rate, convergence with German productivity levels is sustained for longer and does not end until productivity is around 85 per cent of the German equivalent.

The *Transition Report 2014* showed that credit constraints remain pervasive in the EBRD region, and where banks ease those credit constraints, firms respond by increasing the adoption of technology. Bank lending remains the main source of funding underpinning both innovative activity and capital investment in the region. We can investigate the impact that access to bank credit has on TFP differentials across countries and industries by modifying the regression analysis in order to compare an industry with limited reliance on external financing (one where the average firm has a debt-to-asset ratio of less than 10 per cent) with an industry with significant reliance on external financing (one with an average debt-to-asset ratio of more than 40 per cent). As before, these thresholds correspond to the 25th and 75th percentiles of the relevant distribution.

The results of this analysis (which are available on request from the authors) show that an industry where firms are able to access external finance experiences sustained productivity convergence until it reaches around 70 per cent of Germany's TFP level. However, in industries where the average firm does not or cannot take advantage of external financing, convergence ceases at productivity levels of around 55 per cent of the German benchmark. Since older and more established firms typically have higher debt-to-asset ratios, it appears that bank lending plays an important role in helping these firms to replace older equipment as it becomes a drag on productivity growth.

[26] This investment rate is defined as the ratio of the net increase in capital stock at time *t* to existing capital stock at time *t-1*.

Competition and allocative efficiency

Income convergence – that is to say, the closing of the gap between countries in terms of income per capita – can continue even after productivity convergence has ceased. This is because an economy's overall growth is shaped by how the factors of production available to an economy are combined. Even if productivity within individual industries remains unchanged, reallocating resources from less efficient industries to more efficient ones can boost the aggregate output of an economy. Such reallocation is an important determinant of cross-country differences in productivity.

In most countries, more productive firms tend to employ more people than less productive ones. Indeed, recent research shows that labour productivity in the average US manufacturing industry is 50 per cent higher than it would be if employment shares were allocated at random within that industry.[27] In western Europe, this productivity premium is estimated at around 20 to 30 per cent, and in central and eastern Europe, it is estimated at around 5 to 15 per cent.

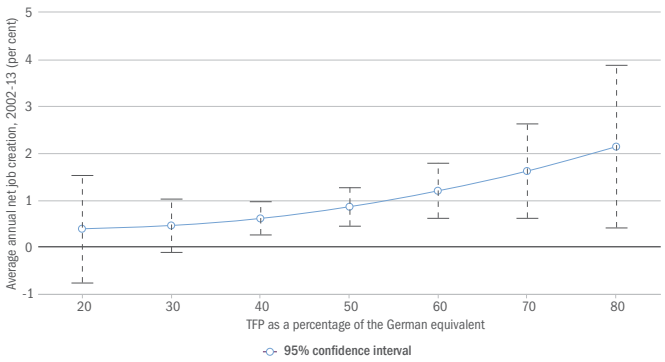
Econometric analysis can shed further light on job creation and the reallocation of labour across industries by looking at net job creation rates in European industries covered by CompNet data relative to their distance from the technological frontier. The results of this analysis show that more productive industries – those closer to Germany's productivity level – contribute more to net job creation (see Chart 2.16). They are typically able to attract labour from the rest of the economy, partly because of their ability to offer higher wages. For instance, an industry with 80 per cent of Germany's TFP increases employment by an average of 2 per cent per year, compared with 0.5 per cent for an industry with 40 per cent of Germany's productivity.

As the employment shares of industries that are further away from the technological frontier decline, they release resources that are redeployed to more productive industries. This represents creative destruction in action. Increased openness to trade and greater competition from imports can facilitate such creative destruction and improve the efficiency with which resources are allocated across industries. We can see this by looking at two types of industry – one that is relatively closed to trade and one that is very open (see Chart 2.17).

In a less open industry, employment grows at a rate of less than 1 per cent per year virtually regardless of how close the industry is to the technological frontier. In contrast, more open industries contribute more to job creation in the economy as their productivity rises. When these industries reach 80 per cent of the productivity levels of their German counterparts, they create jobs at a rate of around 2.5 per cent per year. Even when productivity is only modest, more open industries still contribute slightly more to job creation than closed industries.

