EUROPEAN CENTRAL BANK

EUROSYSTEM

Occasional Paper Series

The impact of the COVID-19 pandemic and policy support on productivity

A report of the ESCB Expert Group on productivity, innovation and technological change

Tibor Lalinsky (editor), Marianthi Anastasatou, Sofia Anyfantaki, Konstantins Benkovskis, Antonin Bergeaud, Maurice Bun, Simon Bunel, Andrea Colciago, Jan De Mulder, Davide Fantino, Beatriz González López, Jiri Havel, Valerie Jarvis, Dmitry Khametshin, Tetie Kolaiti, Olegs Krasnopjorovs, Laura Lebastard, Paloma Lopez-Garcia, Fernando Martins, Philipp Meinen, Jaanika Meriküll, Miles Parker, Josip Raos, Roberta Serafini, Domagoj Šelebaj, Béla Szörfi, Milan Vaňko, Juuso Vanhala, Matjaž Volk

No 341

Contents

Abstract

This paper studies the short-term and long-term consequences of the COVID-19 pandemic for productivity in Europe. Aggregate and sectoral evidence is complemented by firm-level data-based findings obtained from a large micro-distributed exercise. Productivity trends during the COVID-19 pandemic differed from past trends. Labour productivity per hour worked temporarily increased, while productivity per employee declined across sectors given the widespread use of job retention schemes. The extensive margin of productivity growth was muted to some degree by the policy support granted to firms. Firm entries declined while firm exits increased much less than during previous crises. The pandemic had a significant impact on the intensive margin of productivity growth and led to a temporary drop in within-firm productivity per employee and increased reallocation. Job reallocation was productivity-enhancing but subdued compared to the Great Recession. As confirmed by a granular data analysis of the distribution of employment subsidies and loan guarantees and moratoria, job reallocation and also debt distribution and "zombie firm" prevalence were not significantly affected by the COVID-19 policy support. The pandemic and related lockdowns accelerated changes in consumer preferences and working habits with potential long-term effects. Generous government support muted the surge in unemployment and reduced permanent scarring effects.

Keywords: labour productivity, productivity-enhancing reallocation, COVID-19, adjustment of firms, government support, cross-country analysis, micro-distributed exercise, Europe

JEL codes: D22, H25, J38, O47

Executive summary

This report sets out to understand the channels of transmission and quantify, where possible, the short- and long-term impacts of the COVID-19 pandemic, including the containment measures and policy support, on productivity developments within the European Union (EU). To succeed in this task, an Expert Group on Productivity, Innovation and Technological Change, comprising a team of experts from the European System of Central Banks (ESCB), worked with available macro, sector and firm-level data. The report has benefitted enormously from collaboration through so-called "micro-distributed exercises", which involve code sharing and allow for cross-country analysis of otherwise confidential granular datasets**.** The analysis set out in this report is important for at least two reasons. First, the COVID-19 pandemic might have triggered structural changes with deep repercussions on the way we produce and work, and therefore on future productivity growth and the potential output growth of the European economy. It is important to understand the implications of such changes and incorporate them in our regular policy analysis. Second, because the coordinated actions undertaken by the governments of Europe to support households and businesses were truly unprecedented, and we therefore need to understand the intended and unintended impacts of such actions.

The aggregate productivity developments that occurred within the European Union during the COVID-19 pandemic were distinct from those that took place during the Great Recession and those that unfolded in the United States. In addition, the interpretation of productivity developments depends largely on the definition of productivity, given the extensive use of job retention schemes to protect employment. As a result, labour productivity per hour worked temporarily increased, whereas productivity per employee declined across sectors in the EU countries during the first year of the pandemic.

We find that at the onset of the COVID-19 pandemic, firm entries declined significantly in relation to the pre-crisis trend across euro area countries, while firm exits increased much less than in previous crises. On the subject of firm entry, our euro area analysis is complemented by a more detailed analysis based on Spanish data, which finds that the drop in firm entry was concentrated among low- and medium-income households. At the same time, high-income households with higher wealth and better access to external finance took the opportunity created by the pandemic to start up digital businesses. The temporary freeze on firm insolvency proceedings and massive liquidity support to businesses may well explain the somewhat muted increase in exits, despite the steep drop in GDP growth. However, those firms that exited were significantly less productive than those that survived. These findings point to a positive but mitigated cleansing effect of the crisis, with a potential impact on aggregate productivity growth over the medium term.

Within-firm productivity growth was significantly reduced during the pandemic, whereas between-firm resource reallocation was productivity-

enhancing, albeit subdued compared to other crises. Labour hoarding, supported also by the use of job retention schemes and lower capacity utilisation of capital, explains the decline in productivity among incumbent firms in the short term (known as within-firm productivity growth). More productive firms experienced, on average, higher employment gains or lower employment losses. In those countries with positive productivity growth, the reallocation has been productivity-enhancing during the recent economic cycle. However, on a longer-term horizon the productivity-enhancing reallocation was somewhat weaker on average during COVID-19 than during the Great Recession.

The effect of policy support on productivity-enhancing reallocation (PER) is inconclusive and heterogeneous across countries. Reduced productivity-enhancing reallocation among eligible firms is found to exist in only two countries. It is hard to gauge whether the productivity-enhancing reallocation was muted due to the unusually strong effect of the pandemic on productive firms or due to policy support sustaining relatively more employment among low productivity firms. A more precise identification of the effect of policy support on PER for a larger number of countries is impeded by several factors, including a significant time lag in granular data becoming available and the fact that relatively little time has passed since the onset of the pandemic.

However, evidence based on the distribution of COVID-19 pandemic policy support drawing on unique granular firm-level data on wage subsidies, loan moratoria and guarantees shows that productive firms received more support than non-productive firms in 2020. Hence at the onset of the crisis, policy support was not misallocated but rather helped firms in the middle and upper part of the productivity distribution. More productive firms also had a higher chance of receiving the support and ultimately received more support in nominal terms, but less in relative terms with respect to their revenue. Preliminary evidence on the trend in the second year of the pandemic reveals that the link between firm productivity and support weakened as more productive firms exited the support schemes first.

Additional findings confirm that corporate debt developments during the pandemic differed across firms, sectors and countries, though debt distribution and zombie firm prevalence were not significantly affected by COVID-19 policy support. However, we can see a certain trend towards higher leveraging or lower deleveraging in the most severely hit sectors and some signs of reallocation of credit towards less productive firms. Zombie firms decreased their total debt or increased it less than non-zombie firms and our conditional analysis confirms the low probability of zombie firms receiving support.

During the COVID-19 period, and especially during the lockdowns, long-established consumption preferences and working habits were forced to change, with direct and indirect consequences for productivity. The pandemic lockdowns and containment measures led to significant, albeit largely temporary, disruptions in travel and a certain increase in environmental awareness among consumers. More significantly, the pandemic has accelerated trends in e-commerce (online shopping) and teleworking (working from home). Firm-level estimates based

on French data presented in this report confirm a positive impact of teleworking on total factor productivity growth.

The lessons learned from previous crises suggest a significant and lasting impact on recent and future workers, including large upswings in unemployment and longer-term scarring effects, although post-pandemic trends within the euro area do not show a long-lasting negative impact. Lower educational attainment during the pandemic could potentially translate into lower access to higher education, reduced labour market participation, a shrinkage in future earnings and lower productivity. However, online provision of education has gone some way to mitigating the negative consequences of the school closures. Generous government support was successful in containing the increase in unemployment and in reducing permanent scarring effects by maintaining the worker-employer relationship.

1 Introduction

The COVID-19 pandemic was a shock like no other in recent history. It differed from previous crises in at least three ways. First, the shock did not result from accumulated macro- or micro-based imbalances like in previous crises. As a result, it affected all countries, sectors and firms, albeit to different extents, depending on the exposure to the most contact-intensive activities. Second, the measures enacted by European governments to contain the spread of the virus were unprecedented, with partial or full lockdowns that brought economic activity to a standstill, forcing large numbers of employees to work from home and consumers and firms to look for alternative ways of buying and selling. And third, governments reacted quickly to the economic fallout, with policies to support businesses and households of a scale and magnitude never seen before.

