CHAPTER 10

THE BOTTOM ALSO MATTERS: POLICIES FOR PRODUCTIVITY CATCH-UP IN THE DIGITAL ECONOMY

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Summary

Research into the slowdown in global productivity has brought to the forefront of the policy debate the importance of understanding the nature of firm-level productivity developments. This has become particularly relevant following evidence showing a significant increase in the productivity gap between highly productive firms and the rest of businesses within the same industries since the 2000s. This diverging trend in productivity performance would eventually lead to broader social implications in terms of wage inequality and inclusiveness.

This chapter provides an overview of recent and ongoing analysis of these issues and discusses policies that affect the catch-up by laggards in the context of the digital transformation. First, it introduces productivity divergence in the context of the global phenomenon linked to digital transformation and the knowledge economy. Later, it examines trends in productivity divergence and business dynamism, respectively, with a focus on the bottom of the productivity distribution. Beyond common trends, a few examples highlight cross-country and cross-sector heterogeneity. The descriptive sections conclude with firm and sector characteristics and discussions about possible explanations behind the documented trends at the bottom, including the role of openness. The final analytical section provides a framework and summarises the main results of the analysis of the role of policies on the speed of catch-up by laggards.

1. Introduction

The productivity gap between successful firms and the rest of businesses within the same industries has been increasing since the 2000s across OECD countries (Andrews, Criscuolo and Gal, 2016; Berlingieri, Blanchenay and Criscuolo, 2017). Productivity developments at the firm level point to impediments to technology diffusion from the productivity frontier to the rest of the distribution, with too many firms stuck at the bottom – the so-called 'laggards'. The evidence suggests that the increase in the productivity gap has come mainly from the bottom half of the distribution, where the distance in terms of performance between the very bottom and the median firm has increased more over time than at the top of the distribution (Berlingieri, Blanchenay and Criscuolo, 2017). Yet, this does not imply that the left tail of the productivity distribution only includes zombie firms that survive due to weak market selection. Rather, the evidence shows that a substantial share of low-productivity firms are businesses at an early stage of their development and operating below their efficiency level (Berlingieri, Calligaris, Criscuolo and Verlhac, 2019). While allowing for the exit of zombie firms, efficient bankruptcy legislation is key; a dynamic business environment with productivity-enhancing creative destruction is key to enabling these young, small and dynamic firms to achieve their growth potential.

Importantly, the productivity divergence seems to be larger in sectors providing information and communication technology services (e.g. computer programming, software engineering and data processing) and in industries that are intensive in intangible assets (e.g. data, proprietary software, human and organisational capital). The increasing potential of digital technologies to create global winner-takes-most dynamics might have helped frontier firms to increase their performance disproportionally more than laggards within these industries (Criscuolo, 2019) and gain larger market share (Andrews et al., 2016, and Bajgar et al., 2019). Ongoing OECD work suggests that intangible assets are associated with productivity dispersion through their complementarity with digital technologies, and that the effect arises from laggards' worsening productivity performance vis-à-vis the median firm (Berlingieri, Corrado, Criscuolo, Haskel, Himbert and Iona Lasinio, 2019). Intangible assets are also linked to increased concentration, especially in sectors that are open and digital intensive (Bajgar, Criscuolo and Timmis, 2019). The rise of the intangible economy exacerbates productivity dispersion, as laggards may not be able to afford and finance the necessary intangible investments to reap the benefits of technological change (Berlingieri et al., 2019).

This chapter provides an overview of recent and ongoing analysis on these issues and discusses policies that affect the catch-up of laggards in the context of the digital transformation. It is organised as follows: section 2 briefly puts the productivity divergence in the context of other manifestations of the same multifaceted global phenomenon linked to digital transformation and the knowledge economy. Sections 3 and 4 document trends in productivity divergence and business dynamism, respectively, with a focus on the bottom of the productivity distribution. Beyond common trends, a few examples highlight cross-country and cross-sector heterogeneity. Section 5 identifies firm and sector characteristics that may explain the documented trends at the bottom, including the role of openness. Section 6 provides a framework and summarises the main results of the analysis on the role of policies on laggards' rate of catch-up. Section 7 concludes with a policy discussion.

2. A multifaceted phenomenon

The global productivity slowdown has brought to the forefront of the policy debate the importance of understanding the nature of firm-level productivity developments. Recent OECD research has documented the significant increase in the productivity gap between successful firms and the rest of businesses within the same industries since the 2000s, both at the global level and within countries. The divergence in productivity performance has implications in terms of wage inequality and inclusiveness. Indeed, increases in wage inequality and in productivity dispersion are linked. Therefore, policy responses to the increasing productivity divergence could potentially produce a 'double dividend' in terms of both greater productivity growth and reduced income inequality (see Criscuolo, 2018 and references therein). Importantly, productivity policies need to account for local and sectoral specificities as countries and industries have experienced heterogeneous productivity and wage developments beyond well-established common trends (Box 10-1).

Productivity divergence is observed in the context of ongoing digital transformation that radically alters the way firms produce, upscale and compete. In particular, digital technologies may affect the two microeconomic processes that shape aggregate productivity trends. First, they impact within-firm productivity growth, thanks to the efficiency gain that firms can achieve by adopting digital technologies and enhancing their innovation capabilities – if they have the necessary complementary

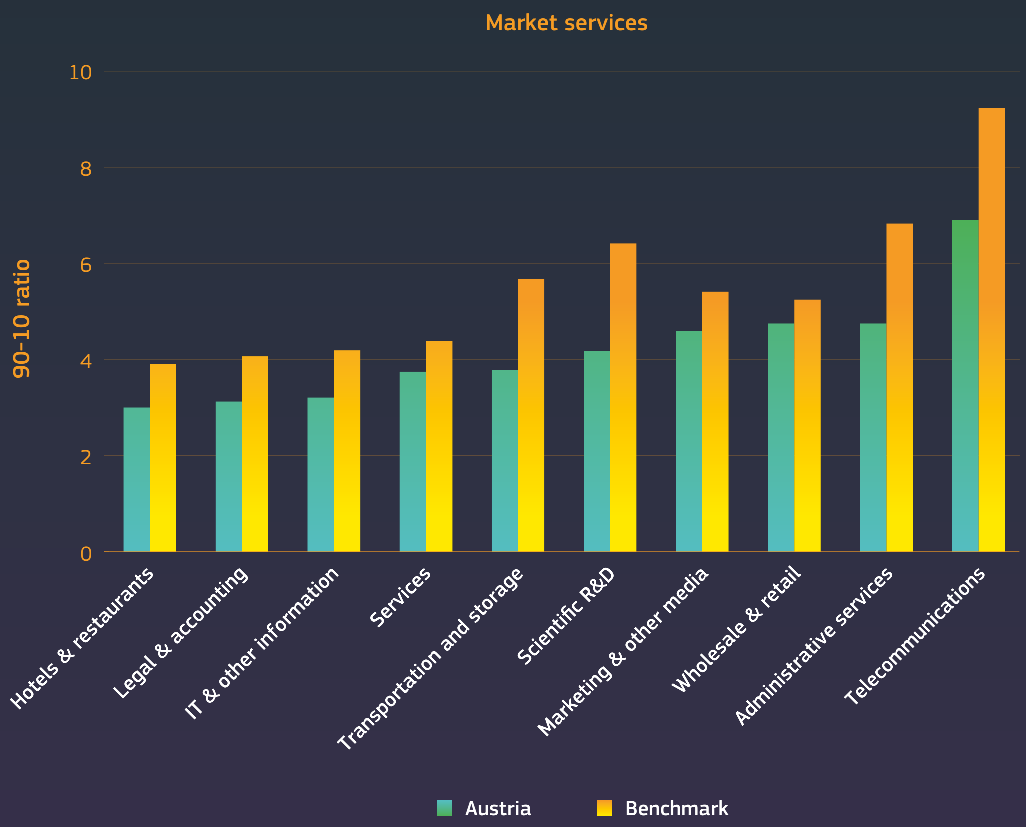
BOX 10-1 Heterogeneity in productivity developments across countries and sectors

Recent OECD research has documented common trends in productivity and wage divergence within industries across advanced economies since the early 2000s. Yet, beyond these general trends, countries have experienced specific productivity and wage developments. The OECD MultiProd project gathers harmonised productivity-related data enabling cross-country comparisons of productivity developments over time at a fine level of disaggregation. The MultiProd data uniquely inform researchers and policymakers about country-specific productivity patterns and enable them to compare the nature of productivity developments across countries. This box gives a few examples:

Productivity dispersion across industries in Austria

Trends in labour productivity dispersion in Austria have been comparable to developments in other OECD economies since the Great Recession (OECD, 2019a). However, the level of within-industry productivity dispersion is lower in Austria than in other countries. Remarkably, average labour productivity dispersion is lower in every manufacturing and service industry over the period 2008-14 (Figure 10-1).

Figure 10-1 Average labour productivity dispersion, Austria, 2008-14



Source: OECD (2019a)

Note: This figure reports the average dispersion in labour productivity within industries in Austria and within country-industry pairs in a set of benchmark countries. Dispersion is measured as the ratio of the 90th percentile to the 10th percentile of the firm-productivity distribution. Figures are the within-industry yearly averages for 2008-14. Results are presented separately for manufacturing and non-financial market services based on detailed industries, following the SNA A38 classification (see Desnoyers-James, Calligaris and Calvino, 2019). Benchmark countries include Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Norway, Portugal and Switzerland. Data from the OECD MultiProd database, accessed February 2019.

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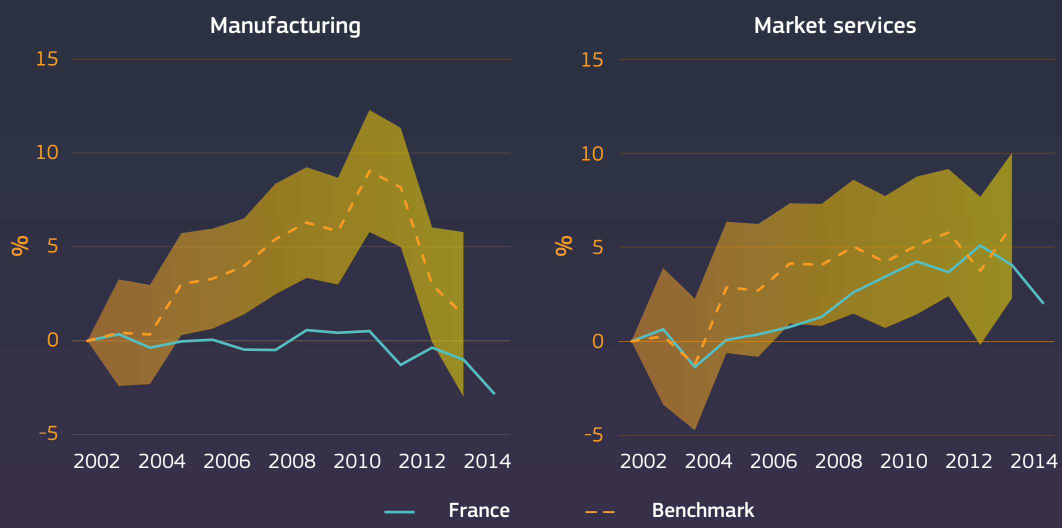
Wage dispersion in French manufacturing

While France has experienced an increase in wage dispersion overall, developments have been significantly heterogeneous across sectors over the period 2002-2015 (OECD, 2019b). While between-firm wage dispersion increased in service industries over that period, it did not in manufacturing industries, possibly pointing to the role of labour market institutions (Figure 10-2).