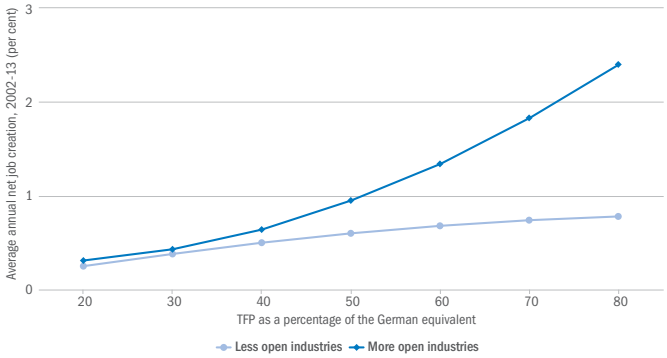
Likewise, a similar econometric exercise (the results of which are also available on request) confirms that greater integration into GVCs also helps to direct labour towards

CHART 2.16. More productive industries create more jobs



Source: CompNet and authors' calculations.
Note: These results represent average predicted growth rates derived from a country and industry-level panel regression of net job creation on TFP relative to Germany, with a lag of one period. Regressions control for country, industry and year fixed effects.

CHART 2.17. Openness to trade helps to reallocate jobs to more productive industries



Source: CompNet, WIOD and authors' calculations.
Note: These results represent average predicted growth rates derived from a country and industry-level panel regression of net job creation on TFP relative to Germany, openness to trade and their interaction term, all with a lag of one period. Regressions control for country, industry and year fixed effects. "Less open industries" are industries where exports and imports have a combined total of less than 10 per cent of output, while "more open industries" are industries where they total more than 90 per cent of output.

[27] See Bartelsman et al. (2013).

more productive parts of the economy. GVCs play a particularly important role in boosting aggregate productivity when they go beyond simple assembly and enable firms to acquire technological know-how and managerial expertise. Involvement in more skill-intensive parts of a chain – such as marketing to end-consumers or the production of high-tech components involving intensive R&D – encourages firms to innovate more. Economic policy needs to take these distinctions into account. A good example of a strong positive relationship between GVC entry and productivity is the development of the automotive industry in Hungary, the Slovak Republic and other central and eastern European economies. Productivity levels in these sectors have risen strongly following local firms' integration into GVCs, out-performing economy wide productivity growth.

Conclusion

This chapter has made a number of empirical observations about the entry, growth and exit of firms in the EBRD region. First of all, there is an abundance of small firms, which lag some way behind larger firms in terms of their efficiency levels. Second, there is a lack of dynamism, which is reflected in firms' inability to grow. And third, the region's productivity convergence at firm level has been driven primarily by larger firms (which, at the same time, face a significant risk of declining in size).

The presence of large numbers of small, inefficient firms is leading to lower aggregate productivity levels in the EBRD region. This has important implications for policies designed to support small and medium-sized enterprises (SMEs). Policy-makers should not concern themselves with the number or percentage of SMEs in the economy as such. Many SMEs may remain stagnant, with no incentives to innovate. Instead, policy-makers should focus on establishing a level playing field which helps those young firms that do innovate and want to grow to expand their market shares and enter new markets. This will strengthen competition in the economy and put pressure on other firms to raise their productivity levels (which they can achieve through greater integration in trade, for example). A successful economy is one in which the most productive SMEs eventually become large firms by attracting resources away from less productive incumbents.

The empirical analysis presented in this chapter is fully consistent with the Schumpeterian framework, which highlights the role that creative destruction and institutions play in fostering economic growth. This framework is highly relevant for the EBRD region. It indicates, in particular, that a larger percentage of businesses need to engage in R&D activities and ground-breaking innovation in order for the region's income growth to regain momentum. In the past, the region's growth was driven largely by the reallocation of resources from inefficient firms to more efficient competitors. In future, a larger contribution will need to come from productivity improvements at existing businesses, driven by innovation.

This chapter's detailed analysis of productivity convergence within the Schumpeterian framework points to several policy implications. First of all, economic institutions and policies that support the growth of firms and industries need to evolve as a country climbs the income ladder. As a country gets richer, smaller and more innovative firms will play a larger role in creating jobs and raising overall productivity. Policies should prioritise better access to capital and technology for these firms. As discussed in the *Transition Report 2015-16*, this may require some rebalancing of financial systems, improving the availability of specialist sources of finance such as venture capital and private equity.

