CHAPTER 12

PRODUCTIVITY GROWTH AFTER THE PANDEMIC: UNDERSTANDING LONG-TERM TRENDS TO TACKLE THE COVID-19 CHALLENGES

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Summary

The pandemic is an unprecedented demand and supply shock that has generated a strong push towards the digitalisation of firms and generated novel opportunities for start-ups, particularly in the online trade sector. Yet, the ability of firms to invest in digital and intangible assets has been very heterogeneous. Indeed, investment in firm digitalisation has been driven by larger and ex-ante more digitalised firms. As a result, the digital divide between more productive and less productive firms has likely increased over the last 2 years. Policies that can mitigate the long-term effects of these developments are discussed, pointing to the importance of ensuring a stronger and more inclusive recovery.

1. Introduction

This chapter summarises existing research on the impact of the COVID-19 crisis on productivity, analysing it in the context of pre-existing trends in productivity, concentration and business dynamics.

Over the last two decades, in most European economies, aggregate productivity growth slowed down, business dynamics (entry and job-creation rates) declined steadily, industry concentration increased and the divide between the most productive firms (frontier firms) and the less productive ones (laggards) rose significantly.

Recent evidence highlights how one key determinant of these trends is the rise of the digital and knowledge-intensive economy. To be used effectively, digital technologies require complementary intangible investments, such as investments in organisational capital, software and databases, and upskilling of workers and managers. The difficulty of financing these investments through loans (due to the low pledgeability of intangibles) and their high scalability (due to a low-margin/high fixed-costs structure) imply a greater gain for better managed, larger and more productive firms. This results in an increased productivity divide, possibly lower competition and reduced incentives to innovate and to enter new markets, and, ultimately, slowing growth.

Against this backdrop, the COVID-19 crisis has represented an unprecedented economic shock that significantly affected both supply and demand. Prompt and large policy interventions in many European countries to support wage-payments and firms' debts effectively prevented a liquidity crisis during 2020. However, uncertainty over the end of the pandemic remains high, demand is still subdued, and problems in the re-activation of global value chains are tightening the supply of goods.

While economic crises generally increase the incentives for firms to restructure, this pandemic shock determined a specific push towards firms' digitalisation. Indeed, the social restrictions imposed by governments to contain the spread of the virus have prompted firms to invest in advanced digital technologies to adapt production and to move the labour force effectively to remote working. Survey evidence from several

OECD countries points to a general increase in digital technology adoption by firms. The acceleration in the digitalisation of the economy has been coupled with investments in complementary intangible assets. National accounts data show that intangible investments, which encompass software and databases, remained stable during 2020, while tangible investments experienced a significant slump. New firms have also contributed to the increased digitalisation of the economy: the rebound in entry rates experienced in several countries was driven by digital-intensive start-ups, mostly in the trade sector, that were exploiting online markets to sell their products and services.

Nevertheless, the ability of firms to invest in digital and intangible assets has been far from homogeneous. Larger, more productive and more digitalised firms have all suffered comparatively less from the shock. These firms have been able to invest more in the digitalisation of their production as well as in complementary intangibles and workers' skills than smaller less tech-savvy firms. Thus, the aggregate boost in the digitalisation of production masks significant heterogeneity across firms, pointing to the risk that the crisis may further exacerbate the productivity divide and increase concentration, with detrimental effects on technology diffusion and long-term productivity growth.

The chapter concludes by discussing how policies can mitigate these long-term risks and ensure a stronger and more inclusive recovery. Governments may support investments in intangible assets and skills by less productive firms, while fostering competition and boosting innovation among frontier firms.

2. Productivity growth and productivity divergence: long-term trends and their determinants

Over the last two decades OECD countries have experienced a set of worrying trends. First, productivity growth has slowed down. The drop has been mainly driven by a within-sector decline rather than the cross-sectoral reallocation of resources. The former accounts for over 80% of the total slowdown in productivity growth experienced by EU economies. Second, business dynamism declined across economies. According to estimate from 18 OECD and non-OECD countries, firm entry rates dropped by 3 percentage points over the period 2000-2015, while job creation rates declined by 5 percentage points (Calvino, Criscuolo and Verlhac, 2020). Third, an increasing number of studies have highlighted how industry concentration increased in several OECD countries, and this trend went hand in hand with a rise in markups (Bajgar et al., 2019; Bajgar, Criscuolo and Timmis, 2021; Calligaris, Criscuolo and Marcolin, 2018).

Seminal OECD research has highlighted how these trends were accompanied by increasing dispersion in productivity distribution, including within narrowly-defined industries (Andrews, Criscuolo and Gal, 2016; Berlingieri, Blanchenay and Criscuolo, 2017). Evidence shows that slower productivity growth of the least productive firms (the laggards) is the fulcrum of the increase in dispersion (Berlingieri, Blanchenay and Criscuolo, 2017). This points to a slowdown in the diffusion of productivity gains among laggard firms (Berlingieri et al., 2020).

OECD analyses have highlighted how increased productivity dispersion, rising concentration and markups, declining business dynamism and productivity-growth slowdown all seem linked to the rise of the digital and knowledge-based economy. Indeed, to adopt digital technologies in the production process effectively, firms need to complement them with key complementary intangible assets and skills. However, several features of intangibles – their scalability, sunkenness, complementarity, non-rivalry and non-excludability – reduce the ability of smaller and less productive firms to invest in them (Haskel and Westlake, 2017).