This report sets out to understand the channels and quantify, where possible, the short- and long-term impacts of the pandemic, including the containment measures and policy support, on productivity trends within the EU. To succeed in this task, an Expert Group on Productivity, Innovation and Technological Change, comprising a team of experts from the European System of Central Banks (ESCB), worked with available macro, sector and firm-level data.[1] The analysis set out in this report is important for at least two reasons. First, the COVID-19 pandemic might well have triggered structural changes with deep repercussions on the way we produce and work, and therefore on future productivity growth and the potential output growth of the European economy. It is thus important to understand the productivity implications of those changes and incorporate them in our regular policy analysis. Second, because the coordinated actions undertaken by European governments to support households and businesses were truly unprecedented, and we therefore need to understand the intended and unintended impacts of such actions.

The report starts by showing the productivity developments in the euro area and, where possible, in specific countries, since the outbreak of the pandemic in 2020 to the latest possible date. Section 2 of this report addresses three significant findings. First, aggregate productivity developments in the euro area during the COVID-19 pandemic were different from the developments seen during earlier crises. Second, productivity developments depended heavily on whether productivity is measured per hour worked or per person employed: while productivity per person employed declined across most sectors of activity in 2020, productivity per hour worked increased in the first year of the pandemic. This discrepancy can be explained by the existence of support policies aimed at protecting existing jobs. As a result, the significant drop in activity came about through hours worked (the intensive margin), rather than through employment (extensive margin). Section 4 describes the different policies put in place, also in contrast with the United States, and gauges their impact on resource allocation and therefore on aggregate productivity growth.

[1] The ESCB Expert Group on Productivity, Innovation and Technological Change has completed three complementary reports analysing the impacts of climate change, digitalisation and monetary policy on productivity growth. See Bijnens et al. (2024), Anghel et al. (2024) and Valderrama et al. (2024).

Third, aggregate statistics mask dynamics that can only be revealed by employing more granular data. In this respect, micro-distributed exercises, based on code sharing and enabling access to confidential granular data, make crucial contributions to our analyses of resource reallocation, distribution of pandemic support and consequences for indebtedness and zombification. More information on the micro-distributed approach applied is provided in in Box 1.

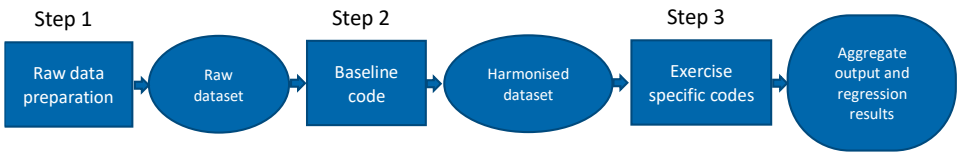
Box 1
Micro-distributed approach to data analysis

The various analyses based on firm-level data presented in this report relied on a micro-distributed approach to country-specific, and frequently confidential, individual data (see Tables A3 and A4 in the appendix for a description of the individual data sources). A common code was distributed to the representatives of the various national central banks involved, who then directly or indirectly ran the code on their respective national firm-level datasets. This method ensured high coverage and cross-country comparability while protecting the confidentiality of the data used.

The approach was motivated by the CompNet (Competitiveness Research Network) infrastructure, and the code largely followed the experience with micro-distributed exercises used for regular updates of the CompNet Dataset of micro-aggregated indicators (mainly the code for the 8th vintage of the dataset).

The process of data collection and analysis was divided into three main steps. During step one, data providers from contributing countries prepared their data in line with the agreed variable definitions.

Figure A – Steps in the micro-distributed approach



In the second step, a baseline code was run on the raw firm-level datasets. It first read the available data, verified whether the data met expected properties and renamed all variables in line with a key common across countries. The code then eliminated false observations and outliers and created various ratios, growth rates and a number of non-parametric variables, such as labour and financial indicators. Lastly, the baseline code calculated several types of total factor productivity and related parametric indicators and completed the preparation of the harmonised firm-level dataset to serve as an input for the various exercises.

In the third step, the data provider ran the exercise-specific modules on their harmonised datasets and shared the aggregate results and regression outputs with the participants to have prepared the exercises – partial analyses. The expert team ran eight separate exercises, with different numbers of participating countries depending on the availability of the data required. The results of seven exercises, which presented a reasonable outcome from a sufficient number of countries, are a crucial part of the results presented in the various reports to have been drawn up by the WGF

Expert Group on Productivity. More precisely, three of them are presented in this report, three in the report on the workstream on monetary policy and productivity (Valderrama et al., 2023), and one in the report on the workstream on digitalisation and productivity (Anghel et al., 2023) (see Table A below for more details).

Table A
Micro-distributed exercises

Report	Exercise	Countries
The impact of the COVID-19 pandemic and policy support on productivity	Intensive productivity growth and productivity-enhancing reallocation	12
	Distribution of pandemic subsidies and guaranteed loans across firms	7
	Pandemic support, indebtedness and zombification	10
The impact of monetary policy on productivity	Role of market power and concentration on the transmission of monetary policy to productivity	8
	Effects of monetary policy on the allocation of input factors	8
	Effects of monetary policy on zombie margins	8
Digitalisation and productivity	The impact of digital uptake of firms on their productivity	2

The COVID-19 pandemic affected aggregate productivity growth via several channels. Some of the impacts occurred shortly after the outbreak of the pandemic and reverted as soon as activity returned to the pre-COVID-19 trend; others materialised when the EU governments enacted unprecedented policy support for businesses, or when that support was lifted; while others will take longer to materialise. Certain COVID-19-related developments affected within-firm organisation and investment and therefore firm-level productivity growth (known as within-firm productivity growth), while others triggered a reallocation of resources across sectors, and also within sectors, affecting aggregate productivity growth (known as between-firm resource reallocation).

Section 3 of this report looks at the short- and medium-term impacts of the pandemic and ensuing containment measures. By short term, we mean the initial months of the pandemic, in 2020, while the medium term looks at 2021 and, where possible, 2022. In the short run, the crisis reduced productivity per head, primarily due to labour hoarding and lower capacity utilisation of capital as output fell by more than inputs in the most exposed sectors, particularly in a context where workers were retained thanks to the support provided by short-time work schemes deployed by most European governments (see also ECB, 2020). Supply chains were disrupted first by stranded shipping cargos during the initial lockdowns, and then by the supply bottlenecks, highlighting the vulnerabilities of a highly integrated global production process.

The COVID-19 pandemic and supporting policies affected the reallocation of resources across sectors, and also across firms in the same sector, albeit with an ambiguous net effect. According to the seminal work of Caballero and Hammour (1996), crises can have a silver lining in the form of a “cleansing effect”, understood as the disproportionate impact of economic shocks on less productive firms, which either shrink or are displaced and eventually replaced by the expansion

or entry of more productive firms. The resulting reallocation of resources from low to high productivity sectors/firms boosts aggregate productivity growth. However, as stated above, the COVID-19 crisis was different, in that the origin of the crisis was entirely exogenous, and not endogenously induced by macro or microeconomic imbalances. Hence, it affected both low and high productivity firms operating in the most contact-intensive sectors, which sometimes resulted in their premature exit, thus reducing aggregate productivity growth. The second main difference with respect to previous crises was the unprecedented reach and magnitude of the policy support measures enacted by European governments to protect both households and businesses. Sections 3 and 4 of this report discuss, respectively, the impact of the crisis and of the supporting measures on the productivity-enhancing reallocation of resources. Section 3.1 documents the impact of the shock on the entry and, above all, exit of firms in 2020, while Section 3.2 analyses the impact of the crisis on the reallocation of resources across incumbent firms operating in the same sector. We find that exit was significantly lower than in other crises, although the few firms that exited were less productive than those that remained. We also find that employment growth among relatively more productive firms was higher than among less productive firms, so productivity-enhancing reallocation was preserved, although in some countries it was more subdued compared to previous crises.