Figure 10-2 Cumulative change in wage dispersion, France



Source: OECD (2019b)
Note: This figure reports the estimated year dummies of a regression of average log wage dispersion within industries in France and within country-industry pairs in a set of benchmark countries, taking the first year as baseline. Dispersion is measured as the ratio of the 90th percentile to the 10th percentile of the firm-wage distribution. The values correspond to the average growth within country-industry since 2002. Results are estimated separately for manufacturing and non-financial market services based on detailed industries, following the SNA A38 classification (see Desnoyers-James, Calligaris and Calvino, 2019). Benchmark countries include Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Norway, Portugal and Switzerland. Data from the OECD MultiProd database, accessed February 2019.
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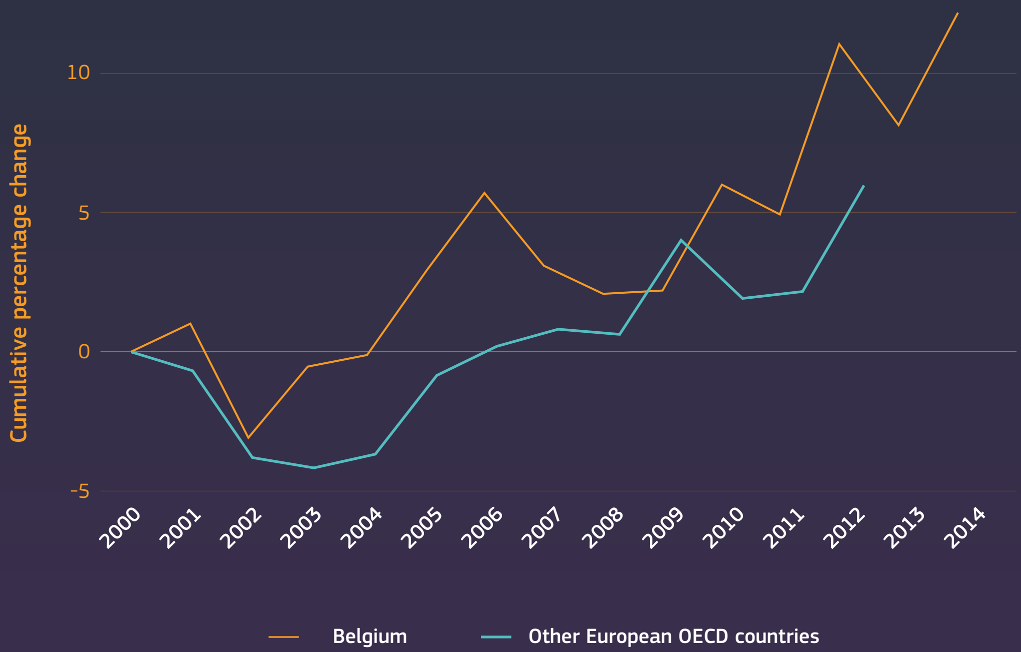
Technology diffusion in Belgium

Increasing disparities between the most- and the least-productive firms point to insufficient technology and knowledge diffusion from frontier firms to laggards. While there is evidence that the pace of diffusion has decelerated across countries, Belgium seems to have experienced a significantly more pronounced slowdown (OECD, 2019c). The productivity gap between the domestic frontier and laggards has increased twice as much in Belgium as in other countries over the period 2000-2012 (Figure 10-3).

Figure 10-3 Cumulative change in the productivity gap between laggard and frontier firms, Belgium



Source: OECD (2019c)

Note: This figure reports the estimated year dummies of a panel data regression of the average labour productivity gap between laggards and the domestic productivity frontier within industry-productivity performance group pairs in Belgium, and within country-industry-productivity performance group triplets in the set of benchmark countries. Laggards are firms belonging either to the bottom decile of the productivity distribution (0 to 10th percentile) or to the medium-low performance group (10th to 40th percentile). The domestic productivity frontier is defined as the top 10 % of the productivity distribution in each country-industry-year triplet. The labour productivity gap is defined as the distance between (log) labour productivity in each country-industry-productivity performance group-year among laggards and (log) LP of the domestic frontier in the corresponding country-industry-year. The first year is taken as the baseline. Results are estimated for manufacturing and non-financial market services based on detailed industries, following the SNA A38 classification (see Box 10-2 and Annex). Other European OECD countries are Denmark, Finland, France, Hungary, Ireland, Italy, Norway, Portugal and Sweden. Data from the OECD MultiProd database.

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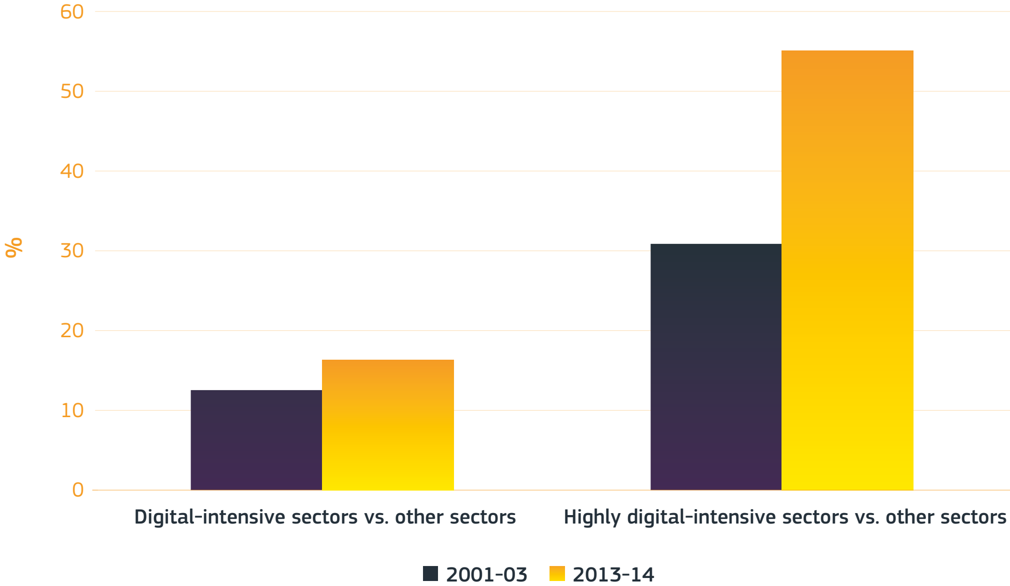
assets, such as organisational capital, data, etc. Second, they have the potential to affect the reallocation of resources across firms, and to create winner-takes-most dynamics, given the near-zero marginal costs of digital inputs and the potential for network effects. The resulting increase in productivity disparities between the most- and the least-productive firms could partially explain the productivity slowdown observed at the macroeconomic level. In addition, these now well-established productivity patterns hint at potential causes of the slowdown, namely insufficient technology diffusion from the frontier to laggards (Berlingieri et al., 2019) and slowing business dynamism (Calvino and Criscuolo, 2019) which slackens the process of creative destruction (Berlingieri, Blanchenay and Criscuolo, 2017).

Concomitant with this increase in productivity dispersion, advanced economies – and digital-intensive sectors within them, in particular – have experienced other major changes in their business dynamics and industry structure (Criscuolo, 2019). Against the backdrop of the productivity divergence, there has been: (i) a decline in business dynamism, measured as entry rates and jobs reallocation across firms (Calvino and Criscuolo, 2019); (ii) an increase in mark-ups, i.e. in the wedge between unit prices and marginal costs (Calligaris, Criscuolo and Marcolin, 2018); (iii) a rise in industry and revenue concentration (Bajgar et al., 2019); and (iv) a decline in the labour share of income (OECD, 2018). Taken together, these elements suggest that something is changing about competitive dynamics more generally, driven by common structural factors linked to the digital transformation. The remainder of this section briefly discusses these factors.

The digitalisation of the economy magnifies the importance of knowledge assets. The intensive use of intangible assets such as data analytics and the difficult replication of successful business models, together with declining IT capital prices, allow few firms, especially in digital-intensive sectors, to benefit from high and increasing mark-ups and to gain a large market share. These in turn may help industry leaders to sustain and advance their position leaving competitors behind.

In line with similar findings for the United States (De Loecker, Eeckhout and Unger, 2018), Calligaris, Criscuolo and Marcolin (2018) point to firm-level evidence of significant changes and increasing differences across companies when looking at firm mark-ups in advanced economies since the early 2000s. Moreover, this works provides novel evidence of a link between the increase in firm-level mark-ups and the digital intensity of firms' production technology, suggesting that, on average, firms operating in digital-intensive sectors have higher mark-ups (Figure 10-4).

Figure 10-4 Average mark-ups in digital-intensive sectors are higher and even more so today



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Source: Elaborations on Calligaris, S., Criscuolo, C. and Marcolin, L. (2018)

Note: The figure illustrates the increasing wedge in mark-ups between firms in digital-intensive and less-digital-intensive industries, 2001-03 and 2013-14. It reports the average percentage differences at the beginning and at end of the sample period, estimated from a pooled OLS regression explaining firm log mark-ups in the period, on the basis of the firm's capital intensity, age, productivity and country-year of operation, as well as a dummy variable with value 1 if the sector of operation is digital-intensive vs. less-digital-intensive (specifications on the left in the graph), or if the sector of operation is among the top 25% of digital-intensive sectors vs. not (specifications on the right in the graph). Sectors are classified as 'digital-intensive' or 'highly digital-intensive' according to the taxonomy developed in Calvino et al. (2018). Mark-ups are estimated from a Cobb Douglas production function. With respect to Calligaris et al. (2018), in this elaboration the parameters of the production function have been estimated at the 3-digit industry level (rather than 2-digit), and including year dummies. Moreover, mark-ups lower than 1 but greater than 0.95 have been winsorized (rather than trimmed) to 1. Standard errors are clustered at the firm level. All coefficients are significant at the 1% level. This figure is an OECD elaboration on Calligaris, S., Criscuolo, C. and Marcolin, L. (2018), 'Mark-ups in the digital era', OECD Science, Technology and Industry Working Papers, No. 2018/10, OECD Publishing, Paris, https://doi.org/10.1787/4efe2d25-en, based on Orbis® data, July 2018. See https://doi.org/10.1787/888933928711

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A key complementary input to digital technologies, most intangible assets are non-rival in nature and easily scalable. Therefore, they can be used in many markets at near-zero marginal cost, which gives larger companies an inherent advantage when leveraging intangible investments over higher sales and more markets. Recent OECD work finds that intangible assets play a key role in enabling large firms to scale up, thereby increasing industry concentration (Bajgar, Criscuolo and Timmis, 2019, and Figure 10-5). Moreover, ongoing work suggests that laggard firms may not be able to transform digital technologies into productivity gains because they cannot afford complementary investments in intangible assets and skills (Berlingieri, Calligaris, Criscuolo and Verlhac, 2019; Berlingieri, Corrado, Criscuolo, Haskel, Himbert and Iona Lasinio, 2019).

Technological progress also affects labour, both by extending the range of existing tasks that can be performed by capital assets and by creating new tasks related to the use of these assets (Acemoglu and Restrepo, 2018). Over the past couple of decades, information and communication technologies seem to have displaced labour and facilitated the emergence of 'superstar firms' with very low labour shares (Autor et al., 2017; OECD, 2018). The increasing weight of these very large and productive firms in the digital economy may help explain the declining labour share of income across the OECD. Consistent with the decline in the labour share, the increasingly large pay differentials across firms account for a large share of the increase in wage inequality in recent decades (Berlingieri, Blanchenay and Criscuolo, 2017; OECD, 2018).

Figure 10-5 Top 8 concentration by potential concentration drivers — change since 2002

Source: Bajgar, Criscuolo and Timmis (2019), 'Supersize me: intangibles and industry concentration', Mimeo

Note: The countries include BE, DK, ES, FI, FR, UK, EL, IT, JP, PT, SE and US. Included industries cover 2-digit manufacturing and non-financial market services. Concentration is measured by the share of top eight business groups in the sales of each industry in each country. The figure shows changes in the (unweighted) mean concentration across country-industry pairs. Panels A-D show concentration separately for country-industries with above- and below-median intensity of intangible investment (Panel A), country-industries with above- and below-median ratio of exports and imports to value added (Panel B), high-digital-intensity industries and less-digital-intensity (Panel C) and countries with above- and below-median values of the product market regulations index (Panel D). The interaction variables are calculated as the means over the period 2002-2014 with the exception of digitalisation, which refers to years 2001-2003.