As a result, technology diffusion may be subdued, particularly at the bottom of the productivity distribution, dampening the productivity growth of laggard firms. Moreover, the resulting increase in market power by technology leaders may reduce the incentives to innovate by productive (even though not-yet leading) firms and depress entry rates.

Several empirical analyses have provided findings consistent with this hypothesis, and have corroborated the relationship between intangibles, digital technology diffusion and macro-economic trends.

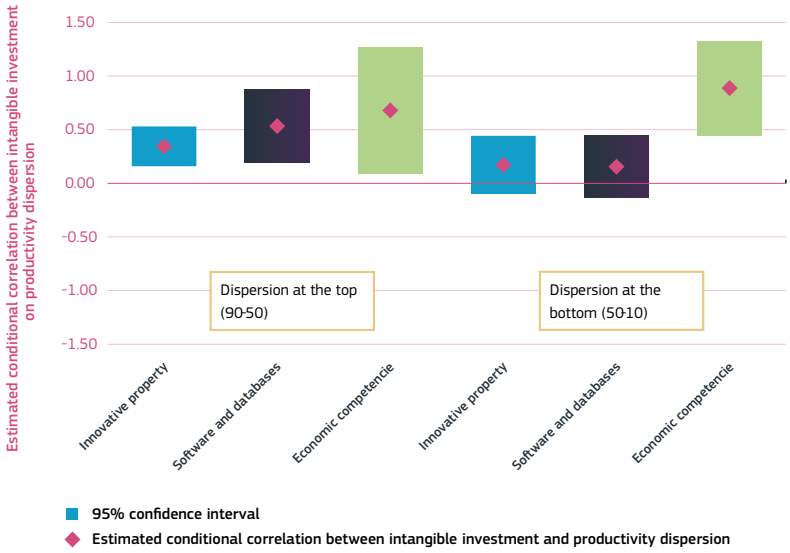
Research has shown that laggard firms catch up more slowly to the productivity frontier in more digital and more knowledge-intensive industries (Berlingieri et al., 2020). Exploiting detailed sector-level information on investments in intangibles merged with the MultiProd database, Corrado et al. (2021) confirm that intangible-intensity is positively correlated with higher productivity dispersion between firms. Among intangibles, the study highlights the key role of economic competencies (e.g. organisational capital and firm-specific skills), which explains divergence throughout the productivity distribution. Instead, intangibles more directly related to innovative activities (such as

R&D and intellectual property, IP, assets) and software and data explain solely the divergence at the top of the productivity distribution (Figure 1). Thus, competencies and skills seem key to support technology diffusion also among laggards, while productivity growth among firms belonging to the central part of the productivity distribution seems to be linked also to investments in innovative activities.

Country-level in-depth analyses may allow dissection of how skills and intangibles complement digital technologies, highlighting heterogeneity in complementarities across firms and technologies. Calvino et al. (2022) studies the case of Italy to identify the causes of the lower digitalisation of its business sector relative to other OECD countries. The study (joint with the Italian National Institute of Statistics and the Bank of Italy) exploits a unique data infrastructure that combines data on firm balance sheets, digital technology adoption, intangibles and matched firm-worker and firm-manager data.

Results show that adoption rates in Italy are extremely skewed, with small and young firms having lower levels of digital technology adoption in comparison with other OECD countries. Moreover, these firms are less likely to adopt bundles of different digital technologies, which are associated with higher productivity gains and are usually key to adopting other advanced technologies.

Figure 12-1: Correlation between intangibles and dispersion at the top and the bottom of the productivity distribution, by type of intangibles



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Source: Corrado et al. (2021)

Note: The figure plots the results from a regression at the country-A38 industry level of productivity dispersion on lagged intangible intensity, controlling for country-sector and year fixed effects as well as average inputs usage. Productivity dispersion at the top (bottom) is defined as the log difference in multi-factor productivity between the 90th and the 50th percentile of the productivity distribution (between the 50th and the 10th percentile). Intangible intensity is defined as the ratio between intangible investments and employment at the sector level. Countries included are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal. Following Corrado, Hulten and Sichel (2009), intangibles are divided into three groups: economic competencies (advertising, market research, training, organisational structure), innovative property (R&D, new products/systems, design, mineral exploration, entertainment and artistic originals), software and databases. Confidence intervals of 95% based on cluster-robust standard errors that allow for serial correlation at the sector-industry level are provided as shaded areas.

Stats.: https://ec.europa.eu/assets/rtd/srip/2022/figure-12-1.xlsx

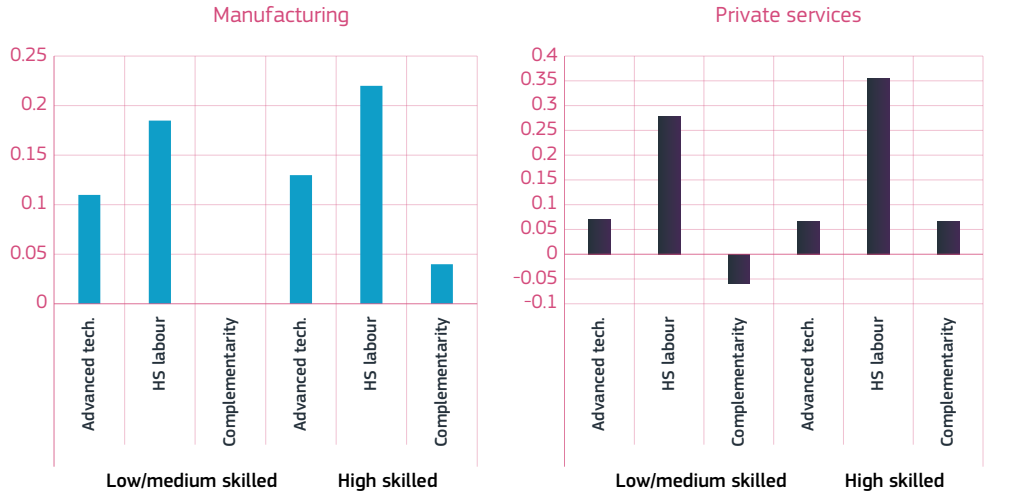
The analysis highlights that three complementary factors are key to boosting adoption rates and the returns of digital technologies among SMEs: worker skills, management capabilities and investments in intangibles.