Section 4 analyses the impact of policy support for corporates on resource reallocation and thereby on aggregate productivity growth. The section relies on aggregate as well as sector and, importantly, novel firm-level cross-country data matching firm performance with firm-specific support. Section 4.1 describes the various policies used to mitigate the impacts of the pandemic and the containment measures employed, while Section 4.2 shows the unconditional and conditional distribution of support across firms of different productivity, in different sectors and countries.[2] Section 4.3 then maps the impact of policy support on firm debt developments and the risk of increased zombie prevalence during the pandemic. It finds that support at the outbreak of the crisis was provided to firms across the whole productivity distribution, although to a larger extent to firms around the median. The allocation of support changed over time, with more productive firms exiting the supporting schemes earlier. Firm-level data confirm a degree of cross-country heterogeneity in relation to debt developments, with a certain trend towards higher leveraging or lower deleveraging in the most severely hit sectors and some signs of reallocation of credit towards less productive firms. The short-run developments do not show increased leveraging, or a prevalence of zombie firms, with respect to pandemic subsidies.

Section 5 looks at the long-term impacts of the pandemic shock. Containment measures accelerated the progress of digital uptake in firms across all sectors, affecting the organisation of work and how business is done (e.g. e-commerce, teleworking and videoconferencing). The productivity response to the acceleration in digitalisation may take time and will depend heavily on the joint development and

[2] Our findings are in line with the preliminary conclusions contained in the current literature (e.g. Bighelli et al., 2023), focusing solely on subsidies allocated during the first year of the pandemic. However, we analyse the allocation developments over longer period of time, extend the findings to more countries and, more importantly, deliver the first analysis on the allocation of loan guarantees and moratoria.

digital transformation of institutions, infrastructure, skills and methods of production and management (see OECD 2020 and also the digitalisation report drawn up by Anghel et al., 2023). The shift towards remote work is likely to persist and could potentially open the door to substantial gains in terms of productivity and worker well-being, though it could also increase levels of inequality among workers. The initial disruptions to global value chains were later exacerbated by the geopolitical tensions resulting from Russia's invasion of Ukraine. These more recent developments have forced some firms to rethink their global activities and relocate tasks based on political alliances rather than on comparative advantages or costs. If this reallocation ultimately goes ahead, sectors that have greatly benefited in terms of productivity growth from international exposure and globalisation might experience a decline in productivity. Within-firm productivity growth might also be affected in the long term by a deterioration in the quality of labour. Human capital accumulation might be affected by the lockdown-induced disruptions to schooling and training, which might hurt aggregate and firm-level productivity in the long run.

The financial distress and high uncertainty triggered by the pandemic have also affected investment decisions with a potential impact on long-term productivity growth. Financial distress, together with high uncertainty, might increase borrowing costs and reduce the expected benefits of new, productivity-enhancing projects, while also prompting companies to put back their investments, thus affecting productivity growth going forward. Further, the uptake of new debt by corporates to cover liquidity gaps could result in debt overhang and further reduce investment. Additionally, some scholars have argued that COVID-19 will have adverse long-term economic implications through so-called scarring of beliefs, i.e. a persistent change in the perceived probability of an extreme, negative shock in the future (Kozlowski et al., 2020). A greater tail risk lowers incentives to invest and thus has implications for the productive capital stock and, ultimately, also for productivity. Box 9 explores the impact of the COVID-19 shock on investment per hour worked in the euro area, distinguishing between different types of investment. The box finds that the sharp decline in hours worked during the 2020 lockdowns led to a sharp spike in the rate of euro area capital deepening. However, the pandemic does not appear to have had such as long-term effect on the investment-to-labour ratio as happened during the Global Financial Crisis (GFC). Neither construction nor other investment per hour worked have suffered such strong and continued declines. The decomposition of non-construction investment suggests a stagnation in the growth of machinery and equipment investment-to-hours worked ratio, while intellectual property products increased.

Section 6 concludes by discussing the main policy implications. As shown in the report, pandemic containment measures together with government support have altered productivity patterns. The striking difference seen between the EU and the United States in terms of labour productivity per employee effectively confirms the far-reaching consequences of employment support, which, albeit unintendedly, did not severely affect the reallocation of employees to productive firms. Corporate indebtedness or the prevalence of firm zombies did not increase significantly amid the extensive support measures. However, we did observe an upturn in e-commerce and teleworking trends, potentially representing longer-term boosts to productivity.

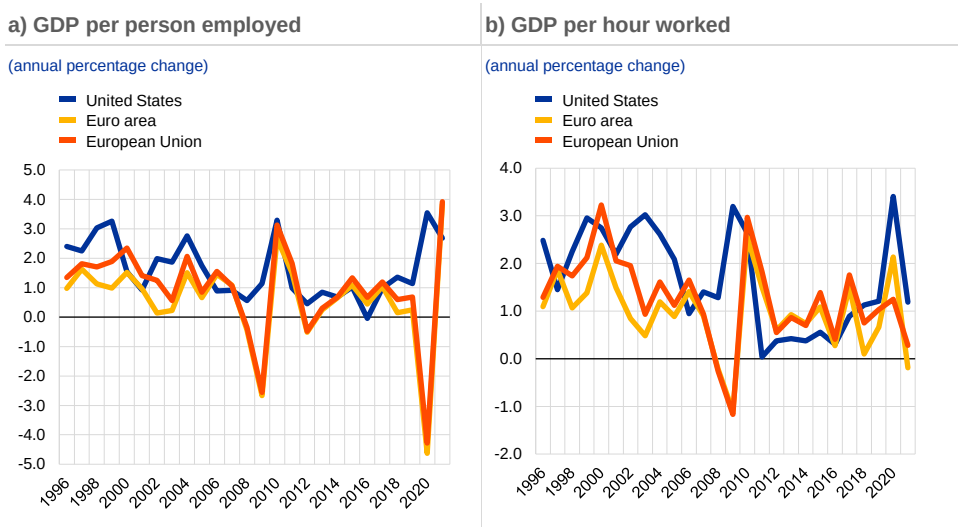
With the pandemic now behind us, new policy challenges related to Next Generation EU (NGEU) funds, green funding and the digital transition lie ahead.

2 Aggregate productivity dynamics during the COVID-19 pandemic

The aggregate productivity changes that took place within the euro area during the COVID-19 pandemic were distinct from both the Great Recession and the trend seen in the United States, and also depend heavily on how we define productivity.[3] In 2020, the euro area's GDP per person employed experienced a sharp decline of 4.6% relative to 2019, followed by a partial recovery in 2021. Meanwhile, productivity measured as GDP per hour worked increased during the first year of the pandemic, before dipping slightly in 2021. The decline in productivity per person employed was more severe than during the Great Recession, though productivity per hour worked showed a much more favourable trend. This notable difference can be explained by the existence of government support programmes aimed at protecting jobs by allowing for more flexible working hours. As explained in Section 4 below, the design and objective of the support policies was different in the United States, which may well explain the different trends in employment seen between both regions.

Chart 1

Productivity developments in the EU and the United States



Source: OECD.

The decline in productivity per person employed in the first year of the pandemic was evident across most sectors. The pandemic and containment measures affected contact-intensive services first and foremost, including retail, hotels and restaurants and entertainment activities. The sudden disruption of global supply chains due to the restrictions on maritime transport extended the impact of

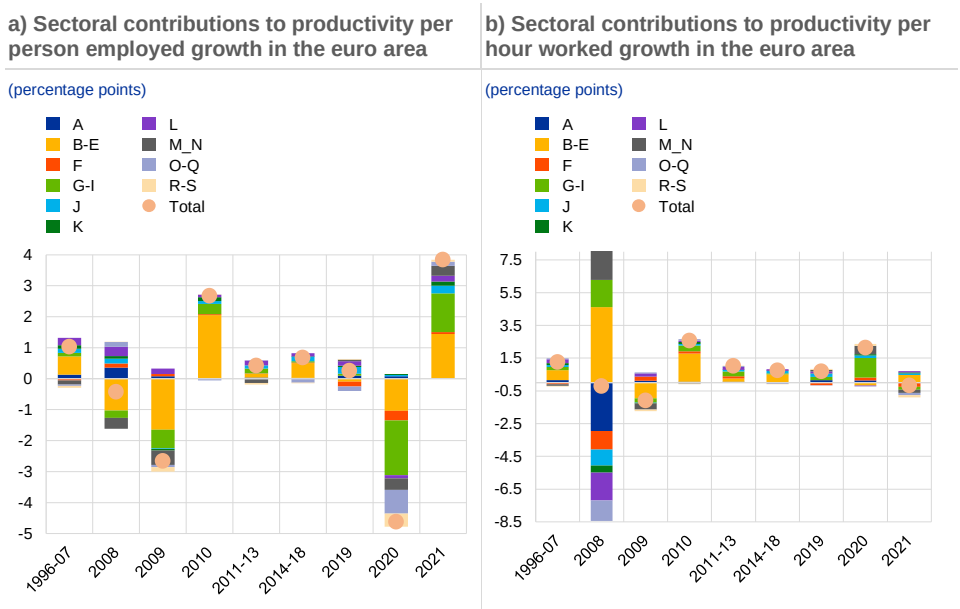
[3] Despite the differences in productivity per person employed and productivity per hour worked, the remaining sections of this report rely predominantly on productivity per person employed due to very limited availability of micro data on productivity per hour worked.

the pandemic to other sectors such as transport and manufacturing. Box 2 discusses empirical evidence from France, employing granular firm-level data, and compares the productivity trend among firms engaged in international trade with those relying solely on the domestic market.