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3. Divergence at the bottom

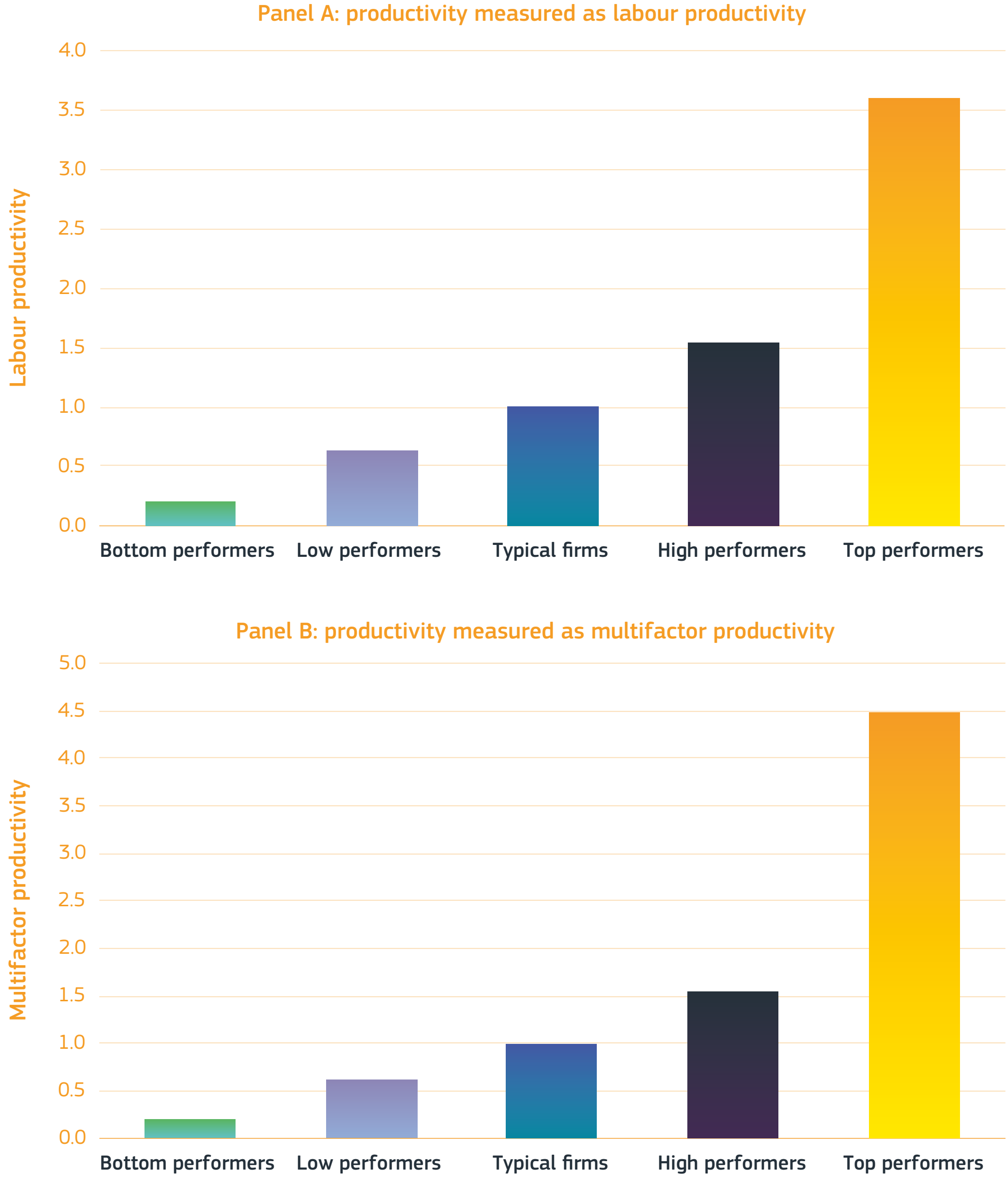
While the emergence of superstar firms points to the rising performance of firms at the top of the distribution as a source of the observed productivity divergence, the rising divergence at the bottom of the distribution suggests that the disappointing performance of laggard firms might also be at play. However, little is known about the characteristics of firms that operate at the bottom of the productivity distribution and what drives their performance, although understanding how their performance affects aggregate productivity growth is of prime interest. Recent OECD work bridges the gap by specifically focusing on the 40% of least-productive firms, the so-called laggards (Berlingieri, Calligaris, Criscuolo and Verlhac, 2019). It highlights the characteristics of laggard firms, their contribution to the economy and the determinants of their productivity performance.

The analysis splits the business population into five groups of firms with different productivity levels in each country and two-digit industry across 13 countries:

- **'Bottom performers'**: firms with a productivity level lying below the 10th percentile of the productivity distribution, i.e. the bottom 10% in terms of productivity performance;
- **'Low performers'**: firms with a productivity level lying between the 10th and the 40th percentile, i.e. firms with a relatively low productivity level, just below the median group, the 'typical firms' group (see below). They account for about 25% of employment and 12% of revenues in the sample;
- **'Typical firms'**: firms with a productivity level lying between the 40th and the 60th percentile, i.e. firms located around the median productivity level;
- **'High performers'**: firms with a productivity level lying between the 60th and the 90th percentile, i.e. firms with a relatively high productivity level, yet lower than the best performing firms, and accounting for 30% of the population;
- **'Top performers'**: firms with a productivity level lying between the 90th and the 100th percentile of the distribution, i.e. the top 10% in terms of productivity performance.

The group of laggards comprises firms belonging to either the bottom performers or the low performers. This classification allows for an analysis of firms based on their relative position in the productivity distribution. The relative average productivity in each productivity group provides evidence about the shape of the distribution and appears particularly relevant for analysing frontier firms and firms at the very bottom.

Figure 10-6 Average productivity by performance group relative to the 'typical firms' group



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Source: Berlingieri, Calligaris, Criscuolo and Verlhac (2019), 'Last but not least: laggard firms, technology diffusion and its structural and policy determinants', Mimeo

Note: The figures plot the weighted average labour productivity (top panel A) and multifactor productivity (bottom panel B) in different groups of the productivity distribution with respect to the median bin. In particular, the productivity distribution has been split into five groups: 1st to 10th percentile, 10th to 40th, 40th to 60th, 60th to 90th, and 90th to 100th. Manufacturing and non-financial market services only. Countries included AU, BE, CA, CH, DK, FI, FR, HU, IE, IT, NO, PT, SE.

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Panel a in Figure 10-6 plots the employment-weighted average labour productivity (LP), defined as value added over employment, in each group relative to the 'typical' group and illustrates the large dispersion existing within country two-digit industries. On the one hand, top performers exhibit much higher levels of productivity, on average around 3.5 times as high as that of typical firms, which serve as the reference point. On the other hand, the average productivity of firms in the bottom performers is around one fifth of the average typical firm. Low performers exhibit productivity that is roughly 60% of a typical firm's productivity. Panel B in the same figure reports similar comparisons when productivity is measured as multifactor productivity (MFP).

Another way to look at the contribution from laggards is to focus on their contribution to aggregate productivity. The contribution of firms with different labour productivity performance (i.e. in different productivity quantiles) to aggregate labour productivity is determined by both the level of labour productivity and their employment. The data shows that the bottom performers account for less than 1% of total productivity in the average two-digit industry, whereas the low performers account for about 10% (Berlingieri, Calligaris, Criscuolo and Verlhac, 2019). This is the result of both low levels of productivity and relatively low employment shares driven, in turn, by the small average size of firms in these groups. However, the potential productivity gains resulting from a hypothetical situation where the (weighted) average productivity in these two groups is equalised to the level of the (weighted) average productivity in the typical firms group are significant.

Figure 10-7 **Share of gross output, value added and employment by productivity group**

Productivity group	Share of firms (%)	Share of gross output (%)	Share of value added (%)	Share of employment (%)
	Labour productivity (LP)			
Bottom performers	10	1.45	0.79	4.94
Low performers	30	10.36	10.36	24.43
Typical firms	20	12.21	12.84	19.92
High performers	30	38.65	39.21	37.88
Top performers	10	37.32	36.8	12.83
	Multifactor productivity (MFP)			
Bottom performers	10	5.07	4.28	6.77
Low performers	30	11.02	11.14	18.42
Typical firms	20	9.08	9.69	14.6
High performers	30	34.18	35.14	35.55
Top performers	10	40.72	39.8	24.75

Source: Berlingieri, Calligaris, Criscuolo and Verlhac (2019)

Note: The figure reports the share of gross output (GO), value added (VA) and employment (L) in each group of the productivity distribution (LP in top panel; MFP in bottom panel). In particular, the productivity distribution has been split into five groups: bottom performers (1st to 10th percentile), low performers (10th to 40th percentile), typical firms (40th to 60th percentile), high performers (60th to 90th percentile) and top performers (90th to 100th percentile). The figure covers manufacturing and non-financial market services only. Countries included: AU, BE, CA, CH, DK, FI, FR, HU, IE, IT, NO, PT and SE.

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These potential benefits raise the question of the nature of the productivity gap and whether improving laggards' productivity is feasible. To answer this question, it is necessary to better understand the characteristics of firms that are at the bottom of the productivity distribution, in particular in relation to firms at the top of the distribution. The richness of the MultiProd database, described in detail in Box 10-2, enables an investigation into the differences between firms in different productivity groups along multiple dimensions. Two characteristics are found to be particularly informative of the nature of laggards: the firms' age and size.

BOX 10-2 MultiProd: distributed microdata suitable for the analysis of the entire productivity distribution

Implementation of the MultiProd project, undertaken by the OECD, is based on a standardised STATA routine that micro-aggregates confidential firm-level data from production surveys and business registers, via a distributed microdata analysis. This methodology was pioneered in the early 2000s in a series of cross-country projects on firm demographics and productivity (Bartelsman et al., 2005; Bartelsman et al., 2009). The distributed micro-data analysis involves running a common code in a decentralised manner by representatives in national statistical agencies or experts in governments or public institutions who have access to the national micro-level data. The centrally designed, but locally executed, program codes generate micro-aggregated data which are then sent back to the OECD for comparative cross-country analysis.

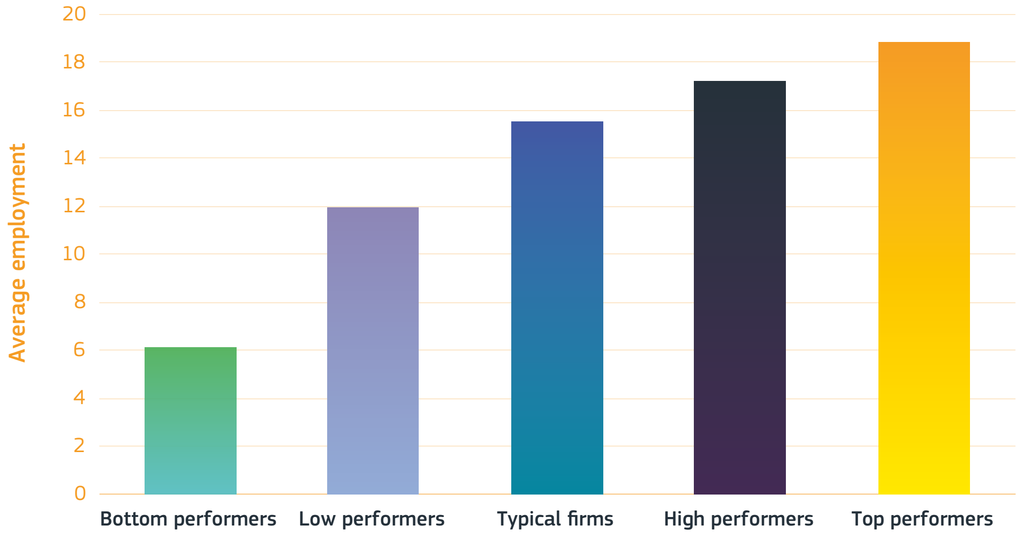
The MultiProd programme relies on two main data sources in each country. First, administrative data or production surveys (PS) which contain all the variables needed for productivity analysis but may be limited to a sample of firms. Second, business registers (BR) which contain a more limited set of variables but for the entire population of firms. The BR is not needed when administrative data on the full population of firms are available. When data come from a PS, however, the availability of the business register substantially improves the representativeness of results and, thus, their comparability across countries.

Indeed, census and administrative data normally cover the whole population of businesses with at least one employee. Still, these datasets do not always exist nor include all the information needed to calculate productivity. In these cases, PS data must be used. One of the big challenges of working with firm-level production surveys is that the selected sample of firms might yield a partial and biased picture of the economy. Thus, when available, BRs, which typically contain the whole population of firms, are used in MultiProd to compute a population structure by year-sector-size classes. This structure is then used to re-weight data contained in the PS in order to construct data that are as representative as possible of the whole population of firms and comparable across countries.