Second, policy-makers need to focus more on flexible labour and capital markets and better competition policies in order to facilitate the efficient reallocation of resources. Leveraging the power of creative destruction and reallocating labour and capital from less productive jobs to more productive ones is a major challenge in any economy. Success in this area means lowering barriers to the entry of new firms while improving the economy's institutional quality and regulatory infrastructure. Creating a business environment that hastens the exit of less productive firms and fosters the growth of more productive ones is essential in order to speed up the reallocation process. This may require some rethinking of bankruptcy laws and competition legislation. More generally, transparent tax systems and improvements to the rule of law can help productive firms to increase the scale of their operations without fear of expropriation.

Third, governments can help firms and industries to improve their performance by supporting greater trade integration with the rest of the world. Trying to pick productive – or potentially innovative – firms and industries will inevitably create a non-competitive business environment. Instead, governments should let competition determine market leaders at the domestic level, while assisting exporters in their efforts to reach out to international markets with new products and services. Importantly, the creative destruction that accompanies greater competition creates both winners and losers. The reallocation of resources as a result of openness to trade and greater competition in the domestic market may lead to rising inequality and social tensions. Policies that promote inclusion, support retraining and provide a social safety net have a key role to play in ensuring that the reallocation of resources within the economy is relatively smooth, efficient and socially sustainable.[28]

Greater integration into GVCs should undoubtedly be a priority for policy-makers looking to improve their economies' productivity growth. Businesses of all sizes benefit from the adoption of industry best practices, product specialisation and the access to high-quality inputs that is necessary in order to be part of a GVC. However, some GVCs are better at supporting a country's transition to an innovation-based economy than others. In particular, businesses at the top and bottom ends of the chain, which develop new products and provide after-sales services, require more skills and innovation than those in the

[28] See EBRD (2016).

middle part of the chain, which focus on simple assembly-related tasks. Although involvement in assembly creates jobs and boosts output in the short run, policy-makers should help businesses to learn from their experience of being part of a GVC with a view to moving up the value added chain over time and developing original products.

Improving the quality of domestic infrastructure and logistics is probably the most effective way of making host economies attractive targets for GVCs. However, the benefits of high-quality transport and telecommunications networks extend far beyond facilitating participation in GVCs. Improvements to infrastructure reduce market frictions by limiting the likelihood of delays to the delivery of production inputs and improving firms' ability to reach out to potential customers located further away, as discussed in Chapter 3. This, in turn, can help firms to specialise in the production of original parts and equipment. All of these aspects are particularly important in terms of fostering the growth of small firms and helping a country to achieve a "bottom-up" transition to an innovation-based economy.

Box 2.1. Innovation and competition in the EBRD region

The Schumpeterian growth framework associates innovation with cross-cutting technological progress and R&D, culminating in patents and products that are new to the world. As was emphasised in the *Transition Report 2014*, however, innovation has many faces, and the relationship between innovation and competition can be a complex one. This box revisits the relationship between innovation and competition, with a particular focus on the experiences of middle-income countries.

In middle-income economies, some innovative activity takes the form of imitating and adapting globally available technology. Although it does not advance the technological frontier, this type of innovation can still boost firm-level productivity. Indeed, customising and upgrading products that have been developed abroad and introducing them to a local market can be the most productivity enhancing form of innovation.[29] Similarly, introducing internationally recognised management practices can also significantly improve productivity.[30]

However, if countries aspire to become high-income economies, the adoption of existing technology ceases to be sufficient. As countries become richer, this kind of innovation becomes less prevalent (including in the EBRD region). Instead, firms spend more on R&D with a view to introducing products that are not only new to their local economies, but also new to the world. In other words, they seek to extend the technological frontier. This type of innovation is associated with stronger productivity growth when countries reach upper/middle-income levels.

Firms in the EBRD region, however, have been struggling to extend the technological frontier (see Chart 2.1.1). As one would expect, the percentage of firms reporting expenditure on R&D has increased as income per capita has risen across the region. However, the rate at which those firms have introduced products that are new to the world has remained modest. Indeed, the percentage of firms innovating at the technological frontier is just over 2 per cent in Slovenia and less than 1 per cent in all other countries – significantly lower than in a comparator country such as the Czech Republic, for example. In some countries with relatively high levels of income per capita, such as Hungary and Lithuania, the percentage of firms innovating at the technological frontier remains tiny.