The wholesale and retail sectors, as well as industry and public administration, were the primary drivers of the decline in productivity per person employed in 2020 due to their relatively large contribution to value added and employment (Chart 2). This contrasts with the Great Recession, where industry was largely to blame for the decline in productivity. The developments in the wholesale and retail sectors had the greatest impact on overall productivity growth in most Member States, with Malta, Croatia, and Cyprus – three countries highly dependent on tourism – recording the largest negative contributions from this sector. However, not all countries followed the same trend. Lithuania saw modest positive productivity growth in most sectors, and in Slovakia and the Czech Republic the decline was driven by industry, as a result of the supply disruptions rather than the pandemic itself (see Table A1 in the appendix for individual country trends).

Chart 2

Sectoral decomposition of productivity growth in the EA



Sources: Eurostat and own calculations.
Note: A for Agriculture, forestry and fishing; B-E for Industry (except construction); F for Construction; G-I for Wholesale and retail trade, Transporting, and Accommodation and food service activities; J for Information and communication; K for Financial and insurance activities; L for Real estate activities; M_N for Professional, scientific and technical activities and Administrative and support service activities; O-Q for Public administration and defence, Education, and Human health and social work activities; and R-S for Arts, entertainment and recreation and Other service activities.

In contrast, productivity per hour increased in 2020, driven by the wholesale and retail trade sector and to a lesser extent by the professional services sector, with the remaining sectors having a broadly neutral impact. This was in stark contrast to the situation observed in 2008, when sharp increases in productivity in the industry, wholesale and retail, and professional services sectors were not enough to offset the significant declines reported by the remaining sectors (particularly agriculture, real estate, and construction), resulting in slightly lower

aggregate productivity growth. In the second year of the pandemic, there was a correction in productivity per hour growth within the wholesale and retail sectors, which was not compensated by the moderately positive contribution made by industry. As a result, there was a slight decline in productivity growth. The impact of the wholesale and retail sector on aggregate productivity was far from homogeneous across Member States. In Croatia, Hungary and Cyprus, this sector had a significant negative effect on aggregate productivity growth in 2021. In Slovakia, however, the positive contribution of this sector, along with strong contributions from professional services and public administration, overshadowed the negative contribution made by industry, leading to a significant improvement in aggregate productivity growth (see Table A2 in the appendix for individual country trends).

Box 2
International trade and firm productivity developments during the COVID-19 pandemic

This box investigates the effect of the pandemic on the productivity of firms involved in international trade compared with domestic firms. The pandemic resulted in domestic and international shocks to both demand and supply, meaning that firms engaged in international trade were exposed to international shocks on top of the domestic shocks: negative supply shocks resulting in shortages of intermediate inputs for the importing firms, and foreign demand shocks for the exporting firms. As both importers and exporters, firms involved in global value chains (GVCs) faced these two additional challenges in tandem. At the same time, empirical studies have shown that firms engaged in international trade tend to be larger and more productive than domestic firms within the same industry (Bernard and Jensen 1995, 1999; Mayer and Ottaviano, 2007). Therefore, understanding their performance during the COVID-19 pandemic is key to assessing and comprehending aggregate productivity developments.

The analysis presented in this box follows up on the expanding literature regarding the effect of the COVID-19 pandemic on the performance of firms engaged in international trade. Focusing on French firms, Bricongne et al. (2022) show the predominant role played by a few large incumbent exporters in driving the trade collapse recorded towards the start of the pandemic (April/May 2020). Brussevich et al. (2022) confirmed that the adjustment largely took place along the intensive margin, while also showing that the COVID-19 shock spread rapidly along the supply chain in 2020. Relying on micro data at firm-product-partner country level for the universe of French exporters, Lebastard et al. (2023) provide an analysis of the impact of the pandemic on firm performance, including the impact of supply bottlenecks that occurred in 2021, when disruptions along value chains were historically high. They find that participation in GVCs increased firms' vulnerability during the pandemic, in terms of both export performance and probability of survival in the export market, with the negative impact of disruptions being stronger for those firms with relatively lower productivity prior to the pandemic.

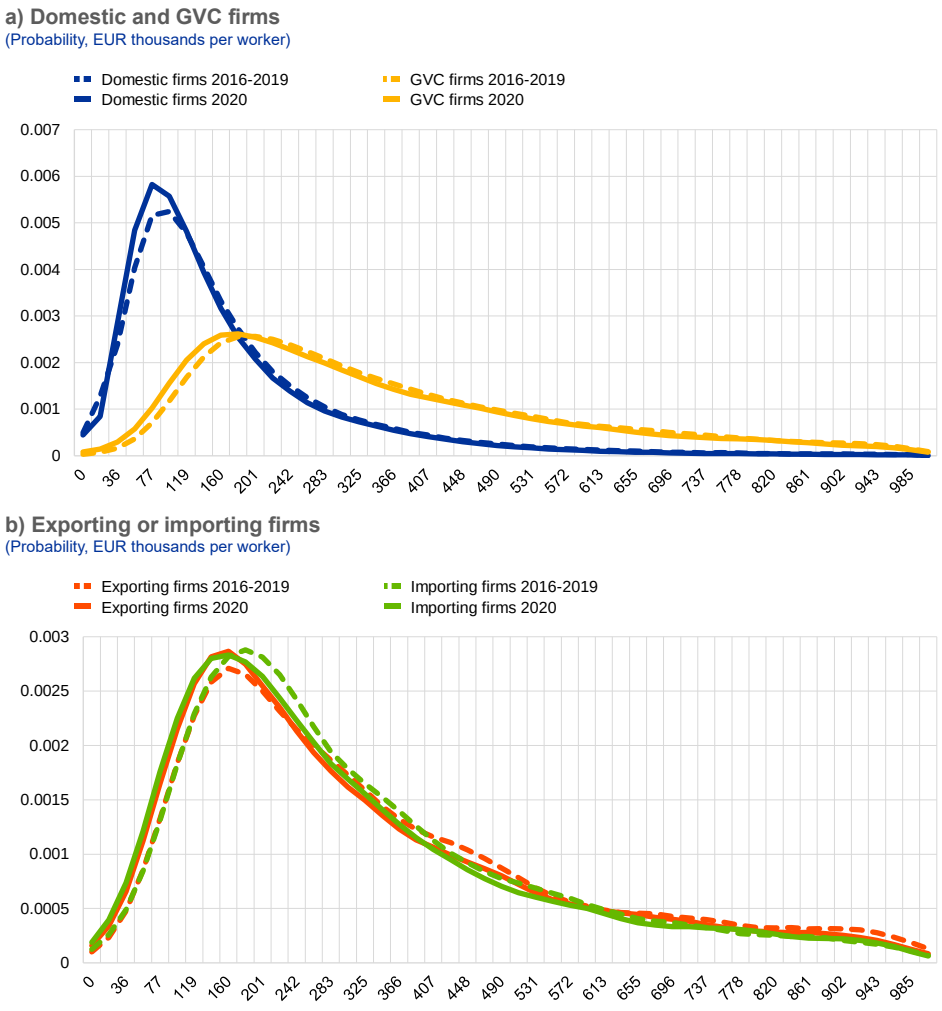
The findings presented here employ granular data on French firms. Our database covers the full universe of French firms between 2016 and 2020, matching the annual balance sheet data produced by the French National Institute of Statistics and Economic Studies (INSEE)[4] with customs data produced by the Directorate-General of Customs and Indirect Taxes (DGDDI). Our sample includes those firms which can be observed in both 2019 and 2020. Our results should

[4] Access to firm-level confidential data from France has been made possible within a secure environment offered by CASD – Centre d'accès sécurisé aux données (Ref. 10.34724/CASD).

therefore be interpreted as conditional on the survival of the firms in 2020. To ensure a clean exporter and importer status, we drop occasional importers and exporters from our sample, meaning those firms that do not trade every year. GVC firms are defined as firms that both import and export. Productivity is defined as the ratio of total sales to the number of employees.