MultiProd is one of the few datasets to include the population of firms for a large number of countries and therefore to be highly representative of all parts of the productivity distribution. This peculiarity makes it particularly suitable to analyse the bottom part of the productivity distribution and allows for a closer look at laggard firms' contribution to productivity slowdown.

In terms of size, Figure 10-8 shows a positive relationship between firm size and productivity, confirming the theoretical prediction from Melitz (2003), and the empirical finding by Berlingieri et al. (2018) for manufacturing. Indeed, typical firms are 2.5 times bigger on average than the bottom performers and 1.3 times bigger than low performers.

Figure 10-8 Average size by productivity (LP) groups



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Source: Berlingieri, Calligaris, Criscuolo and Verlhac (2019), 'Last but not least: laggard firms, technology diffusion and its structural and policy determinants', Mimeo

Note: The figure plots the average size (employment) in different groups of the LP distribution. In particular, the LP distribution has been split into five groups: 1^{st} to 10^{th} percentile, 10^{th} to 40^{th}, 40^{th} to 60^{th}, 60^{th} to 90^{th}, and 90^{th} to 100^{th}. Manufacturing and non-financial market services only. Countries included: AU, BE, CA, CH, DK, FI, FR, HU, IE, IT, NO, PT, SE.

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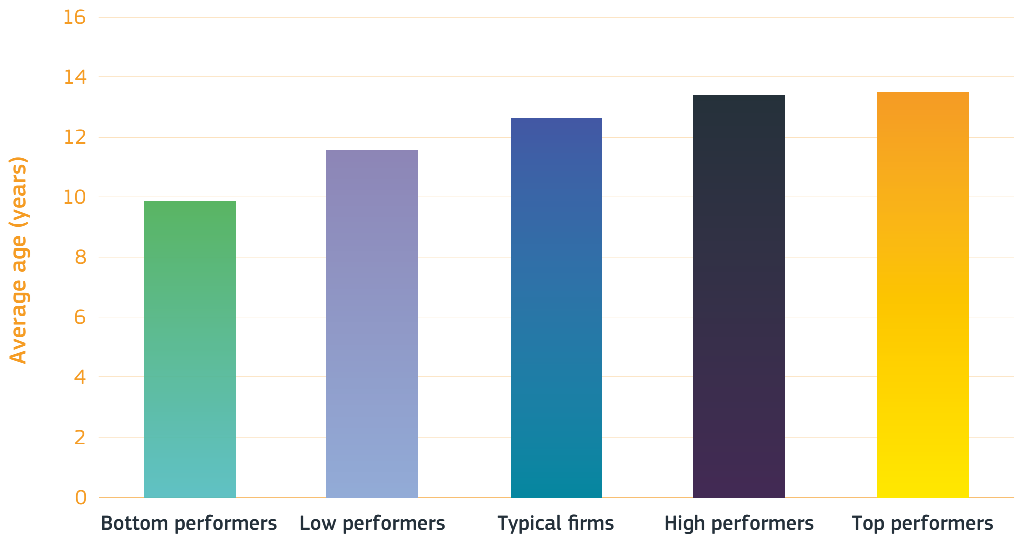
In terms of age, laggards are younger than firms in the median group, as illustrated in Figure 10-9. In addition, Berlingieri, Calligaris, Criscuolo and Verlhac (2019) confirm these differences in a regression framework allowing for a comparison of firms in the same country, industry and year.

Figure 10-9 Average age by productivity (LP) performance groups



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Source: Berlingieri, Calligaris, Criscuolo and Verlhac (2019), 'Last but not least: laggard firms, technology diffusion and its structural and policy determinants', Mimeo

Note: The figure plots the average age in different groups of the productivity distribution. In particular, the LP distribution has been split into five groups: 1st to 10th percentile, 10th to 40th, 40th to 60th, 60th to 90th, and 90th to 100th. Manufacturing and non-financial market services only. Countries included: BE, DK, FR, IE, IT, NO, SE.

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These differences between firms in different groups are key to understanding the nature of the laggards' productivity gap. There may be several reasons why firms have a productivity lower than the typical firm. Firms at the bottom may indeed be: (i) low-productivity firms that would typically exit in a competitive market, the so-called zombie firms (e.g. Caballero et al., 2008; Adalet McGowan et al., 2017); (ii) SMEs that by the nature of their governance (or a life-style choice) are likely to remain small and have limited scope for productivity growth (e.g. local services); but also (iii) firms entering the economy, which are likely to operate below their productivity potential during the first stage of their development.

The characteristics illustrated above are averages within the groups and thus highlight differences across groups but mask such within-group heterogeneity. However, they illustrate a key point for the analysis of laggards: the low tail of the productivity distribution is partly composed of young and small firms with a potential for growth. Therefore, the group of laggards is partly composed of firms that might only transit through the bottom of the productivity distribution to become high performers in the future. Pointing to the coexistence amongst laggards of firms with persistently low productivity (type (i) and (ii) above) and firms with temporarily low productivity but with high potential (type iii) is of primary importance for policy. It suggest that policies which aim to raise the productivity of laggards could matter for aggregate productivity and could be complementary to policies that allow the exit of zombie firms, e.g. efficient bankruptcy legislation, efficient financial systems, etc.

4. The role of business dynamism in the productivity gap

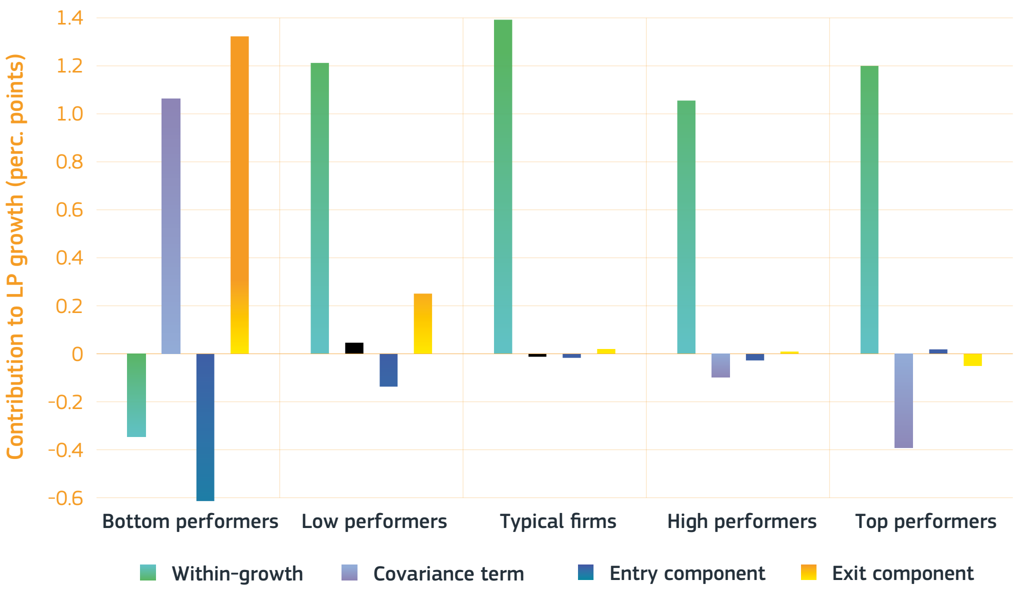
The age difference between laggards and more-productive firms raises the question about the connection between the existence of a large tail of low-productivity firms and business dynamism in the economy.

To answer this question, Berlingieri, Calligaris, Criscuolo and Verlhac (2019) apply the Melitz and Polanec (2015) dynamic decomposition of productivity growth to each productivity group. In this approach, the productivity growth of each group is decomposed into the following components: the contribution of incumbent firms (further decomposed into the change in the unweighted average productivity of incumbents and the change in the efficiency of resource allocation), and the contributions of entering and exiting firms.

Results of this decomposition are reported in Figure 10-10. The main take-away is that entry and exit account for a significant share of the laggards' productivity growth. Entrants and exiting firms transit through the group of laggards when entering and exiting the economy and, therefore, most of the firm churning occurs at the bottom. While for more productive groups the most important contribution comes by the average growth of incumbents' productivity, the reallocation term accounts for most of the growth of the bottom performers. In addition, while in the rest of the distribution, entry and exit play a very marginal role, in the bottom tail of the productivity distribution they are significant components of the overall productivity growth. The positive contribution of exit reveals that firms exiting the economy are generally less productive than the average surviving firms, suggesting a healthy market selection. In the same way, the negative contribution of entry suggests that newly created firms are also less productive than surviving ones, which explains the age difference observed previously.

Overall, the results presented so far stress the peculiarities of the bottom part of the productivity distribution, i.e. A more diverse environment with respect to the rest of the distribution, given the higher importance of entry, exit and reallocation of resources. These results provide a new insight into the nature of laggards and convey important policy implications. However, the importance of business dynamism for laggards suggests that the secular decline of business dynamism, the productivity slowdown and the poor performance of productivity growth observed over the last decade may be interrelated.

Figure 10-10 Melitz and Polanec decomposition by LP performance group



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Source: Berlingieri, Calligaris, Criscuolo and Verlhac (2019), 'Last but not least: laggard firms, technology diffusion and its structural and policy determinants', Mimeo

Note: The figure plots the Melitz and Polanec decomposition in different groups of the productivity distribution. In particular, the productivity distribution has been split into five groups: 1st to 10th percentile, 10th to 40th, 40th to 60th, 60th to 90th, and 90th to 100th. Manufacturing and non-financial market services only. Countries included: AU, BE, CA, CH, DK, FI, FR, HU, IE, IT, NO, PT, SE. The bars in this figure are computed in the following way: first gains are aggregated across industries within country and productivity bins using employment shares of the industry in the economy. Subsequently, a simple average is computed across years within each country-productivity bin. Finally, the median is computed over countries, separately for each group.

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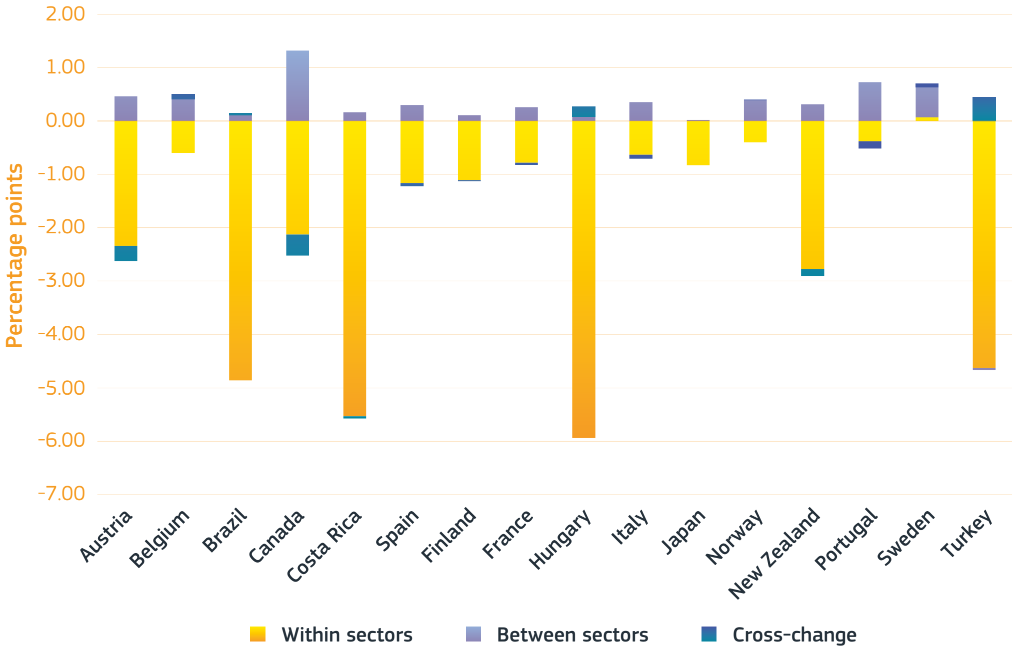
The secular decline in business dynamism takes various forms, but numerous studies have highlighted declining trends in entry rates, and this is considered as one of the top signs of such a decline (Haltiwanger et al., 2015). In particular, declines in entry rates have been prominent in the USA, as documented by Decker et al. (2016) (and by a number of subsequent publications) using the US Census Bureau's Longitudinal Business Database (LBD). Decker et al. (2016) show a marked decline of entry rates over the period 1980-2012. Other countries, such as Australia, Canada and Portugal, have experienced declines in entry rates. In particular, Bakhtiari (2017) reveals patterns of declining dynamism in Australia over the period 2002-2015, which entail a decline in entry rates. Focusing on entry and exit rates over almost 30 years (1984-2012), Macdonald (2014) reveals a downward trend in entry rates in industries in Canada. Sarmento and Nunes (2010) evaluate the entrepreneurship performance of Portugal, highlighting that the country has also experienced a relevant decline in dynamism.