A skilled workforce and a high-quality management are significantly related to increased adoption of digital technologies. High-skilled and well-managed firms, especially micro and small ones, realise larger productivity gains from adopting more advanced digital technologies since their managers are better able to deal with the increasing complexity of digital technologies and complement the workforce's skills when leveraging these new technologies in production (Figure 2).

Among intangible assets, R&D expenditures are key to boosting a firm's ability to realise the full potential of digital technology adoption. Digital technologies also tend to increase the likelihood that R&D activities will result in a new patent, pointing again to complementarities between digital and intangible assets.

Evidence from cross-country firm-level data both confirms that intangible investment boosts productivity growth and supports firms' catch-up towards the productivity frontier and highlights the role of financial frictions in preventing less productive firms from investing in these assets. Indeed, in a recent paper, Calvino, Koegel, Manaresi and Verlhac (2021) estimate that the speed of catch-up towards

Figure 12-2: Returns on advanced technology, high-skilled labour and their complementarity by skill of the manager in manufacturing and services, Italy, 2018



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Source: Calvino et al. (2022)

Note: The figure plots the estimated elasticities of output to advanced digital technologies, high-skilled labour and their interaction. Elasticities are obtained from a production function estimated separately for high- and low/medium-skilled managers. Advanced digital technologies include are measured as a dummy =1 if the firm has invested over the period 2016-2018 in at least one of the following technologies: internet-of-things, big data, advanced automation, 3D printing, AR/VR, computational simulations. High-skilled labour is the (log) number of workers that are tertiary educated. Low-, medium- and high-skilled managers are defined as top executives (CEOs) that have, respectively, a primary, secondary or tertiary education. The Cobb-Douglas production function includes the following additional inputs, also interacted with advanced technologies: low-skilled labour, medium-skilled labour, tangible capital and intangible capital. It also includes management software, cloud computing, e-sales and enabling technologies (broadband, 4G/5G connections, cybersecurity) as additional digital technologies. The production function is estimated for the year 2018 on Italian data using the De Loecker and Warzynski (2012) methodology.

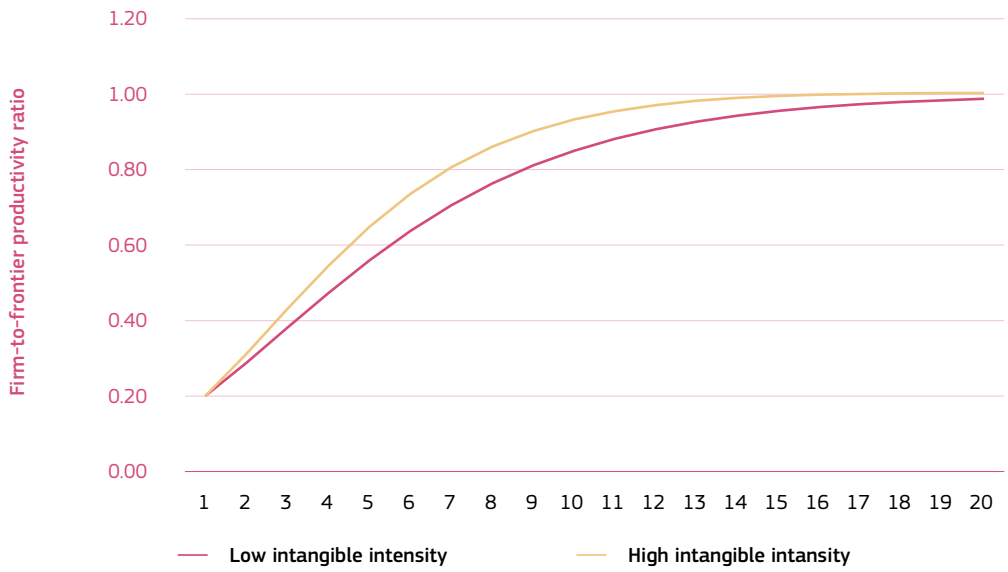
Stats.: https://ec.europa.eu/assets/rtd/srip/2022/figure-12-2.xlsx

the productivity frontier is significantly higher for firms that have larger intangible intensity (Figure 3). Importantly, this result also holds when intangible intensity is instrumented using changes in corporate R&D tax rates. This result points both to the causal role of intangibles in explaining the speed of catch-up and to the effectiveness of R&D tax credits.

The analysis also highlights the role of financial frictions in preventing less productive firms from investing in intangible assets: firms that are credit constrained (as identified through several state-of-the-art methodologies) are unable to invest in intangible assets, and thus catch up at a lower rate. This result points to the importance of developing credit market solutions to finance intangibles (e.g. through IP-based collaterals) as well as supporting access to financial markets for all firms.