Chart A

Productivity distribution by trade status



Sources: Direction générale des douanes et droits indirects, INSEE and authors' own calculations.
Notes: Kernel density estimation. Productivity bonded to 1,000 due to very skewed distribution (especially for GVC firms).

Our data show that firms involved in international trade experienced higher productivity losses during the pandemic than domestic firms. While productivity is highly heterogeneous across firms depending on their trade status, all groups (domestic firms, exporters, importers and two-way traders) experienced a productivity decline after the pandemic broke out. As widely documented in the empirical literature, our data confirm that domestic firms tend to be less productive than GVC firms, with a very skewed productivity distribution to the left (Chart A, panel a). At the other end of the spectrum, GVC firms are the most productive firms, with a very fat and long right-hand tail, while firms that only export or import display similar distributions to the picture for GVC firms (Chart A, panel b). The productivity of all four groups deteriorated during the pandemic, particularly in the lower part of the distribution, with the losses being higher for those firms involved in international trade.

To test the significance of the observed difference in productivity losses between domestic firms and firms involved in international trade, we estimate a difference-in-differences model. The regression is as follows:

$$\log Prod_{i,t} = \beta_1 GVC_i \times COVID19_t + \beta_2 Exporter_i \times COVID19_t + \beta_3 Importer_i \times COVID19_t + FE_i + FE_t + \varepsilon_{i,t}$$

Where $\log Prod_{i,t}$ is the productivity log of firm i at time t; GVC_i is a dummy variable that takes the value 1 if firm i is involved in a GVC (i.e. if it is both an importer and an exporter); $Exporter_i$ is the dummy for firms that only export; and $Importer_i$ is for firms that only import. $COVID19_t$ is a dummy variable that takes the value 1 for the year 2020. FE_i and FE_t are firm-fixed and time-fixed effects respectively. We add firm-fixed effects to control, among other factors, for the size of firms and the initial difference in productivity across groups. In the same vein, we include time-fixed effects to control for business fluctuations. The results of the equation are presented in Table A, column 1.

Table A

Determinants of productivity comparing domestic firms and firms involved in international trade

(Difference-in-differences regression)

VARIABLE	(1) Productivity	(2) Sales	(3) Employees
$GVC_i \times COVID19_t$	-0.0618***	-0.136***	-0.0325***
	(0.00281)	(0.00258)	(0.00265)
$Exporter_i \times COVID19_t$	-0.0598***	-0.125***	-0.0294***
	(0.00724)	(0.00621)	(0.00603)
$Importer_i \times COVID19_t$	-0.0517***	-0.109***	-0.0226***
	(0.00441)	(0.00411)	(0.00401)
Constant	4.956***	6.031***	1.146***
	(2.52e-05)	(2.21e-05)	(2.30e-05)
Observations	4,158,472	4,362,905	4,183,406
R-squared	0.788	0.909	0.920
Firm FE	YES	YES	YES
Time FE	YES	YES	YES

Notes: Robust standard errors in parentheses. Significance at *** p<0.01, ** p<0.05, * p<0.1. The title of each column is the dependent variable, in logarithm. The control group is domestic firms.

The empirical results shown in this box reveal that GVC firms are the most affected by the pandemic, seeing as though firms involved in international trade saw a relatively sharp decline in their productivity after the pandemic broke out. Table A, column 1 shows a negative and significant effect of the pandemic on productivity among all firms trading internationally. The finding that GVC firms are the most negatively affected (-6.2%) is intuitive as they were exposed to the same shock as importers (supply bottlenecks) and exporters (drop in foreign demand), both being negative and significant (-5.2 and 6.0% respectively).[5] Column 2 tests the effect of the pandemic on sales, and column 3 on the number of employees, with the ratio of the two serving as our productivity variable. The productivity loss observed in column 1 is the result of a contraction in both total sales and employment. The negative reaction is much higher for sales than for employment, suggesting that the job retention schemes introduced during the pandemic may have limited its negative effect on employment.

A shift-share analysis shows that the contraction of productivity per employee during the first year of the pandemic was driven by high- and low-contact sectors and, to a much lesser extent, by cross-sector reallocation of resources.[6] The negative impact of the pandemic on growth in productivity per employee peaked in the second quarter of 2020, with sectors less exposed to the pandemic contributing roughly 60% to the 11.6% year-on-year decline in productivity per employee (Chart 3, panel a). With labour reallocation across sectors playing a negligible role, the contribution of higher-contact services was more significant than their share in value added and employment. During the second half of 2020, higher-contact services continued to have a negative impact on aggregate productivity growth. While productivity growth resumed in the second year of the pandemic (with both higher-contact services and remaining sectors contributing), productivity per person employed did not fully recover.

In contrast, the increase in productivity per hour worked was driven by within-sector productivity gains in the less exposed sectors, and also by significantly increased reallocation of resources across sectors. The between-sector reallocation of resources contributes on average very little, if not negatively, to aggregate productivity growth (see Modery et al., 2021). However, the sharp contraction of hours worked in high-contact services, traditionally including low-productivity activities, and the expansion of high-productivity sectors such as ICT, resulted in a positive and sizeable contribution of cross-sector reallocation of

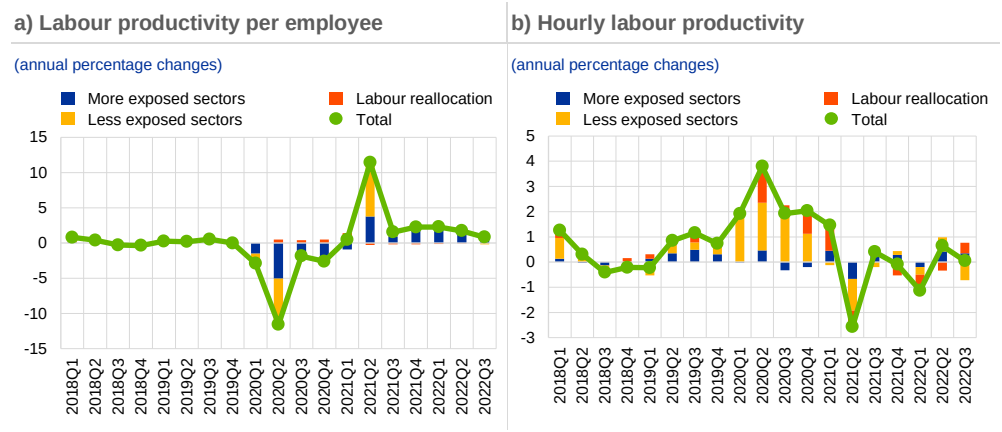
5 These results are robust to the inclusion of occasional exporters as part of the control group, different definitions of exporter, importer and GVC status (exporting/importing three or four years in the period 2016-2019 or exporting/importing at least in 2019), keeping the firms that appear in the database every year between 2016 and 2020, and finally decreasing the period study to 2017-2020, 2018-2020 and 2019-2020.

6 Following McMillan and Rodrik (2011), we decompose aggregate labour productivity growth into growth originating from within economic sectors and labour reallocation between sectors. This can be described with the following equation: $\Delta Y_t = \sum_{i=1}^{n} \theta_{i,t-k} \Delta y_{i,t} + \sum_{i=1}^{n} y_{i,t} \Delta \theta_{i,t}$, where Y_t and $y_{i,t}$ refer to aggregate and sector-specific labour productivity levels respectively and $\theta_{i,t}$ denotes the employment share of sector i. The Δ operator corresponds to change in productivity or employment shares between periods t and $t-k$. Thus, the first term of the equation captures the growth in productivity originating from within the sectors, while the second term represents labour reallocation. Furthermore, the within-sector component can be decomposed into sectors less exposed to the COVID-19 shock and sectors with higher-contact services. The latter include the following sectors under the NACE classification: Wholesale and retail trade; Repair of motor vehicles and motorcycles (code G in the NACE classification), Transportation and storage (H), Accommodation and food service activities (I), Arts, entertainment and recreation (R); and Other activities (S-U).

resources in 2020, amounting to one-third of aggregate productivity growth in 2020 Q2 (Chart 3, panel b). As high-contact services reopened, the contribution of the between-sector reallocation slowly declined and converged towards historical averages.