Calvino, Criscuolo and Verlhac (2019) provide additional evidence of declining entry rates, reported in Figures 10-11 and 10-12. These figures illustrate two key facts: (i) overall, business dynamism has been steadily declining in a large number of countries; and (ii) this phenomenon is pervasive, affecting most industries to some extent. In addition, the authors explore possible drivers of the decline in business dynamism and highlight four groups of causes – in addition to cyclical factors affecting dynamism in the short run. Globalisation, demographic factors, technological change and changes in the regulatory framework are all likely to contribute to declining business dynamism.

Declining entry rates are of particular concern given the importance of firm dynamics for productivity growth, especially at the bottom of the productivity distribution. A corollary of results presented in Figure 10-10 indicates that the process of firm churning, i.e. firm entry and exit, determines the nature and composition of the group of laggards. Firm entry is profoundly associated with experimentation, enabling new firms to compete with incumbents, introduce innovation and gain market shares when successful. Market selection induces low productivity and non-profitable firms to exit the market so that resources can be used in more productive firms. Dynamic markets can be characterised by a high degree of experimentation, the productivity-enhancing selection of profitable firms and the scale-up of these firms (in terms of productivity, market shares and/or employment). Therefore, another facet of economic dynamism, of particular importance for the future of productivity, can be characterised by the extent to which the improvement of productivity by firms at the bottom of the productivity distribution is conditional on survival, through innovation, as well as imitation, technology adoption and knowledge diffusion.

Figure 10-11 Contributions to changes in entry rates



Source: Calvino, Criscuolo and Verlhac (2019), 'Declining business dynamism', Mimeo

Note: This figure reports, for each country, changes in entry rates between 2000-2015 due to variations within sectors ('within sector' component), due to changes in the share of industries with different levels of dynamism ('between-sectors' component), and due to the covariance between changes in a sector weight and its level of dynamism ('cross-change' term). For each country, the figure covers the period from the first to the last available year within the period 2000-2015. Data for some countries are preliminary.

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Figure 10-12 Average trends in job reallocation, entry and exit rates

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Source: Calvino, Criscuolo and Verlhac (2019), 'Declining business dynamism', Mimeo

Note: This figure reports average within-country-industry trends of job reallocation, entry and exit rates, based on the year coefficients of regressions within country-sector, for the period 2000-2015, including 16 countries: AT, BE, BR, CA, CR, ES, FI, FR, HU, IT, JP, NO, NZ, PT, SE and TR. Each point represents cumulative change in percentage points since 2000.

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5. Laggards catching up

The capacity of laggards, generally smaller and younger, to improve their productivity over time is a potential driver of future productivity growth. Young firms in their first stage of development operating below their efficiency levels are indeed more responsive to productivity shocks (Decker et al., 2018) and some may have the potential to become the future productivity frontier. Hence, the rest of this section evaluates the extent to which laggards are catching up with the national frontier.

Neo-Schumpeterian growth theory (e.g. Aghion and Howitt, 2006; Acemoglu et al., 2006) and models of competitive diffusion (e.g. Jovanovic and MacDonald, 1994) predict productivity convergence: laggard firms should grow faster, given the larger stock of unexploited technologies and knowledge that they can readily implement. Yet, the rising productivity gap between frontier firms and the rest, and especially laggards, questions whether ongoing transformations of the economy have affected the strength of this catch-up effect. A lack of diffusion stemming from relatively high costs for laggard firms to adapt to the new digital/knowledge-intensive economy, or from rising barriers in adopting technology due to a lack of absorptive capacity, may be a significant driver of the productivity divergence.

Berlingieri, Calligaris, Criscuolo and Verlhac (2019) confirm the existence of a catch-up effect for laggards and focus on the determinants of convergence forces and undermining factors. More specifically, based on an econometric framework derived from the neo-Schumpeterian concept of convergence, they confirm that laggards catch up with the national frontier. The methodology is outlined in Box 10-3.

BOX 10-3 Measuring the strength of the neo-Schumpeterian catch-up effect and its determinants

The 'catch-up effect' has been widely documented in the literature (e.g. Griffith et al., 2004; Bartelsman et al., 2008). Empirical studies have confirmed the existence of a catch-up effect both at the firm level (Griffith et al., 2009; Bartelsman et al., 2008; Andrews et al., 2015; Andrews et al., 2016) and at the industry level (Nicoletti and Scarpetta, 2003; Saia et al., 2015).

Testing the existence of the catch-up effect implies testing for a positive association between the distance to the frontier at time $t - 1$ and productivity growth between $t - 1$ and t, for surviving firms. The following specification is the starting point of the analysis:

$$\Delta P_{cjq,t} = \alpha + \beta_1 gap_{cjq,t-1} + \lambda \Delta P^F_{cjq,t} + \delta_{ct} + \tau_j + \epsilon_{cjq,t}$$

$P_{cjq,t}$ denotes the measured average produc-tivity (LP or MFP) in country c, industry j, productivity performance group q (productivity bins (p(0-10) and p(10-40)) and year t. $\Delta P^F_{cjq,t}$ is then the annual (log) productivity growth of firms belonging to the bottom 40% of the productivity distribution at time $t - 1$, whereas $\Delta P^F_{cjq,t}$ the annual (log) productivity growth of firms at the national frontier in t, defined as the top 10% of the productivity distribution in each country-2-digit industry-year. Moreover, $gap_{cjq,t-1}$ is the productivity gap at time $t - 1$, modelled as the distance in the level between (log) productivity in each country-industry-productivity bin-year in the bottom 40% of the productivity distribution and (log) productivity in the corresponding country-industry-year in the top 10%. Productivity growth can be affected by macroeconomic shocks at the country level and by industry characteristics, possibly correlated with the explanatory variables. To control for them, the error term in (12) is allowed to include country-year and industry fixed effects: $\delta_{ct} + \tau_j$. The existence of a catch-up effect is confirmed if $\beta_1 > 0$.

Berlingieri, Calligaris, Criscuolo and Verlhac (2019) extend this equation to uncover factors that can affect the catch-up. The following equation is estimated:

$$\Delta P_{cjq,t} = \alpha + \beta_1 gap_{cjq,t-1} + \beta_2 \, (gap_{cjq,t-1} \times X_{cjq,t-1}) + pX_{cjq,t-1} + \lambda \Delta P^F_{cjq,t} + \delta_{ct} + \tau_j + \epsilon_{cjq,t}$$

$X_{cjq,t-1}$ includes all main variables of interest, reflecting either firms' characteristics or structural factors affecting the strength. The paper focuses mainly on structural industry characteristics X_j.

The analysis in the study confirms a positive relationship between the productivity gap and the productivity growth of laggards, indicating the existence of convergence among firms, even at the bottom of the distribution. The existence of a catch-up effect is a necessary condition for laggards to exit the group of low-productivity firms and confirms that, on average, laggard firms have the potential to significantly improve their productivity. The results also show that younger laggard firms catch up more rapidly (although this result is only available for a subset of countries and the age variable is only available for 7 out of 13 countries). This suggests that the younger the group of laggards, the higher the potential for productivity growth at the bottom of the distribution through knowledge and technology diffusion.

Focusing on spillovers from the global productivity frontier, Andrews et al. (2016) document a decline in the speed of catching up, pointing to a breakdown in the diffusion machine (see also the discussion in Criscuolo, 2018). Berlingieri, Calligaris, Criscuolo and Verlhac (2019) also find that convergence forces driving productivity gains of laggards have weakened over time (Figure 10-13).

Figure 10-13 Catch-up over time

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Source: Berlingieri, Calligaris, Criscuolo and Verlhac (2019)
Note: The figure represents the estimates for catch-up effect over time. It plots coefficients from a regression of productivity growth on the productivity gap interacted with year dummies, including country-year and industry fixed effects. Manufacturing and non-financial market services only. Countries included: AU, BE, CA, CH, DK, FI, FR, HU, IE, IT, NO, PT, SE.
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The decline in knowledge diffusion intensity is also discussed in depth by Akcigit and Ates (2019a) and Akcigit and Ates (2019b) as the main cause behind many of the current trends. Indeed, using an endogenous growth model of strategic interaction and innovation, the authors show that the decline in knowledge diffusion is the dominant factor behind a number of recent empirical trends, such as increasing productivity dispersion, rising market concentration, and a slowdown in business dynamism.

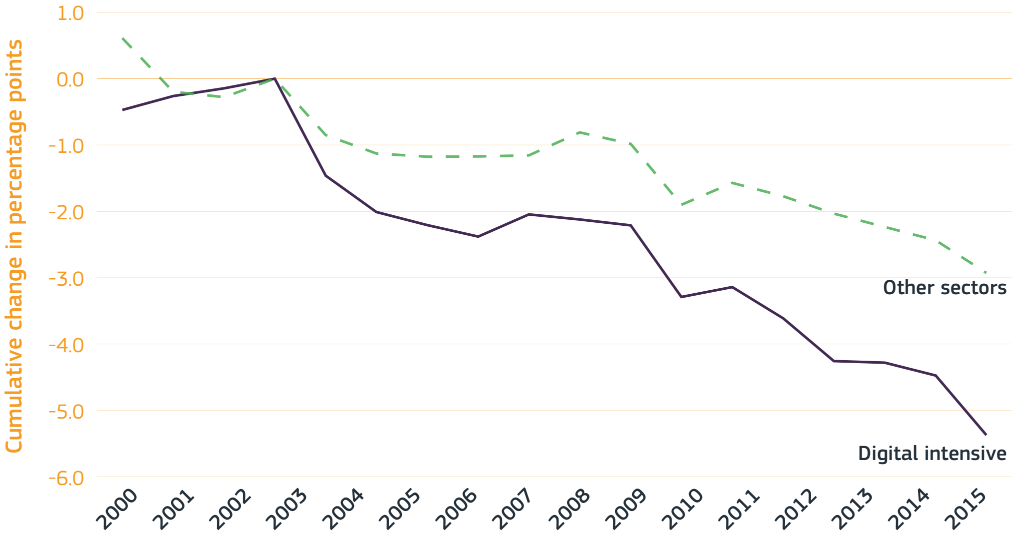
Berlingieri, Calligaris, Criscuolo and Verlhac (2019) associate the decline in diffusion to the ongoing transformation of the economy by analysing how some structural factors – and specifically digitalisation and knowledge intensity – affect catch-up. While the neo-Schumpeterian catch-up effect is a significant driver of productivity growth, the diffusion of innovation does not occur automatically, but requires a costly process of adoption, conditioned by firms' capabilities and incentives to learn from the most innovative ones (see Griffith et al., 2004, for instance). In addition, the digital transformation and transition to an economy based on ideas seem to have intensified the role of firms' capabilities and incentives (Andrews et al., 2016), thus raising additional obstacles to a broad diffusion of technology and knowledge. This transformation of the economy expands the scope for productivity growth but also brings with it several challenges. It increases the average level and the composition of skill requirements and the need for complementary investments in both tangible and intangible assets (software, database, management, etc.), and it requires higher levels of absorptive capacity for adopting more complex technologies and innovations.

To test whether this transformation may be linked to the slowdown in diffusion, Berlingieri, Calligaris, Criscuolo and Verlhac (2019) investigate differences in the speed of catch-up between sectors characterised by different levels of digital and skill intensity. Several dimensions are explored: First, industries are classified into digital- and non-digital-intensive, based on the taxonomy proposed by Calvino et al. (2018). Second, a number of sub-indicators of digital intensity are considered: (i) investment intensity in ICT equipment; (ii) investment intensity in software and databases; (iii) ICT goods as intermediate inputs; and iv) ICT services as intermediate inputs. Third, sectoral differences in skill requirements are also explored using indicators of: (i) ICT skill intensity; and (ii) the share of hours worked by high-skilled workers. Finally, services are divided into knowledge-intensive (KIS) and less-knowledge-intensive industries (LKIS). The association of industry characteristics and the speed of diffusion is evaluated using the methodology presented in Box 3. All results overwhelmingly point in the same direction: in more digital-intensive and more knowledge-intensive industries, laggards catch up with the productivity frontier more slowly. While a greater use of digital technologies and knowledge may be beneficial for overall productivity growth, nonetheless they seem to push towards divergence in productivity, especially in digital- and knowledge-intensive industries. On the contrary, laggards belonging to less digital- and knowledge-intensive industries are catching up faster with the frontier.