Other key macroeconomic trends have been linked to the digital transformation and the rise of the intangible economy. Firms in digital- and intangible-intensive industries are found to experience a more rapid decline in business dynamism (Calvino, Criscuolo and Verlhac, 2020). Industry-level digital and intangible intensity are positively correlated with industry concentration and markups (Bajgar, Criscuolo and Timmis, 2021; Calligaris, Criscuolo and Marcolin, 2018).

Figure 12-3: Estimated catch-up towards the productivity frontier for firms with low vs high intangible intensity of capital



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Source: Calvino, Koegel, Manaresi, Verlhac (2021)

Note: The figure reports results from estimating a dynamic panel model of firm convergence towards the productivity frontier. The dependent variable is the ratio between the firm productivity and the average productivity of the national frontier (the top 5% of the national productivity distribution within each sector-year). The model controls for the growth of the productivity frontier and for firm and country-year unobserved heterogeneity. The Figure reports the convergence coefficient by intangible intensity. Low intangible intensity refers to the 25th percentile of the intangible distribution, while high intangible intensity refers to the 75th percentile of the intangible distribution. The model is estimated on Orbis data over the period 2000-2015 for the following countries: Austria, Belgium, Denmark, Germany, Spain, Estonia, Finland, France, United Kingdom, Hungary, Italy, Japan, the Netherlands, South Korea, Portugal, Slovenia, Sweden, USA.

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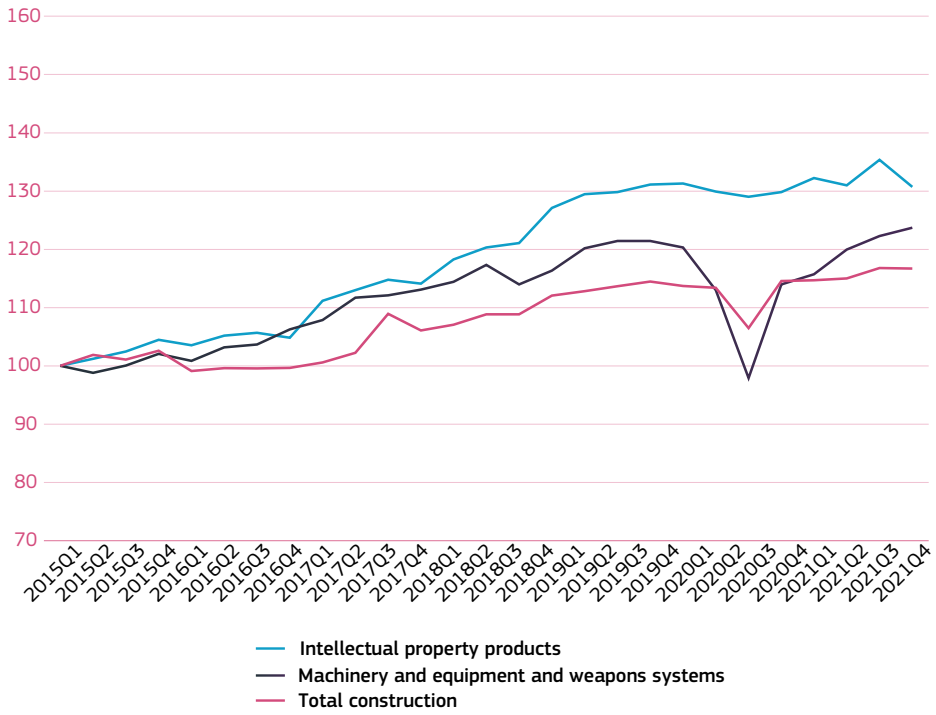
3. The COVID-19 shock

The COVID-19 crisis has profoundly hit the global economy. To curb the spread of the virus, governments imposed strict containment measures that have affected both demand and supply. While the rapid development of vaccines allowed most EU countries to partially lift the restrictions by the end of 2020, the emergence of new variants of the virus increases uncertainty over the future impact of the pandemic on economic activities and the need for further restrictions.

The containment measures generated a substantial drop in output in the second quarter of 2020, when most EU countries imposed lockdowns. This drop, however, was accompanied by an increase in aggregate labour productivity as hours worked decreased more than output (Criscuolo 2021).

Sectoral reallocation has also positively contributed to the increase in aggregate productivity (Bloom et al., 2020; Ascari, Colciago and Silvestrini, 2021; Criscuolo, 2021). Indeed, sectors characterised by ex-ante lower productivity have been the most affected by the crisis, while high-productive sectors (such as information and communications) were able to cushion the impact of COVID-19.

Figure 12-4: Investments by tangibility of assets: EU-27 average, quarterly data – Q1 2015=100



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Source: Authors' calculations based on Eurostat national accounts database.

Note: Average investments (gross fixed capital formation) are averaged across the EU-27 countries. Six countries are excluded from the sample because of data issues (Ireland, Belgium, the Netherlands, Cyprus, Malta, Estonia).

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The pandemic has favoured the digitalisation of the economy, with potential positive effects on productivity growth. Indeed, in order to cope with restrictive measures imposed by governments, firms have accelerated the adoption of digital technologies, put employees into teleworking and moved sales and purchases online, with a significant share of European enterprises, surveyed by the EIB Investment Survey, expecting the use of digital technologies to further intensify after the COVID-19 crisis (EIB, 2021). A growing body of evidence shows similar trends across the EU, the USA, the United Kingdom and several emerging countries (McKinsey Global Institute, 2021; World Bank, 2021; Riom and Valero, 2020).