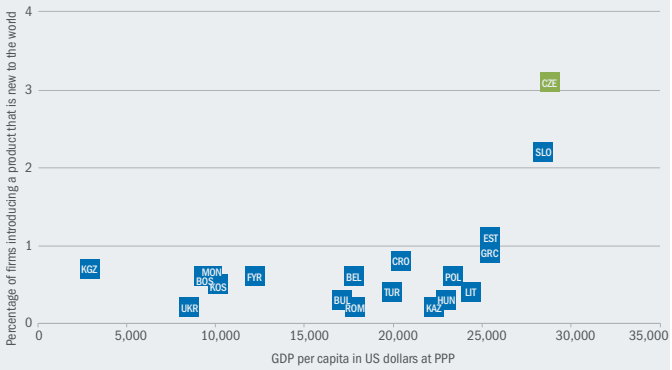
The role of competition

How does Schumpeterian theory link firm-level innovation with competition and macroeconomic growth? Imagine a new and highly efficient entrant in an industry. This new firm may offer a novel product, or it may use proprietary technology to substantially reduce its costs. Either way, this innovative competitor poses a threat to incumbent firms.

What happens to the rate of innovation and productivity growth in that economy will ultimately depend on how those incumbents respond. Incumbent firms with technology and productivity levels that are similar to the new entrant's ("frontier firms") will strive to innovate in order to preserve their market shares and reduce costs. In contrast, incumbents with far lower productivity levels ("laggard firms") may feel that they no longer stand any chance of reaching the technological frontier even if they do undertake costly investment. Thus, competition may actually discourage these firms from investing and innovating.

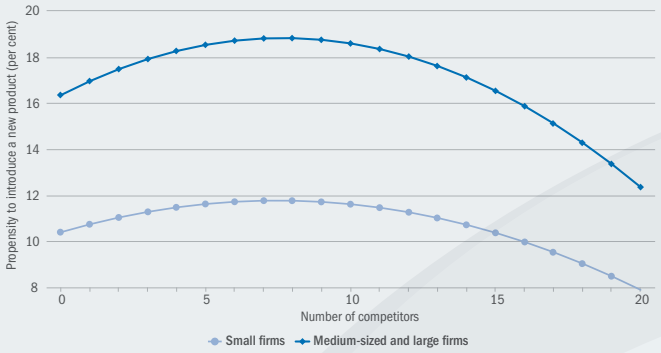
[29] See EBRD (2014).
[30] See Bloom et al. (2014). Increasing the quality of tax administration can also help improve the productivity of small and young firms (see Dabla-Norris et al., 2017).

CHART 2.1.1. Countries need to push back the frontier more as they get richer



Source: BEEPS, WDI and authors' calculations.
Note: Calculations are based on verified (as opposed to self-reported) indicators of innovation.

CHART 2.1.2. Too little or too much competition hurts innovation



Source: BEEPS and authors' calculations.
Note: These results represent estimates derived from a firm-level regression of innovation on the number of competitors, the number of competitors squared and a set of firm-level characteristics (including size, age, export status, ownership and credit constraints). Regressions control for main market, country and industry fixed effects.

In advanced economies, frontier firms typically outnumber laggard firms. In this case, increases in market competition and firm entry are beneficial for the industry's development. Indeed, in the absence of new entrants, incumbents may seek to protect their market shares and stop innovating. However, in industries with too many laggard firms, the entry of new businesses and increases in competition may actually suppress aggregate productivity growth.

Cross-country regression analysis shows that the relationship between the extent of innovation and the degree of competition is not a linear one (see Chart 2.1.2). Firms that only have a handful of competitors are less likely to introduce new products than firms with moderate levels of competition (defined as 5 to 15 competitors). Equally, firms with larger numbers of competitors are also less likely to innovate, possibly because they feel that competition will soon erode any advantages that may be gained through additional investment. What is more, innovation by medium-sized and large firms is especially sensitive to the degree of competition, with these firms tending to innovate more than small firms in the EBRD region.

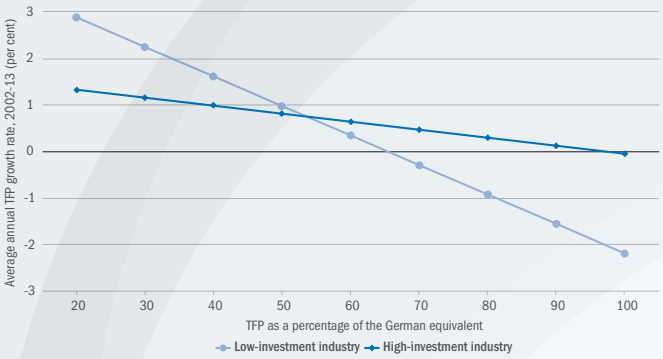
Box 2.2. The role of investment in small firms' growth

Smaller and younger firms often have a comparative advantage when it comes to introducing new products and disruptive technology.[31] Consequently, they have the potential to make major contributions to aggregate growth through their selection of entrepreneurial talent and their impact on competition. However, small and young firms are often the least productive companies in emerging markets. Why do small firms in emerging markets typically find it much more difficult to raise their productivity levels?