To summarise, laggard firms catch up at a lower speed in industries characterised by a high level of digitalisation and knowledge intensity, suggesting that they face higher obstacles to growth. Taken as a whole, these findings suggest that digitalisation and the transition to an economy based on ideas, although potentially beneficial for overall growth, may not benefit all firms equally. This in turn points to the existence of barriers to technology and knowledge diffusion raised by these recent mega-trends. Not having the necessary absorptive capacity to learn from the frontier, laggards struggle more to catch up in industries where digitalisation, intangibles and knowledge matter the most.

Interestingly, Berlingieri, Calligaris, Criscuolo and Verlhac (2019) emphasise the direct connection between slower diffusion and productivity dispersion and show that industries characterised by a slower catch-up also display higher levels of dispersion. These results also echo the finding by Calvino and Criscuolo (2019) who show that entry rates, and more generally business dynamism, have been declining faster in digital-intensive sectors, as illustrated in Figure 10-14.

Figure 10-14 Trends in entry rates for digital-intensive vs. other sectors



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Source: Calvino and Criscuolo (2019)

Note: The figures report average within country-industry trends, based on the year coefficients of regressions within country-sector, with and without interaction with the digital-intensity dummy. Digital-intensive sectors are reported with a solid line and other sectors with a dashed line. The dependent variable is entry rates. The baseline year is set to 2001. Each point represents average cumulative changes in percentage points since 2001.

Stat. link: https://ec.europa.eu/info/sites/info/files/srip/2020/partii/chapter10/figure_10-14.xlsx

6. A framework and analysis of the role of policy

Digital-intensive sectors experience faster declines in entry rates, and laggards in these sectors catch up with the national frontier more slowly than less-digital-intensive industries. Given the importance of young firms' scale-up for the future of productivity, this calls for an investigation into the potential role of policies in helping laggards overcome such obstacles. This section provides a framework for policy responses, focusing first on policies that can influence entry rates in digital-intensive industries before outlining policy areas that could influence the speed of diffusion and catch-up.

6.1 Policies and business dynamism

Calvino and Criscuolo (2019) review policies that can encourage entrepreneurship and propose a guiding framework for policymakers. This framework and the methodology are presented in Box 10-4. Entry rates are related to the supply (quantity) and quality of entrepreneurs in a country. In this context, human capital, education – in terms of educational attainment but also of quality of the education system – and training workers play an important role and policymakers can influence these outcomes with the appropriate policy instruments.

The availability of capital, especially seed and early-stage financing but also to some extent bank loans, is crucial as it enables those potential entrepreneurs with the financial means needed to start their venture. In order to enter the market, such entrepreneurs need to have the right incentives and expected positive returns on their project. This is also linked to the possibility of successfully listing their company on the stock markets.

Potential entrepreneurs also need to be able to set up their business easily, which is possible when regulatory entry barriers and administrative burdens are low. Once entry has occurred, new firms need to face a level playing field and be given equal opportunities with respect to other incumbent firms. Important levers in this context are related to business regulations, efficiency in the enforcement of contracts, and innovation support measures. Finally, entrepreneurs must be able to experiment as this is a key feature of the creative destruction process. Policy related to the cost of reallocation (such as employment protection legislation) and to the cost of failure (efficiency of bankruptcy regulation) are important levers that policymakers can influence.

A summary of the econometric results of the study is presented in Figure 10-15. A positive (negative) coefficient is to be interpreted as an indication of the fact that the particular policy under investigation is positively (negatively) related to entry rates in digital-intensive sectors. In other words, an improvement along the particular policy setting examined are found to have a positive (negative) association with business dynamism in these sectors.

BOX 10-4 Policies and entry rates: methodological framework

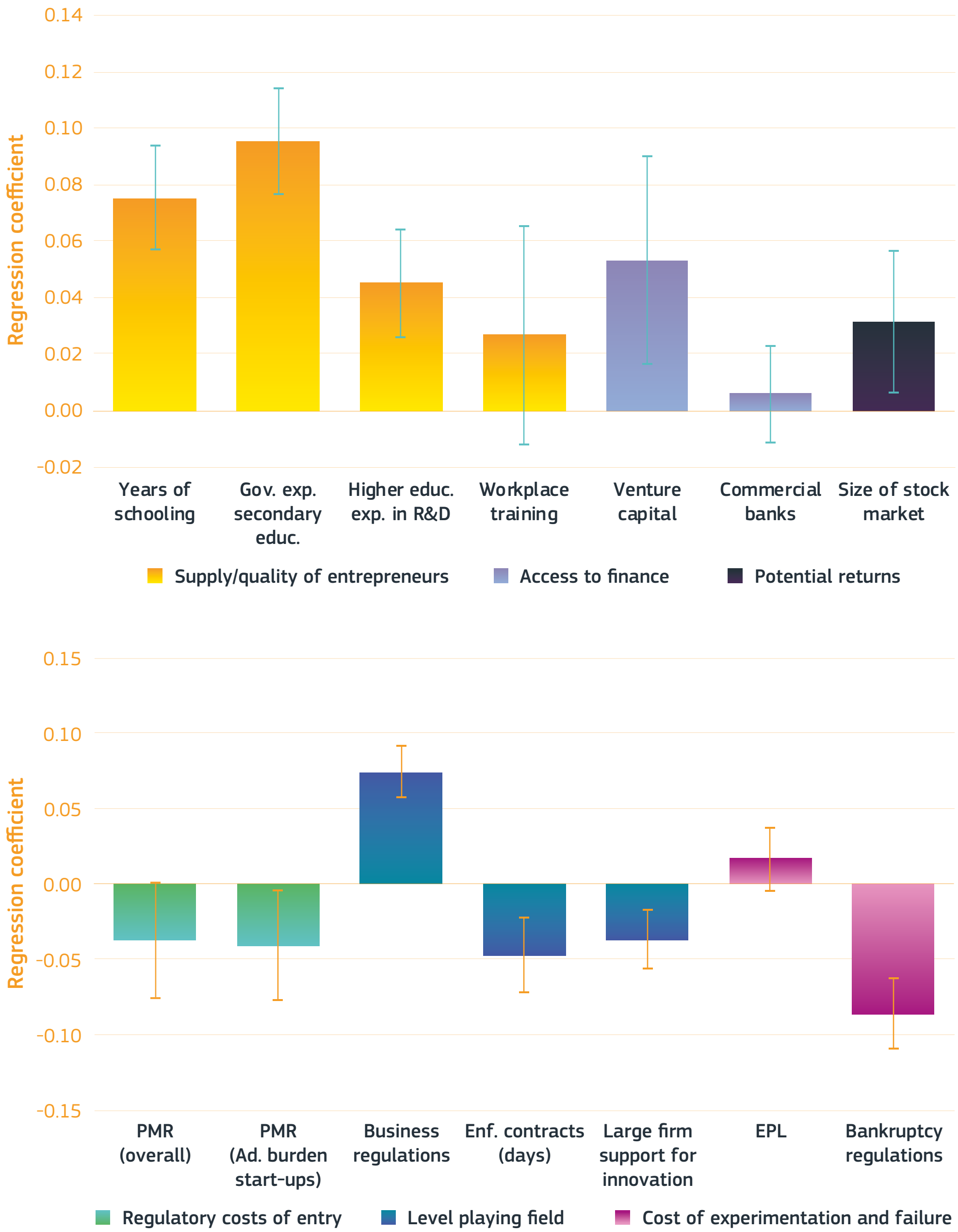
The main approach used to estimate the extent to which policy and institutional factors influence business dynamism in digital-intensive sectors follows the methodology proposed by Rajan and Zingales (1998). In particular, the basic intuition of this approach is that some sectors may be more exposed than others to the effect of certain national policies or framework conditions due to some of their (technological or structural) characteristics. Identifying the impact of policies is therefore based on this differential exposure of sectors to policy.

In this context, the approach is adapted using as the exposure variable the same digital-intensity measure used in the rest of this paper. This allows for an assessment of the extent to which different policies have a differential role for business dynamics mediated by digital intensity. The main model estimated becomes:

$$EntryRate_{c,s,t} = \beta \times Policy_{c,t} \times Digital_s + K_c \times \Theta_t + Y_s + \varepsilon_{c,s,t}$$

where *EntryRate* identifies the log of entry rates, *Policy* refers alternatively to each of the policy variables described above, *Digital* is the digital-intensity indicator used in the rest of the paper; *c* indicates countries, *t* year, and *s* sectors.

Figure 10-15 Entry rates and policies



Source: Calvino, F. and Criscuolo, C. (2019)

Note: The bars report coefficients based on separate regressions where the dependent variable is (the log of) entry rates, the exposure variable is the digital-intensity dummy and the policy variables are those listed in the text (see equation 1). All regressions include country-year and sector fixed effects. Confidence intervals (95 %) are also reported based on robust standard errors.

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6.2 Policies for diffusion

Policy intervention has a potential instrumental role in reducing these barriers to foster diffusion, and consequentially increasing aggregate productivity growth. Potentially significant barriers to adoption – hindering a wide diffusion of the benefits associated with technological progress – include the rapidly changing demand for skills in the economy inducing skill shortages in high-skilled jobs, costly complementary investments to technology, and a lack of absorptive capacity.

Berlingieri, Calligaris, Criscuolo and Verlhac (2019) explore three policy areas where policies could be effective in increasing the speed of catch-up: skills, finance, and R&D support. First, the analysis focuses on policy objectives and instruments related to changing skill needs in the economy, by looking at skill mismatch, under-qualification, the share of adults participating in training and expenditure in training targeting the unemployed. A good match between skills demand and supply is associated with a faster rate of catch-up, and there is evidence that this positive association is stronger in digital- and skill-intensive industries. Conversely, a higher share of underqualified workers in the economy is associated with a lower speed of catch-up, especially in industries that are more digital- and skill-intensive. The results also provide evidence that training adults may be effective in increasing the speed of catch-up, and that training the low-skilled may be particularly effective.

Next, SMEs' access to finance is investigated, as it can be informative about the financial conditions that laggards are facing – given the correlation between size and productivity. The results show that diffusion is more rapid in countries where a larger share of lending is directed towards SMEs and more specifically in industries where investments in digital technologies are more prevalent. Conversely, less-favourable financing conditions for SMEs, revealed by a higher interest rate spread between SMEs and large firms, are associated with a lower speed of catch-up only in sectors that require higher investment in ICT equipment and software and databases. These results suggest that appropriate financial support relaxing financial constraints could help unleash the potential of laggards to catch up. However, given the heterogeneity of this group, care should be taken over the design of such policies.

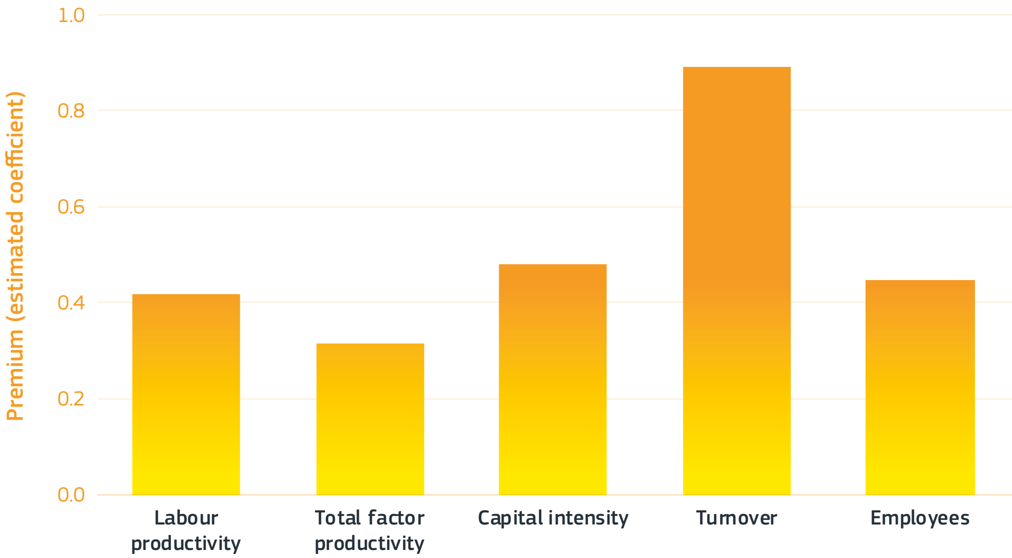
Finally, suggestive evidence shows that support to business R&D through direct government funding may encourage diffusion in digital- and skill-intensive industries. While further research is needed to confirm this link, it seems in line with the 'second face of R&D' unveiled by Griffith et al. (2004). Not only does R&D foster innovation, but it also enhances technology transfers by increasing firms' absorptive capacity. By engaging in R&D, firms accumulate a tacit knowledge that allows them to understand and assimilate existing technology and innovations.