Increased adoption of digital technologies has gone hand in hand with investments in complementary intangible assets. Consistently, national accounts data show that investments in IP assets (which comprise R&D expenditures, software and databases, and expenditures related to intellectual property products) remained largely unaffected by the initial shock (declining by 1.7% in the second quarter of 2020 relative to the beginning of the year, against a 18.6% drop in machinery and equipment and a 6.4% drop in construction – Figure 4).

The pandemic has thus contributed to accelerating the shift to a more digital and knowledge-intensive economy. At one side, this might have been a stimulus for smaller and less productive firms to accelerate their process for catching-up to more productive firms. On the other side, if larger, already digital and more productive firms with complementary intangible assets were more likely to adopt new digital technologies and better exploit their returns, the crisis might have exacerbated the existing trend of productivity divergence and possibly strengthened the market power of more digital-intensive firms.

4. COVID-19 and business dynamics

Business dynamism has been significantly affected by the COVID-19 crisis. In the first half of 2020, the drop in demand and increased uncertainty reduced the number of new firms entering the market. Across OECD countries, entry dropped indeed markedly, ranging from around -3% in the Netherlands to around -70% in Portugal and Spain (Figure 5), reflecting the restrictions imposed by governments on activities. Indeed, evidence for five euro-area countries (Belgium, Finland, Italy, the Netherlands and Portugal) shows that sectors with a higher share of employment with face-to-face contact with customers registered a larger decline in new business registrations, both in the second and the fourth quarters of 2020 (Criscuolo, 2021).

Digitalisation has helped new firms to cushion the impact of the crisis. Especially in the first months of the crisis, the drop in firms' entry has been less severe in sectors with higher ICT task-intensity of jobs, ICT skills of workers and teleworking potential (OECD, 2021a; Criscuolo, 2021).

Since June 2020, firms' entry has generally recovered, with a positive outlook for job creation and innovation. The rebound in firms' entry displays, however, substantial differences across OECD countries. Figure 5 shows that some countries, such as Belgium, France, the Netherlands, the United Kingdom and the USA, have experienced a V-type recovery, i.e. a significant rebound in entry offsetting the reduction observed in the early months of 2020; in some of these countries, such as the USA, the number of new firms in 2021 even exceeded 2019 levels. Other countries, including Italy, Portugal and Spain, continue to struggle with a L-type recovery, still displaying considerably fewer entries at the end of 2020 than in 2019.

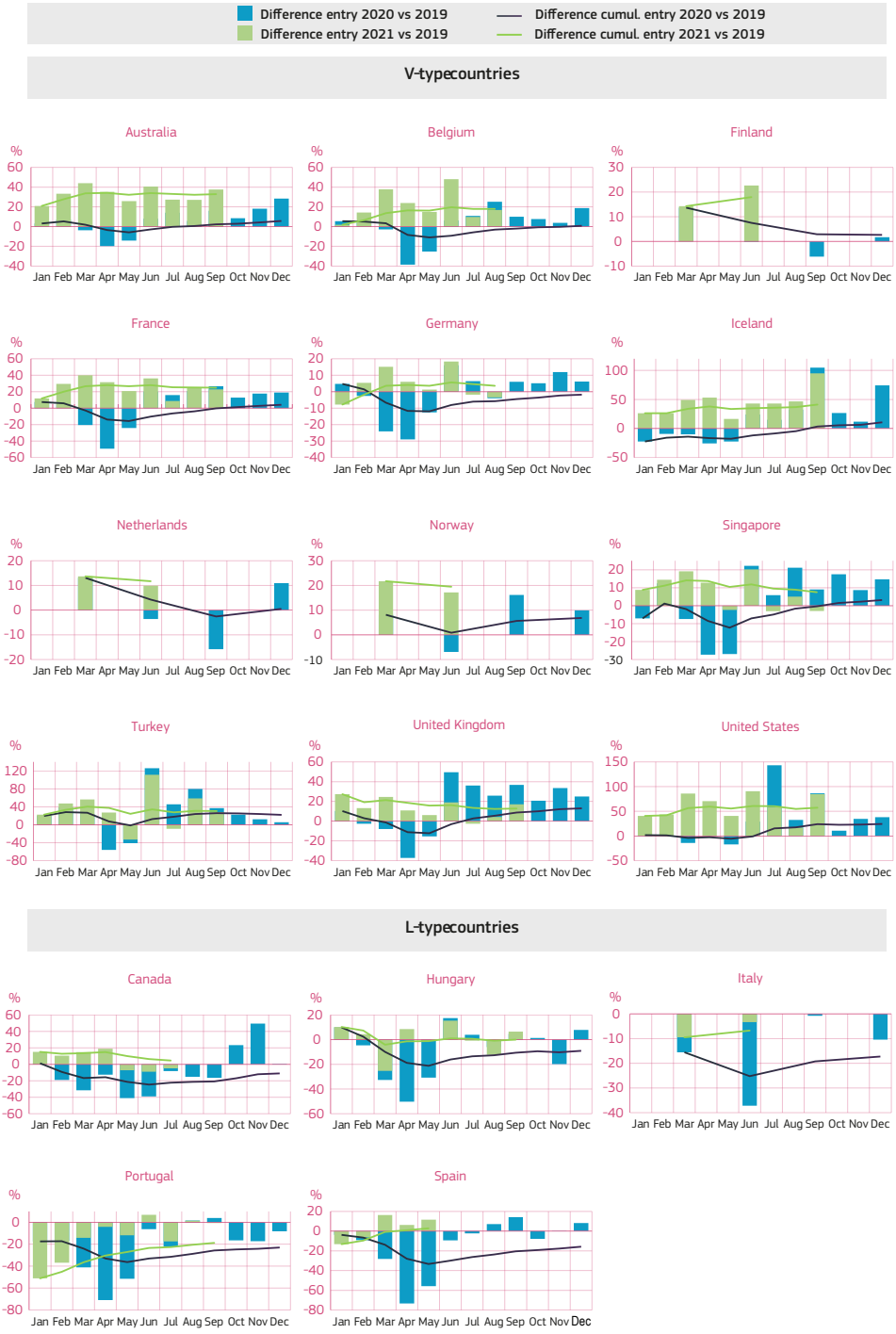
Subdued entry registrations observed in southern European countries may further exacerbate the secular declining trend in business dynamism and may have negative implications for employment: according to OECD estimates, a decline in firms' entry by 18%, such as the one experienced by southern countries in 2020, could generate a reduction in aggregate employment of between 0.4% and 0.6% after 3 years and between 0.3% and 0.5% after 10 years (Criscuolo, 2021).