Chart 3

EA productivity developments in more and less exposed sectors

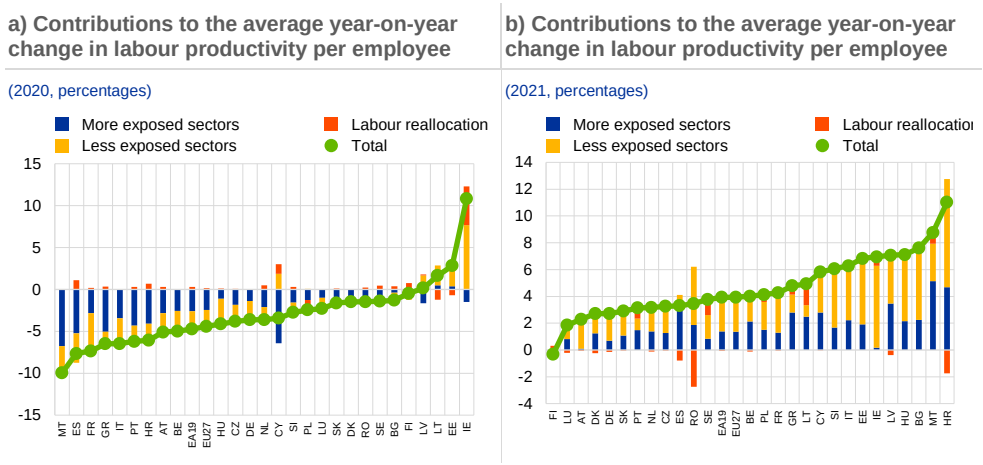


Sources: Eurostat and own calculations.
Note: See footnote 5 for details of the decomposition and the definition of more exposed sectors.

Productivity per person employed in most EU member countries followed the same trends as those observed in the euro area, with some notable exceptions. Ireland, Estonia and Lithuania saw an improvement in their productivity during the first year of the pandemic (Chart 4, panel a). The growth in Irish productivity was driven by sectors less exposed to the pandemic and, to a lesser but overall significant extent, by a reallocation of labour between sectors. Higher-contact services had a negative impact. In the case of Estonia and Lithuania, modest productivity growth was largely driven by sectors less exposed to the pandemic, while labour reallocation had a negative impact. In 2021, all EU Member States, with the exception of Finland, saw positive productivity growth when measured per person employed (Chart 4, panel b). Both higher-contact services and remaining sectors contributed to this growth, though the extent of their contribution varied across countries. Of particular note is the relatively significant positive contribution made by labour reallocation in Lithuania and Sweden, compared to a negative contribution in Romania and Croatia.

Chart 4

Growth in productivity per employee by country

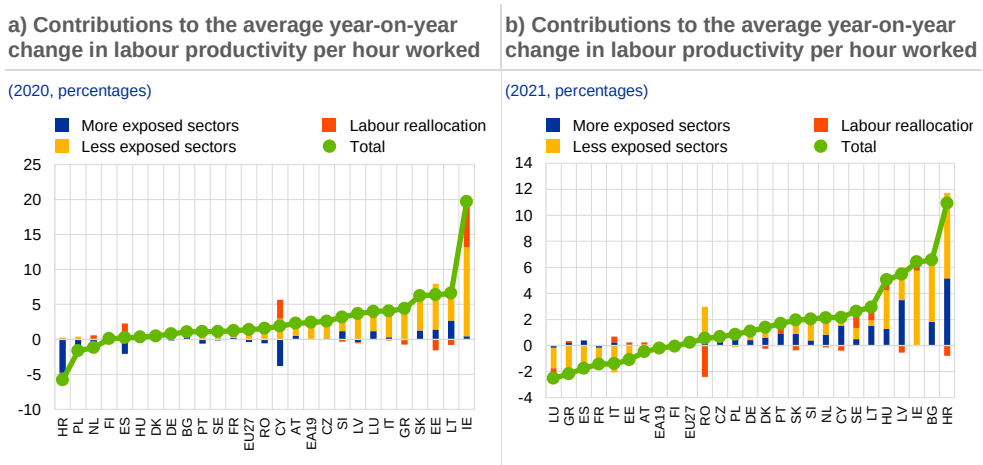


Sources: Eurostat and own calculations.
Note: See footnote 5 for details of the decomposition and the definition of more exposed sectors.

Country-specific developments in productivity per hour worked were more heterogeneous than those relating to productivity per person employed. However, it can be concluded that positive aggregate developments across countries were largely driven by sectors less affected by the pandemic and, in some cases, aided by labour reallocation (e.g. Ireland, Cyprus and Spain). Conversely, the decline in aggregate productivity seen in Croatia, Poland and the Netherlands was predominantly driven by higher-contact services. Lastly, while aggregate productivity in the euro area dipped slightly in the second year of the pandemic (mainly due to sectors less affected by the pandemic), the developments across the EU were highly heterogeneous in terms of aggregate productivity and the factors contributing to it.

Chart 5

Growth in productivity per hour worked by country



Sources: Eurostat and own calculations.

In summary, pandemic productivity dynamics in the euro area, affected by the extensive policy measures put in place to support employment, differed from the

dynamics seen during the Great Recession and depend also on the way productivity is measured (by employee or by hour worked). Trends in the euro area were also distinct from those that took place in the United States, as both regions had different objectives and designed their policy support in different ways. Euro area productivity per hour worked increased temporarily due to within-sector productivity gains in the less exposed sectors, though also due to significant productivity-enhancing reallocation of resources across sectors, which is in contrast to historical patterns. However, productivity per employee dropped significantly during the first year of the pandemic, driven by the changes that took place in both high- and low-contact sectors and, marginally, by cross-sector reallocation of resources.

3 Productivity impacts in the short run

This section analyses the short- and medium-term impacts of the COVID-19 pandemic and containment measures on resource reallocation through firm entry and exit (Section 3.1) and across incumbent firms (Section 3.2), focusing on productivity-enhancing reallocation.

3.1 Reallocation of resources through entry and exit of firms

The concept of creative destruction, first mentioned by Schumpeter, accounts for the process whereby new, more innovative firms displace obsolete firms:

"As a matter of fact, capitalist economy is not and cannot be stationary. Nor is it merely expanding in a steady manner. It is incessantly being revolutionized from within by new enterprise, i.e., by the intrusion of new commodities or new methods of production or new commercial opportunities into the industrial structure as it exists at any moment," Joseph A. Schumpeter (2013), *Capitalism, Socialism and Democracy*, p. 31, Routledge.

The contribution of entry to aggregate productivity growth takes time to materialise, as a product of selection and learning. New firms are, on average, less productive than incumbents in their market of activity. Hence the short-term impact of entry on aggregate productivity growth tends to be negative, but turns positive over time as a result of selection and learning. Following market entry, only the most productive new firms survive the first few years of operation, in what is known as the "selection effect" in the literature (Jovanovic, 1982).[7] The productivity of surviving firms grows quickly thereafter to catch up with the average productivity of incumbents in the sector (known as the "learning effect"). Few of these new firms will bring innovations to the market and will push the technology frontier outward, either directly or indirectly by forcing incumbents to innovate to maintain their market shares.[8]

Firm exit contributes to aggregate productivity growth in the short term to the extent that exitors are less productive than incumbents. The survival of less productive firms might also affect productivity growth indirectly if it creates congestion effects whereby viable firms are no longer able to access available resources (capital and labour).[9]

The process of firm churning might accelerate during busts. Since Caballero and Hammour (1996), the literature has been referring to the enhanced creative destruction process during crises as the "cleansing effect", which provides a silver

7 The analysis provided in Modery et al. (2021) shows that about one third of firms in the euro area exit before competing three years of activity.