6.3 Trade, trade openness and catch-up

The theoretical and empirical economic literature has extensively discussed the role of international trade on economic growth, convergence and catching up at the macro level. Inevitably, the dynamics are more complex when looking at the issue at the micro (i.e. firm) level.

First, empirical research has shown that firms which engage in exports are more productive than non-exporting firms, for two alternative – but not mutually exclusive – reasons. First, engaging in trading activities involves both per-unit and fixed costs; as a result, there is a self-selection into exporting, so that only the most competitive firms engage in export activity (Melitz, 2003). Recent analysis of EU firms has shown that new exporting firms (i.e. those that have just started to export) are, on average, about 15 % more productive than non-exporting firms in the same sector (ECB, 2017). Second, firms 'learn by exporting' and are more likely to innovate; they also have access to cheaper and higher-quality inputs (Mayer, Melitz and Ottaviano, 2014). In addition, exposure to trade leads to reallocation of resources across firms towards the most productive ones, with a positive impact on aggregate productivity.

Figure 10-16 Premia of exporters over non-exporters in selected EU countries, 2002-2016



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Source: European Commission, DG for Economic and Financial Affairs based on CompNet Database

Note: The chart shows the coefficient of the export dummy, indicating whether the firm is an exporter or not, from OLS regressions where the dependent variable is the log of the performance indicators, controlling for country, time and sector dummies. The coefficients are always significant at all levels. The analysis refers to firms with more than 20 employees. Due to data availability, countries included are HR, CZ, FI, FR, DE, HU, IT, LT, PL, RO, SK, SI and SE.

Stat. link: https://ec.europa.eu/info/sites/info/files/srip/2020/partii/chapter10/figure_10-16.xlsx

However, exporting firms are different from non-exporters in other dimensions, too. Mayer and Ottaviano (2008) showed that exporters are generally bigger, more profitable, more capital-intensive and more productive than non-exporters (Mayer and Ottaviano, 2008). Figure 10-16 shows that this is indeed the case in the EU[1]. According to CompNet data, over the period 2002-2016, exporting firms in the countries covered here are bigger, on average (in terms of both number of employees and turnover), approximately 30-40 % more productive (in terms of labour productivity and total factor productivity), and more capital-intensive than non-exporting firms.

1 Data come from the CompNet Database. This database provides sectoral distributions for a number of variables and indicators based on firm-level data provided by national sources (statistical institutes or national central banks). The 6th vintage of the CompNet Database, released in November 2018, covers 19 EU countries. Of these countries, 13 also have data on the export status of firms which are relevant in this section. For more information: http://www.comp-net.org

Since the sample includes all exporters, the productivity gap between exporters and non-exporters depicted in Figure 12 is the result of both self-selection and learning-by-exporting[2].

The higher productivity of exporting firms is also due to their participation in global value chains (GVC)[3]. Recent research has shown that GVC participation can stimulate productivity growth through different channels. These include: (i) specialisation in the activities where they are most productive and outsource the others; (ii) access to a larger variety of cheaper, higher-quality and higher-technology goods as inputs; (iii) knowledge spillovers from foreign firms; and (iv) access to larger markets and competition lead to the growth of the most productive firms (see Criscuolo and Timmis, 2017).

Not only are exporters profoundly different from non-exporters, even in the same sector, as shown in Figure 10-16, but a large share of exports can be accounted for by just a handful of firms ('the happy few' in Mayer and Ottaviano, 2008), which therefore also have great influence on the aggregate performance and growth potential of regions, countries and sectors[4].

As mentioned above, there is a self-selection into exporting, implying that only those firms that are productive enough to overcome the costs associated with engaging in trade will start exporting. Therefore, there is a 'productivity threshold' below which firms would not engage in trade, and this differs across countries and is related to a number of macroeconomic and institutional factors[5]. Such 'new exporters' productivity premium', in particular, tends to be higher in countries with lower GDP per capita; Figure 10-17 shows that this is also the case in the EU. The explanation is intuitive: first, GDP per capita is correlated with productivity; therefore, in countries with higher average productivity, non-exporting firms are closer to the 'benchmark' set by internationalised firms. Second, converging economies usually have less-integrated markets which allow low-productivity non-exporters to stay in the market. Moreover, better institutions reduce the trade costs firms face (in particular, fixed costs, which particularly affect self-selection into exporting), and institutional quality and efficiency are generally correlated with GDP per capita. As a result, in countries with lower GDP per capita, highly productive export-oriented firms (that can afford the costs associated with exporting) will coexist in the same sector with low-productivity domestically oriented firms.

What are the implications of the discussion above on firms' productivity divergence and catch-up? At least within sectors, increases in trade exposure (for example, as a result of trade liberalisation or other measures facilitating firms' and markets' trade openness) should induce reallocation of labour and capital towards the most productive firms, while gradually driving less efficient firms out of the market. In principle, this would reduce within-sector productivity dispersion and foster higher productivity. However, if policies hinder product, labour and capital market flexibility, the result might be less clear cut since the reallocation process might not take place.

As regards global value chains, not only participation in GVC but, in particular, higher centrality in the production networks appears to

2 For this reason, this rough estimate is also not comparable to the 15 % premium mentioned at the beginning of this sub-section, which referred to new exporters only.

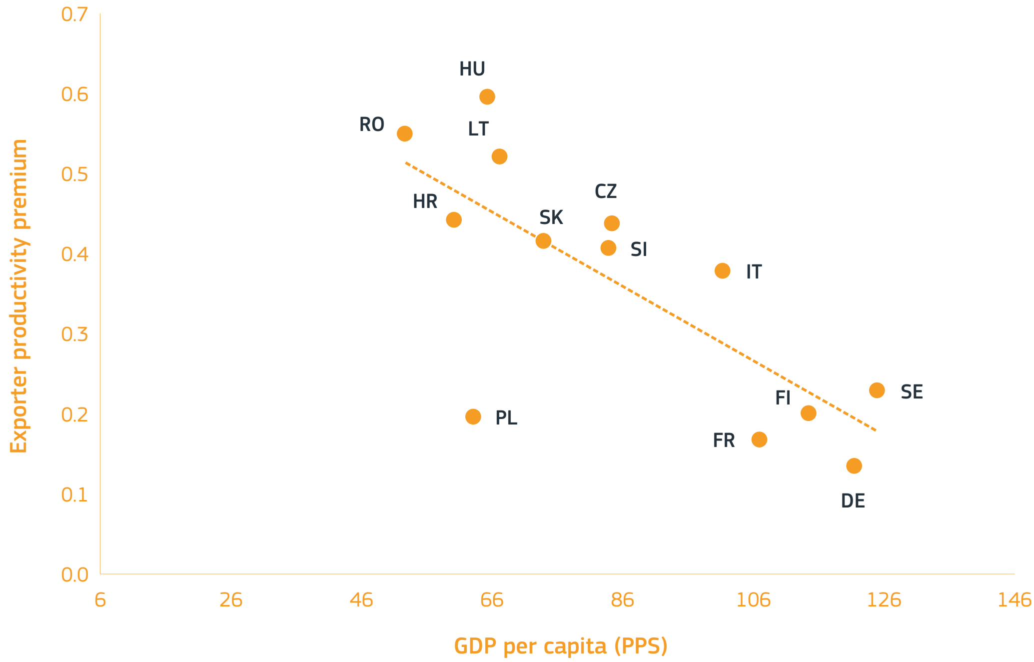
3 In this respect, GVC participation does not refer only to offshoring and trading intermediate goods but also to indirect backward and forward linkages.

4 Meyer and Ottaviano (2008), cit. and Altomonte, C. and Békés (2016) Measuring competitiveness in Europe: resource allocation, granularity and trade, Bruegel Blueprint Series, Brussels, Belgium.

5 See ISGEP (2008) 'Understanding cross-country differences in exporter premia: comparable evidence for 14 countries', Review of World Economics 144(4) pp. 596-635 and Hallward-Driemeier, M., Iarossi, G. and Sokoloff, K.L. (2002) 'Exports and manufacturing productivity in East Asia: a comparative analysis with firm-level data', NBER Working Paper 8894.

be associated with higher productivity growth; this is especially true for non-frontier firms and economies[6]. At the same time, the actual structure of GVC has been evolving over the last couple of decades, and the centrality and importance of eastern European countries in particular has increased since their accession to the EU[7]. This implies that higher integration and influence in GVC can foster firms' catch-up process and might suggest that it can also explain, at least in part, the ongoing catching up of eastern European countries in terms of productivity and GDP per capita.

Figure 10-17 New exporters' productivity premium and GDP per capita in selected EU countries, 2002-2016



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Source: European Commission, DG for Economic and Financial Affairs based on CompNet Database and Eurostat

Note: The new exporters' productivity premium is defined here as the difference between (log) labour productivity of new exporters (defined as the group of firms which exported in year t and t+1 but did not export in t-1) and non-exporters.

Stat. link: https://ec.europa.eu/info/sites/info/files/srip/2020/partii/chapter10/figure_10-17.xlsx

6 'Centrality' in GVC measures influence within a production network due to both direct and indirect trade linkages.

7 Criscuolo, C. and Timmis, J. (2018), The changing structure of Global Value Chains: are central hubs key for productivity?, *International Productivity Monitor* 34, pp. 64-80.

7. Concluding discussion on the role of policies

7.1 Fostering business dynamism

A well-functioning business environment should provide companies with a predictable, transparent, simple and inexpensive way to anticipate and comply with regulation.

While faced with sluggish growth performance, policymakers need to enhance business dynamism by focusing on three cornerstone policies: *product and labour market policy, innovation policy and competition policy*. Broadly speaking, the policies and measures that are put in place should foster, or at least not hinder, the process of creative destruction. At the same time, they should promote innovation at the frontier and diffusion of technological advances from leaders to laggards.

This subsection will focus on product and labour market policies as tools to foster business dynamism. The next subsections will focus on innovation and skills policy as a tool to promote innovation and technological diffusion, and we will conclude with regulation and competition policy as a tool to ensure a level-playing field.

Fostering business dynamism implies facilitating business creation and firm growth and removing the obstacles to the exit of non-profitable firms. Facilitating business creation is not only about reducing the time, cost and number of procedures to create a business – where EU countries have made important improvements in recent years, although many still underperform compared to their main competitors[8] – but also about improving the chances of survival and growth of young and promising startups.

To this end, improving access to finance is one of the key priorities. Sources of funding alternative to bank finance (e.g. crowdfunding, venture capital, private equity, private placements and issuance of debt) are especially important for SMEs, young innovative firms and startups. These firms in particular often struggle to get funding for their investments from banks due to higher perceived risks, and thus can benefit from better access to market-based sources of finance. Innovative firms with high potential might be driven out of the market – or not enter at all – not as a result of a well-functioning resource-reallocation process but because of existing barriers. However, the market for alternative sources of finance is still underdeveloped in Europe compared to its main competitors: for instance, in 2016, total venture capital investments in the EU equalled approximately EUR 4 billion compared to EUR 2.15 billion in Canada and over EUR 60 billion in the USA[9]. Moreover, recent survey data confirm that access to finance is seen as a barrier to investment more by younger companies than by established businesses[10].