Recent studies have shown, instead, that the increase in entry registrations observed in V-type countries has been mainly dominated by the trade sector. Country-level evidence from the USA, the United Kingdom and the Netherlands shows that the rebound has indeed been driven by online retail, i.e. by start-ups that are selling their products and services in online markets (Haltiwanger, 2021; Bahaj et al., 2021; Fareed and Overvest, 2021). The rising role of these new e-sellers likely reflects the increased incentives for firms to adopt digital technologies to shield from the effects of the COVID-19 shock and to respond to changes in consumers preferences for online transactions.

The support and regulatory measures implemented by governments to cushion the impact of the crisis have also markedly reduced firm exit, and in particular bankruptcies. Evidence from 12 OECD and non-OECD countries show that bankruptcies dropped by more than 30% in 2020 relative to their 2019 levels (OECD, 2021a).

The delay in bankruptcies may be beneficial in the short-term as it may have helped viable firms not to exit the market, but it also brings the risk of firms being kept in business despite being unproductive, with negative implications for resource reallocation and productivity growth in the long run. A growing body of evidence for OECD countries shows that public support measures have not slowed down the reallocation process: high-productive firms have been more resilient to the crisis, were more likely to remain in business and less likely to exit (Bighelli et al., 2021; Cros et al., 2021; Andrews et al., 2021; Kozeniauskas, Moreira and Santos, 2020).

Figure 12-5: Investments by tangibility of assets: EU-27 average, quarterly data – Q1 2015=100



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Source: Criscuolo (2021)

Note: Green (blue) bars represent the percentage difference in entry in 2021 (2020) relative to the same month/quarter of 2019. Green (blue) lines represent the percentage difference with respect to 2019 in cumulative entry from January to each month of 2021 (2020).

Stats.: https://ec.europa.eu/assets/rtd/srip/2022/figure-12-5.xlsx

5. The impact of COVID-19 on technology diffusion

While the crisis has led to a general increase in firms' digitalisation, aggregate patterns in adoption of digital technologies and teleworking practices hide large heterogeneity across countries, firms and sectors.

Dispersion of digital technology adoption will most likely increase in the aftermath of the crisis. Indeed, several international studies, for the EU, the USA, the United Kingdom and emerging economies, provide evidence that larger, more productive and more digital firms have adopted more and more advanced technologies during the pandemic (EIB, 2021; McKinsey Global Institute, 2021; World Bank, 2021; Riom and Valero, 2020) and were more resilient to the shock (Valero, Riom and Oliveira-Cunha, 2021).