8 See Criscuolo, Nicolau and Salter (2012), Acemoglu et al. (2018), and Modery et al. (2021).

9 See Valderrama et al. (2023), where the authors analyse the congestion effects created by the survival of the so-called "zombies".

lining of sorts to otherwise economically painful periods. Foster, Grim and Haltiwanger (2016) review many of the arguments behind the cyclicality of resource reallocation through the intensive and extensive margin, finding that it is less costly in downturns, although some distortions and policies may make it more costly.

The unprecedented magnitude of policy support for the euro area corporate sector during the COVID-19 pandemic raises the question of whether such support might have dampened the cleansing effect of crises, with a potential impact on aggregate productivity growth over the medium term. This sub-section uses recently available granular data covering the first year of the pandemic, 2020, as well as other aggregate and sectoral data sourced from the OECD and Eurostat to analyse the productivity-enhancing impact of firm entry and exit during COVID-19 and also in relation to other major crises.

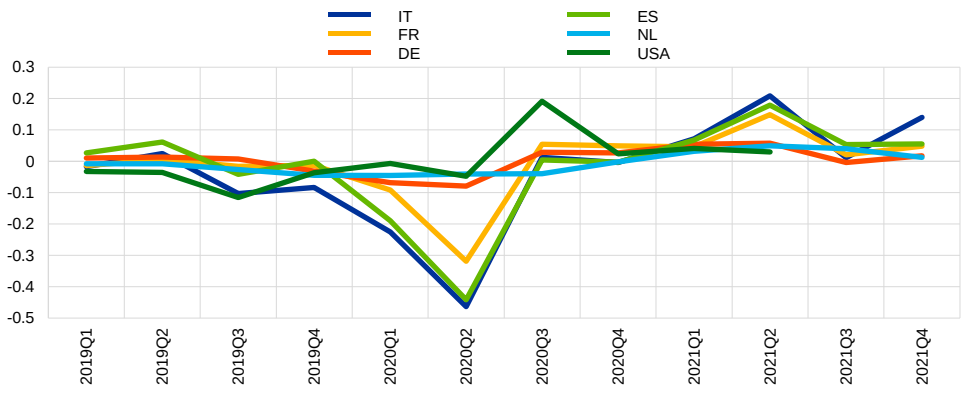
3.1.1 Firm entry and exit during COVID-19

At the onset of the COVID-19 pandemic, firm entry declined significantly among euro area countries compared to the pre-crisis trend, based on available data. Lags in firm-level administrative data are particularly noticeable when dealing with entries, as firms might start filing their financial accounts years after entry or, in some countries, only upon reaching a certain employment or revenue threshold. For these reasons, there is still scarce information about dynamics of entry during COVID-19, so most of the analysis of this sub-section will focus on exit instead. The scant information we have so far on entry stems from surveys (Box 3 shows a case study based on timely survey data from Spain) and quarterly data on firm dynamics, available for relatively few euro area countries and the United States, as shown in Chart 6. The countries where entry declined more abruptly – Spain, Italy and France – are also those with the strictest lockdowns, which might have affected the entry of firms in the market.

Chart 6

Firm entry dynamics during the COVID-19 pandemic

(Percentage deviation to the trend)

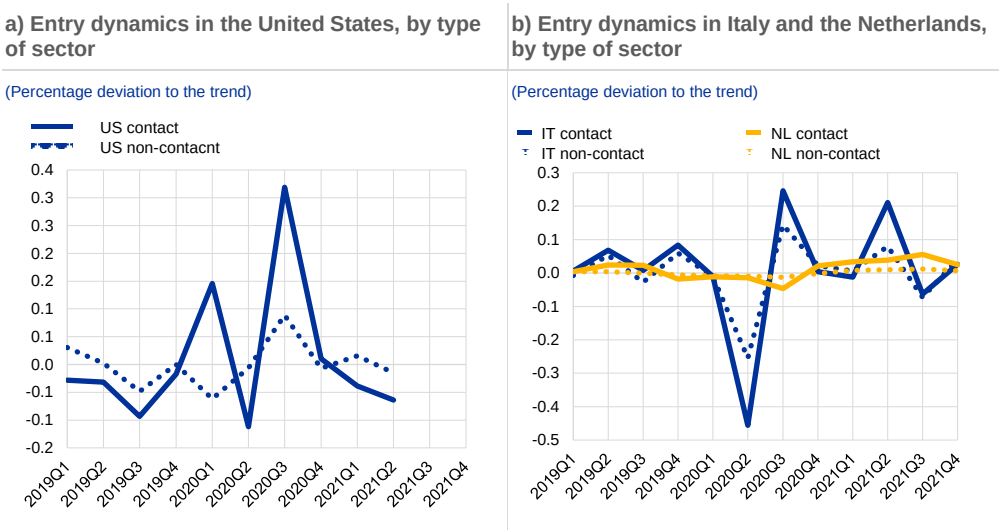


Source: Own calculations on OECD timely indicators of entrepreneurship.
Notes: Detrending allows us to isolate the cyclical components of entry. Trend calculated over the period Y.

In contrast, firm entry surged in the United States during the second half of 2020. Chart 7, panel a) shows that the surge in entry was driven by start-ups in the contact-intensive sectors, which is in stark contrast to the trend seen the two euro area countries with sector information (Chart 7, panel b). Unfortunately, it is still too early to properly understand the reasons for this discrepancy. It could be related to the creation of new demand for online solutions, and the readiness of firms in the United States to enter the market to serve such demand. It could also relate to the nature of policy support in the United States, which targeted households rather than firms and which could have affected the number of self-employed (see Section 4 for a description of the fiscal measures in the euro area and in the United States). Findings from a survey conducted in Spain in 2020 and reported in Box 3 below seem to favour the first hypothesis, highlighting the superior readiness of US firms to serve increasing online demands.

Chart 7

Firm entry dynamics by sector



Source: Own calculations on OECD timely indicators of entrepreneurship.

Turning to exit, both aggregate and sector data show that significantly fewer firms exited the market during the first year of the pandemic when compared to previous crises. Eurostat annual data show that the exit ratio in 2020 increased only in the Netherlands among the large euro area countries, while flattening or even decreasing in the case of the other countries (Chart 8). The muted cyclicality of exits during COVID-19 is confirmed by a regression analysis using sector data, as shown in Table 1, where the dependent variable is the exit rate in a given country-sector-year, and the main regressor is sector value added growth. The regression results show that, on average, the exit rate of firms increases by 0.03 percentage points per every percentage point drop in sector value added growth. However, during the first year of COVID-19, the elasticity of exits to value added dropped by two thirds.

Chart 8
Firm exit rates

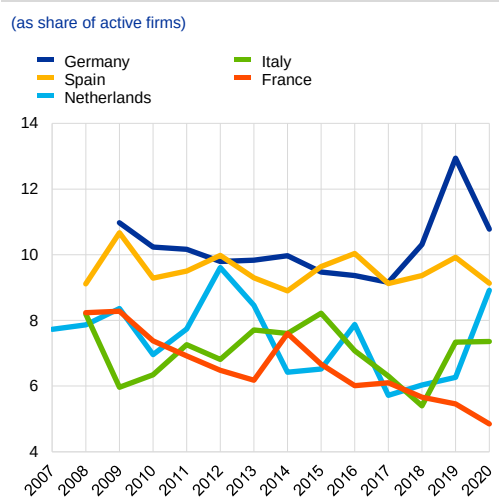


Table 1
Elasticity of exit to value added growth

Regressor	Exit rate
VA growth *Covid	0.0239**
	(0.00927)
VA growth	-0.0309***
	(0.0104)
Covid	-0.490*
	(0.271)
Observations	3,209
R-squared	0.571
Sector FE	YES
Country FE	YES
Year FE	YES
Mean exit rate	0.068
Mean VA growth	0.017