To address these issues, in September 2015, the European Commission launched the Capital Markets Union (CMU) which will provide businesses with a greater choice of funding at lower costs, offer new opportunities for savers and investors and make the financial system more resilient. The initiatives approved under the CMU include VentureEU, a pan-European venture capital programme supported by the European Commission and the European Investment Fund and aimed at boosting investment in innovative startups and scale-up companies across the EU.

8 Canton, E. and Petrucci, M. (2017), Ease of doing business in the euro area, *Quarterly report on the euro area* Vol. 16, No. 2.

9 Canton, E. and Petrucci, M. (2017), Ease of doing business in the euro area, *Quarterly report on the euro area* Vol. 16, No. 2.

10 European Commission (2018), Flash Eurobarometer 459.

Addressing barriers to firm entry and growth, while further opening up to trade and foreign direct investment (FDI), is important to promote competitive domestic markets. Pro-competitive product and service markets regulation contributes to the efficient allocation of resources and functioning of supply chains. In addition, empirical studies have shown that growth in sales is a prime determinant of firm growth (in terms of employment)[11]. As a result, policies that open up markets and facilitate access to consumers can foster firm growth and avoid the 'small firm trap'. Moreover, there is a trade-off associated with policies, laws and measures that are size-dependent (e.g. legal thresholds imposing different employment rules based on firm size; investment support for SMEs and, more generally, preferential tax treatment). On the one hand, these are important because of the competitive disadvantage often faced by SMEs, especially micro firms. On the other hand, however, they might discourage firm growth.

The growth of the most efficient firms – and exit of the least efficient or 'zombie' ones – occurs through reallocation of capital and labour in the economy. Hence, well-functioning labour markets and insolvency frameworks also play a role. Labour market institutions that foster this reallocation not only have to deal with flexibility at the entry or exit, but also with a broader range of policies that facilitate geographic and industry mobility of workers. These include housing markets, well-functioning infrastructure services for commuters, lifelong learning and retraining, to name but a few. Inefficient insolvency frameworks can instead trap resources in zombie firms. Therefore, bankruptcy legislation and judicial efficiency also play an important role, as does the treatment of business failures by legislation (e.g. second-chance rules).

The recent EU Directive on business insolvency will contribute to improving insolvency frameworks in the EU. It includes, among other things, common principles on early restructuring (which may result in better recovery rates for lenders as well as helping companies to continue their activity); rules for a second chance for entrepreneurs (by reducing the period after which they can make a fresh start); and targeted measures for Member States to increase the efficiency of insolvency frameworks.

Policies facilitating trade have an important role to play for business dynamism and resource reallocation. Reducing trade barriers, including administrative procedures at customs, facilitates trade integration and is especially relevant to GVC integration, where intermediate inputs are traded several times. In this respect, in the case of the EU, this concerns not only the completion of the Single Market but also agreements with third countries. Moreover, to avoid reinforcing existing gaps, policy should not focus on the national champions and incumbent superstars, but rather promote intra-industry competition and access to markets. Over the past five years, the EU has finalised (and, in some cases, started to implement) trade agreements with 15 countries, including Canada, Singapore, Japan and the Mercosur countries.

It must be highlighted, however, that there is no silver bullet for business dynamism, since similar policies can have very different impacts on firms both across and within countries. Across countries, different sectoral composition, institutions and even cultural differences matter. Within countries, there can be important regional differences and specificities; in addition, the business environment can weigh differently on the operation and growth prospects of firms of different sizes. In this respect, for example, medium and large businesses appear to be relatively less affected than SMEs by a lack of

11 OECD (2017) Business Dynamics and Productivity, OECD Publishing, Paris.

access to, and the cost of, financing, as well as by crime, corruption and the anti-competitive effect of firms operating informally[12].

7.2 Fostering catching up: the role of public expenditure in R&D

An additional policy area that can be investigated relates to innovation policies, and more specifically to government support to R&D. Griffith et al. (2004) unveil a 'second face of R&D' showing that it not only fosters innovation, but also enhances technology transfers because it increases firms' absorptive capacity. By engaging in R&D, firms accumulate a tacit knowledge that enables them to understand and assimilate existing technology and innovations. However, the concentration of business expenditures in R&D (BERD) suggests that low-productivity firms – generally younger and smaller – may also lag in terms of their efforts devoted to R&D. Accordingly, policies supporting R&D expenditures could help laggard firms develop their absorptive capacity.

Berlingieri, Calligaris, Criscuolo and Verlhac (2019) look at the role of government direct funding of business expenditures in R&D (with contracts, loans, grants and subsidies) using two different measures. First, such direct funding is normalised by GDP to provide a comparable measure of the level of support across countries and over time. Second, a measure of the composition (the source) of R&D funding is used, defined as the share of business expenditure financed by the government over total BERD. In a nutshell, the authors' results show that direct government support to business expenditure in R&D is associated with faster catch-up, providing evidence that direct funding of R&D projects through grants, subsidies or procurements may effectively raise firms' absorptive capacity as these might be more effective policies for firms with growth potential to access support.

Direct public funding of business expenditure in R&D takes various forms, such as competitive grants, debt financing (loans), risk-sharing mechanisms or public procurements, which may be particularly relevant for laggards. For instance, grants, loans and risk-sharing through credit guarantee schemes can reduce the cost of R&D and improve access to finance for otherwise financially constrained firms.

R&D procurement creates a demand for technologies and services that might help young innovative firms and can also provide early-stage financial support before the commercialisation phase (pre-commercialisation procurements of R&D). Each of these instruments may be efficient in promoting R&D business expenditure for firms with growth potential, but such policies are also part of a broader policy mix that can reinforce the effectiveness of these instruments by exploiting their complementarities.

7.3 Fostering catching up: the role of skills

Recent OECD work investigates the effect of the allocation of human resources, using the proportion of workers whose educational attainment level is well matched to the level required in their job. Results show that a good match between skills demand and supply is associated with a higher speed of catch-up, and there is evidence that this positive association is stronger in digital- and skill-intensive industries.

The study then focuses on the share of workers who are underqualified, measured as the proportion of workers whose educational attainment level is lower than that required in their job. Thus, this particular dimension of skills mismatch focuses on skills shortage. Results show that a lack of appropriate skills (as measured by educational attainment) in the

12 Bartelsman et al. (2010), Cross-country and within-country differences in the business climate, *International Journal of Industrial Organisation* 28.

labour force reduces the speed of catch-up and might contribute to the widening productivity gap, possibly reflecting the fact that low-productivity firms may struggle when competing for talents. This negative association between skills mismatch and the strength of the catch-up effect is particularly strong in digital- and skill-intensive industries. This result corroborates the view that changing skills requirements associated with digitalisation of the economy and the growing importance of knowledge in the production of goods and services erect barriers to diffusion when such skills are in short supply.

The previously mentioned results suggest that policies addressing skill mismatches through the better allocation of workers and a greater supply of appropriate skills could thus alleviate obstacles to diffusion. The same report focuses on the effect of training employed adults, proxying for lifelong training, as well as that of targeted training provided in the context of active labour market policies (ALMP). It shows that both lifelong training and education support diffusion, but without a significant difference in digital- and skill-intensive industries. In addition, it points to a positive relationship between training expenditure (from ALMP) and the speed of catch-up, particularly for digital- and skill-intensive sectors.

The stronger association between the speed of diffusion and higher spending in adult training in the context of ALMP rather than training working adults could reflect the need for targeted training. Indeed, the results confirm that under-qualification of the workforce is hampering the process of diffusion. The higher participation of working adults in training allows them to adapt their skills to continuously changing skill requirements. However, there is evidence that low-skilled workers are less likely to participate in on-the-job training than other workers (Nedelkoska and Quintini, 2018). Conversely, training targeted at the unemployed or closely related groups (e.g. people who are inactive but would like to work, and employed people who are at known risk of involuntary job loss) might better contribute to reduce skills mismatch and might disproportionately benefit low-skilled workers. Policies aiming at enrolling low-skilled workers in training, as well as policies specifically designed to improve their literacy and numeracy skills (see Windisch, 2015, for a survey of such policies), might contribute to lifting barriers to diffusion. In addition, other instruments are available to policymakers to reduce the incidence of skills mismatch. For example, McGowan and Andrews (2015) find that framework conditions, such as well-designed product and labour markets and bankruptcy laws that do not overly penalise business failures, are associated with lower skills mismatches, possibly because they reduce hiring and firing costs and allow smoother transition across jobs and, thus, better reallocation of resources across firms. The digital transformation not only alters the bundle of skills that is required, but also changes more broadly the relative demand of occupations, with some occupations becoming more prevalent and in high demand while others decline. This requires training and education policies that may be costly, reinforcing the need to define possible and acceptable transitions towards other occupations, while minimising the cost of such policies (Andrieu et al., 2019; Bechichi et al., 2019).

7.4 Fostering supporting framework conditions

Policy has an important role in addressing market failures and, more generally, fostering supporting framework conditions. High-quality regulation together with effective competition policy can complement flexible product and labour markets and innovation and skills policy by creating a level playing field.

Improving the quality of regulation implies simplifying and reducing regulatory costs without undermining the aims or benefits of the legislation, whereas badly designed laws and fragmented regulations act as a drag on the business environment. Services markets in the EU still present a number of inefficiencies that are closely related to the fragmentation of product market regulation[13]. Policy reforms aiming at simplifying product market regulation and completing the Single Market for services in the EU could help to unlock European growth potential notably by improving conditions for the services sector to make a greater contribution to productivity growth. For instance, ensuring better homogeneity in regulation could allow ICT to enter into non-digital sectors, thereby fostering the improvement of business models and potentially resource allocation[14].

Moreover, since investment in intangible capital is more sensitive to the regulatory framework than investment in tangible capital (i.e. labour and product market regulation)[15], improving regulatory quality could be particularly relevant for the most innovative firms which also invest more in intangibles. Indeed, Europe suffers from a persistent business innovation gap vis-à-vis the main competitors. For instance, new firms fail to play a significant role in European industry, especially in the high-tech sectors[16]. In addition to improving the regulatory framework and sound R&D and skills policies (as discussed in the previous section), strengthening the cooperation between academia and the business economy could then help to turn high-quality research into business ideas.

One of the key elements for supporting framework conditions is sound and effective competition policy. The European economic landscape still presents many industries with excessively high mark-ups, with persistent barriers to the entry of new competitors, stressing the importance of strengthening competition policy[17]. In addition, although the European framework of competition law has so far provided evidence of being sound and sufficiently flexible to protect competition in the digital era, the very evolving nature of digital markets calls for vigilance[18]. There are at least two types of challenges for competition policy in the data economy: (i) the identification of the market to regulate (i.e. regional, national, EU Single Market); and (ii) the presence of winner-takes-all dynamics, since the first movers tend to have a substantial advantage over potential new entrants, based on their learning. Without intervention, the market dynamics may lead to the creation of monopolies, while positive externalities may reinforce this trend further.

It is therefore essential to protect competition 'for' the market and 'on' the market. To protect it for the market, policy should make sure that incumbents do not enjoy an unfair advantage and erect barriers to the entry of new competitors. In the data economy, for example, this implies working towards multi-homing, protocol and data interoperability, and differentiation. To protect competition on the market, policy must ensure a level playing field so that firms enjoying a dominant position do not use their rule-setting power to determine market outcomes. In sectors that are open to international competition, this also implies that safeguarding, inflating, or helping incumbents just because they are 'national champions' should be avoided.

13 Van der Marel (2016). Who reforms for High Productivity, Policy Brief No. 1/2016, European Centre for International Political Economy, Brussels.

14 Bauer and Erixon (2016). 'Competition, Growth and Regulatory Heterogeneity in Europe's Digital Economy', Five Freedoms Project at ECIPE Working Paper No. 2, Brussels.

15 Thum-Thysen, A., Voigt, P., Bilbao-Osorio, B., Maier, C. and Ognyanova, D. (2017). 'Unlocking investment in intangible assets', European Economy Discussion Paper 047, European Commission.

16 Veugelers (2013). 'How to turn on the innovation growth machine in Europe', EuropaForum, KU Leuven.

17 Amelio et al. (2018). 'Recent Development at DG Competition: 2017/2018', *Review of industrial Organization* 53(3).

18 Crémer, J., de Montjoye, Y.-A. and Schweitzer, H. (2019). 'Competition policy for the digital era', European Commission, Directorate-General for Competition.

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