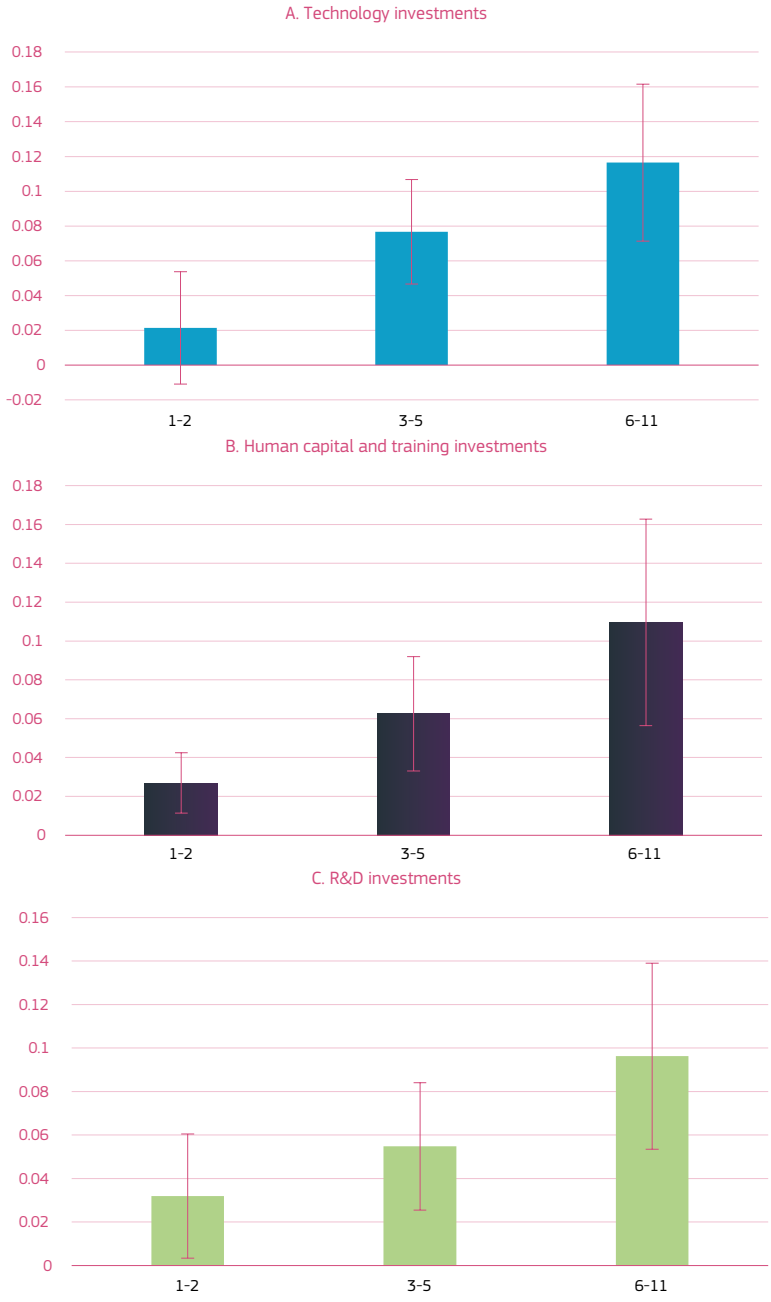
More in-depth single-country studies confirm that technology adoption during the crisis has been heterogeneous. Exploiting survey data collected in November 2020 for a representative sample of over 40 000 firms by the Italian National Statistical Institute, Calvino et al. (2022) show that firms that were using digital technologies before the pandemic were better able to cope with the crisis. Holding firm size, age, sector and location fixed, results show that these firms suffered less in terms of loss of revenues and faced a lower probability of closure. Moreover, these firms were more likely to continue investing in digital technologies and complementary intangible assets during 2020. Figure 6 shows that the probability of a firm raising its investments in new digital technologies, human capital and R&D during 2020 increases with the number of digital technologies the firm had adopted before the COVID-19 crisis.

The use of teleworking arrangements has increased markedly since the outbreak of the crisis and represented a key element of resilience among firms. However, substantial differences emerge across countries, partly reflecting pre-pandemic adoption. In euro-area countries, the share of workers teleworking ranges from around 30 % in Slovakia to more than 60 % in Belgium in June-July 2020. Despite the acceleration in its adoption, telework uptake remains positively associated with the quality of both firms' and workers' access to fast broadband infrastructure and with the ICT skills of the workforce (OECD, 2021b).

Telework adoption has also been heterogeneous across firms. Recent OECD analysis on the European Labour Force Survey has shown that larger firms (with more than 50 employees) experienced higher teleworking uptake in 2020 (Criscuolo, 2021). Firm-level evidence from Italy confirms that the use of teleworking practices during the COVID-19 pandemic was more widespread among digital firms, in particular those that already used cloud computing and had adopted advanced digital technologies (Calvino et al., 2022). This finding also holds true when measured within industry, region, size and age classes.

The COVID-19 crisis has thus provided an opportunity to boost the adoption of digital technologies and teleworking among firms. However, evidence points to a possible exacerbation of the pre-existing digital divide, with smaller and less productive companies struggling more. This might further increase productivity dispersion, lowering the incentives for new businesses to enter the market and for more productive firms to innovate.

Figure 12-6: Probability that firm increased its investments in 2020 relative to 2019 by type of expenditure and number of technologies adopted in 2018, Italy



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Source: Calvino et al. (2022)

Note: The figure combines the coefficients of a regression model that estimates the probability of increasing investments in 2020 relative to 2019 by number of technologies adopted by firm in 2018 (grouped into four categories: 0, 1-2, 3-5, and 6-11). The bars indicate differences in probability compared to the base category of zero technologies. The model is estimated separately for investments in digital technology, human capital and training, and R&D. The regression includes sector and geographic-area fixed effects, and controls for labour productivity and firm size measured in 2018.

Stats.: https://ec.europa.eu/assets/rtd/srip/2022/figure-12-6.xlsx

6. COVID-19 and industry concentration

Heterogeneity in the adoption of digital technologies also poses the risk that larger, more productive firms may further reinforce their market power, with consequences for competition and concentration. Industry concentration might, thus, increase in the aftermath of the crisis particularly in digital-intensive sectors.

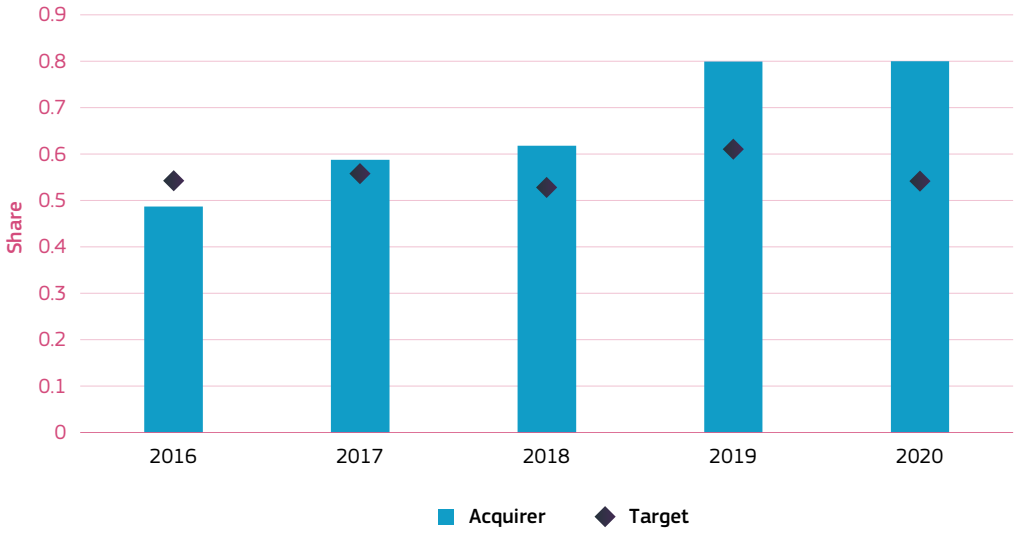
Although industry concentration data for the crisis period are not yet available, mergers and acquisitions (M&A) that occurred in 2020, for which timely data are available, provide a first insight into the consequences of COVID-19 on industry structure.