This box looks at one potential reason: a lack of physical investment. Small firms may lack incentives to undertake productivity-enhancing investment if they do not plan to grow, and there are a number of possible reasons why small firms might choose to remain small. Moreover, even sufficiently innovative firms may simply lack the resources that are necessary to grow. In particular, young innovative companies can face serious challenges when it comes to accessing credit,[32] given their weak cash flows and short credit histories. A lack of external finance can make it especially difficult for these firms to increase their capital stock.

The regression analysis in the rest of this chapter can be used to shed further light on the role that investment in capital stock plays in supporting the growth of small firms in Europe (see Box 2.3 for details of the methodology). The results of this analysis show that productivity growth at micro-sized and very small firms is crucially dependent on investment. In contrast, this relationship is weak where firms employ more than 20 people. In particular, a micro-sized firm in a sector with a low investment rate stops enjoying productivity growth when productivity in the sector reaches around 65 per cent of the corresponding level in Germany (see Chart 2.2.1). In contrast, a firm of a similar size in a sector with a high investment rate sustains productivity growth for a lot longer – all the way up to the point where it reaches the technological frontier.

CHART 2.2.1. Smaller firms achieve more sustainable productivity convergence in the presence of higher investment rates



Source: CompNet and authors' calculations.
Note: These results represent average predicted growth rates derived from a country and industry-level panel regression of TFP growth on TFP relative to Germany, the average investment rate and their interaction term, all with a lag of one period. Regressions control for country, industry and year fixed effects. "Low-investment" and "high-investment" industries are industries with investment rates of less than 5 per cent and more than 20 per cent respectively.

[31] See Pagano and Schivardi (2003).
[32] See EBRD (2015) for evidence on the EBRD region and Bloom et al. (2014) for evidence on other developing economies.

Box 2.3. Methodology

The main dataset used in this chapter was compiled by the CompNet research network, which was set up by the European Central Bank in March 2012. CompNet collects data from participating countries using the "distributed micro-data approach" developed by Bartelsman et al. (2004). This approach uses a common protocol to extract relevant information from existing firm-level datasets for each country and aggregate it at a level of interest (for instance, at sector level), while preserving the confidentiality of firms' data. The final dataset provides a rich set of economic indicators based on firm-level data, which are comparable across countries and years.

CompNet's industry classification is in line with NACE (the statistical classification of economic activities in the European Community) Rev. 2. The nine sectors covered are: manufacturing; construction; wholesale and retail trade; transport and storage; accommodation and food service activities; information and communication; real estate activities; professional, scientific and technical activities; and administrative and support service activities.

The second dataset used in this chapter is the 2013 release of the World Input-Output Database. WIOD data have much greater coverage than CompNet in terms of countries and years, as well as offering measures of openness to trade and shares in value added at industry level.

This chapter uses regression analysis to study productivity convergence at industry level. In the baseline equation, the growth rate of TFP, net value added or net job creation for each two-digit industry *i* in country *c* at time *t* is related to the relevant industry's proximity to the technological frontier in the previous period, while taking account of industry, country and year fixed effects:

$$y_{ict} = \alpha + \beta_1 Proximity\ to\ Frontier_{ict-1} + \gamma_i + \gamma_c + \gamma_t + \varepsilon_{sct}$$

The methodology is then extended in order to incorporate other industry-level measures (such as openness to trade or the average firm-level investment rate) into the baseline equation as follows:

$$y_{ict} = \alpha + \beta_1 Openness_{ict-1} * Proximity\ to\ Frontier_{ict-1} + \beta_2 Openness_{ict-1} + \beta_3 Proximity\ to\ Frontier_{ict-1} + \gamma_s + \delta_c + \delta_t + \varepsilon_{sct}$$

The results reported in this chapter represent predicted growth rates for various indicators derived from panel regressions estimated as described above. The same methodology is applied in Box 2.2, which also takes account of firm size.

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