Figure 7 highlights that during the pandemic, over 80% of the total value of M&As originating in the EU had an acquirer active in highly digital-intensive sectors. Conversely, in terms of M&A targets, the share was almost equally split between high and low digital-intensive sectors.

More in-depth analysis shows that the rise in the total value of M&As with a digital acquirer was the result of an increase in the average value of deals performed by the largest firms in digital sectors (Criscuolo, 2021).

The evidence on M&A dynamics over the last years and the rising importance during the pandemic of larger players in high digital-intensive sectors, suggest that, in the aftermath of the crisis, industry concentration might increase and competition might be lowered, with potentially negative consequences for innovation.

Figure 12-7: Trends in share of total M&A value in high digital-intensity industries, 2016-2020



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Source: Calculations based on Zephyr 2021

Note: Share of M&A in high digital-intensity industries for the available EU countries. The countries include Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Germany, Denmark, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden. The M&A data reflects the annual total value of acquisitions (i.e. result in a majority stake), purchasing minority stakes and issuing of new share capital. The sample looks at deals where at least one acquirer (target) is located in the European Union and is active in manufacturing and services sectors (i.e. NACE rev.2 codes 10-33 and 45-83, excluding 19 and 68). M&A value is expressed in 2005 USD (exchange rates from the World Bank Development Indicators). The digital intensity of sectors is defined using the industry of the target firm and the STAN A38 global digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as 'high-digital' if they are in the top quartile of the industry distribution in terms of digital intensity.

Stats.: https://ec.europa.eu/assets/rtd/srip/2022/figure-12-7.xlsx

7. Policy implications

The COVID-19 crisis has brought tremendous challenges for firms, but also generated new opportunities to foster the adoption of digital technologies and implement new business models.

However, evidence shows that – so far – these opportunities have been mostly seized by firms that were ex-ante more digital, more productive and larger in size. Consequently, the digital and productivity divides may be exacerbated, with consequences for competition and long-term growth. The extent to which the pandemic shock will have long-term negative impacts crucially depends on structural policy responses to ensure a more inclusive digital transformation.

To enable more firms and workers to benefit from this new wave of digitalisation, governments need to support complementary investments in skills and intangibles, especially among SMEs, and promote the diffusion of digital infrastructure.

As discussed in section 2, enhancing the skills of workers and improving the quality of management are crucial to increase the returns to technology adoption (Calvino et al., 2022; Brynjolfsson, Rock and Syverson, 2019; Sorbe et al., 2019). In the short-term, policies to support the training and upskilling of workers, as well as managerial coaching and consulting activities, can favour the digital transformation of smaller and less productive firms. Longer-term investments in education, notably in vocational secondary and in STEM and management tertiary courses, would also be key to increasing the supply of skilled workers and managers (Bianchi and Giorcelli, 2020; Calvino et al., 2022).

Supporting R&D expenditures, through direct government support or tax credits, has also been found to effectively boost firms' absorptive capacity (Berlingieri et al., 2020).

Providing high-speed and high-quality digital infrastructure is important to support the adoption of digital technologies and enable a greater share of employees to benefit from teleworking. Evidence from Italy shows that high speed connectivity complements other digitalisation policies (such as financial incentives to technology adoption), raising the performance of their beneficiaries (Calvino et al., 2022).

The crisis generated significant cross-sectoral reallocation of valued added, at least in the short-term. This, coupled with increased digitalisation of production may generate a substantial push to labour reallocation. Adjustment costs in the short-to-medium run, may result in high level of skill mismatch and frictional unemployment. To mitigate these initial frictions, policies could facilitate the transition to new occupations by providing workers with (digital) skills and supporting labour mobility.

In some OECD countries, the new opportunities brought by the pandemic have incentivised start-ups, particularly in online trade; however, firm entry remains subdued in southern European countries. Policies can encourage new business

entry by reducing barriers to entry, such as red tape and regulatory uncertainty, and allowing easier access to financial resources. Additionally, the bankruptcies avoided thanks to the support measures implemented by governments may have contributed effectively to sustaining viable firms but may result in the risk of 'zombification' of the economy. To reduce this risk and smooth the process of firm entry and exit, it is important to ensure efficient insolvency procedures when phasing-out crisis measures.

The rising importance of digital technologies and intangible assets has been linked to the observed increase in concentration. The M&A dynamics observed during 2020, where larger players in digital sectors have entered in larger M&A deals, suggest that concentration might increase after the crisis, especially in digital intensive industries. Maintaining a level-playing field and supporting free entry in these markets will be crucial to ensure a competitive environment conducive to innovation and sustain long-term growth.

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