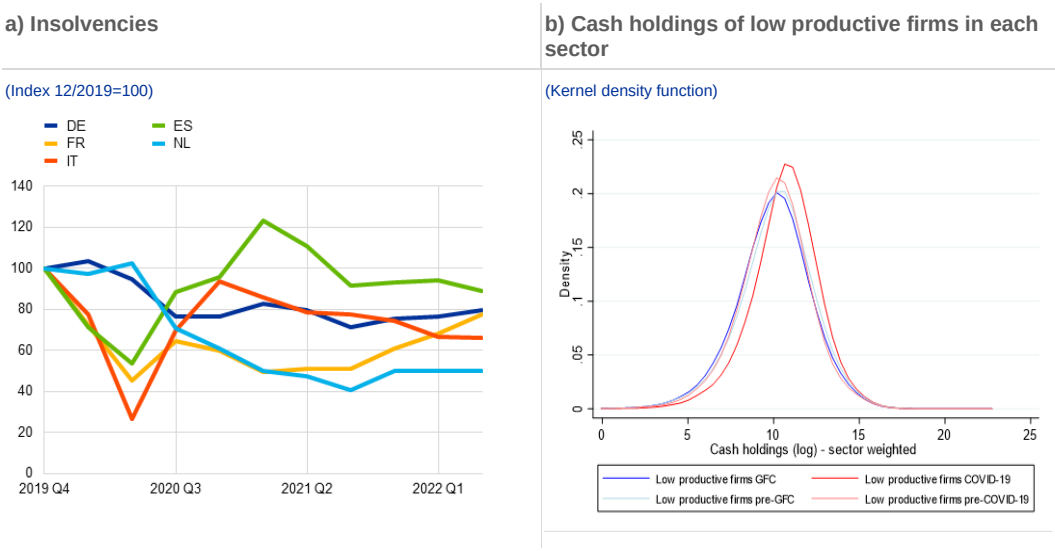
Source: Own calculations based on Eurostat.
Notes: Table 1 presents the results of an OLS regression with sector, country, and year fixed effects, using data from Germany, Spain, France, Italy and the Netherlands over the period 2004-2020 and 50 two-digit sectors. Errors are clustered at the sector level.

The freeze on insolvencies and massive liquidity support for businesses could well explain the drop in firm exits during a period of steep decline in GDP growth. The freeze on insolvencies was either the result of a policy decision to prevent a wave of bankruptcies, or of administrative difficulties in processing bankruptcies during the worst of the lockdowns. Whatever the reason, Eurostat data show that insolvencies dropped by 70% in the second quarter of 2020 relative to December 2019 in Italy, by about 50% in France and Spain, and by 2% in Germany (Chart 9, panel a). Another possible reason for the abnormal trend in the exit rate over the COVID-19 period is the large holdings of cash in the hands of corporates. Chart 9, panel b) shows that liquidity holdings among relatively less productive firms (defined as the bottom half of the productivity distribution in each sector) were significantly larger during the first year of the COVID-19 pandemic than during the Global Financial Crisis (GFC).

The large cash holdings of relatively less productive firms in 2020 was the result of extensive policy support to the corporate sector. The observed large cash holdings of (low productive) corporates could be the result of years of under-investment prior to the pandemic, or otherwise the result of the government support. To discriminate between these two possibilities, Chart 9, panel b) shows the cash holding distribution of the less productive firms in each sector the year before the GFC and the COVID-19 crisis (in light blue and red respectively). If the large cash holdings of the less productive firms were the result of severe under-investment during the previous years, both the distribution in 2019 and in 2020 would be shifted to the right. However, this is not the case, suggesting that supporting policies may have played a role.

Chart 9

Firm financial situation during the pandemic



Sources: Own calculations based on Eurostat; own calculations based on Orbis.
Notes: Firm-level data include information for Germany, France, Italy, Spain, Belgium and Portugal. GFC is defined as years 2008-09 and COVID-19 refers to 2020. Sector-specific distributions have been aggregated using sector value added weights.

Box 3

Entrepreneurship in Spain during COVID-19

This box presents the results of the study conducted by Albert et al. (2022), focusing on the impact that COVID-19 had on entrepreneurship in Spain. The COVID-19 crisis caused significant income losses among affected households, and the high level of prevailing uncertainty made it harder for entrepreneurs to secure bank loans. Despite the prompt policy measures rolled out to support incumbent firms hit by the shock, such as furlough schemes, guaranteed loans or moratoria, government support for those looking to set up new business was more lacklustre and took longer to arrive.[10] Since start-ups play a key role in terms of job creation, innovation and long-term growth, the lack of firm creation can hinder the recovery and future growth, essentially creating a missing generation of firms. In this paper, the authors provide an in-depth analysis of a relatively recent extensive survey on the entrepreneurial attitudes and decisions of more than 24,000 households (the 2020 wave of the Global Entrepreneurship Monitor – GEM – survey for Spain). The data is representative of the whole adult population of Spain, and rich and detailed enough to disentangle the main drivers of firm creation during COVID-19 while controlling for individual characteristics. This survey has been conducted (as a repeated cross-section) since 1999, thus allowing the authors to compare their findings to the characteristics of firm entry during the Great Recession of 2008-2010.

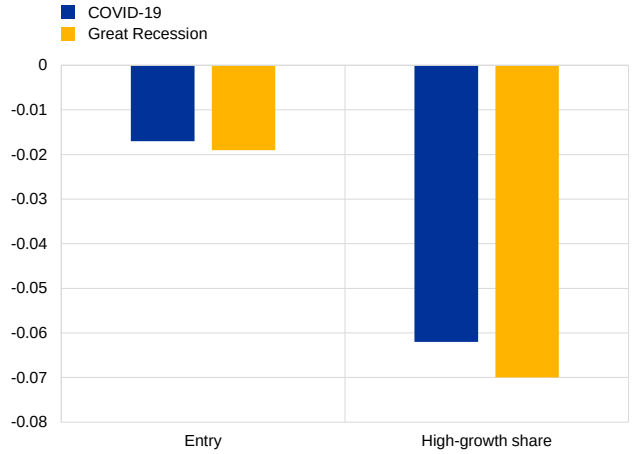
The main findings are as follows. First, controlling for population characteristics (age, gender, income and education), the overall decline in the start-up rate during the 2020 COVID-19 recession was large and of a similar magnitude to the decline seen over the years of the Great Recession

10 At the beginning of the COVID-19 crisis, policy measures typically did not target start-ups specifically, and many liquidity relief measures were not accessible to early-stage entrepreneurs or new firms because of their eligibility criteria. While countries like Germany, France or Italy would subsequently introduce dedicated start-up packages, other countries like Spain never got around to it. See OECD (2021a) for further information about policy support for start-ups in OECD countries.

(Chart A). Entry declined by approximately 40% with respect to the long-term average entry rate (1.7 pp). The decline in firm entry was more concentrated among start-ups with high growth potential, as also happened during the Great Recession.[11]

Chart A

Changes in entrepreneurship, COVID-19 vs Great Recession



Notes: The graph depicts changes in the probability of starting a firm during COVID-19 and the Great recession; and conditional on starting a firm, the probability of starting a high-growth firm. Coefficients from an OLS regression – see Table 1, columns (1) and (2) of Albert et al. (2022) for more details on the exact specification and regression outcomes.

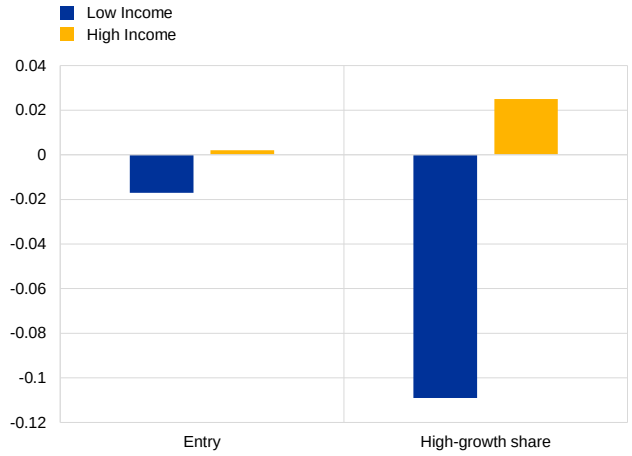
Second, during 2020, the drop in firm entry was entirely concentrated among low- and medium-income households (Chart B). There was no reduction in entry among high-income households (defined as the top tercile income group). Furthermore, the changes seen in entry composition towards low-growth firms only occur among low- and medium-income households, but increase among high-income households.[12] This entrepreneurship gap is not a direct result of social distancing, as it is mostly driven by the sectors not directly affected by the lockdown measures, and it is more pronounced among households that did not suffer a negative income shock during the pandemic. A surge in necessity entrepreneurs as the source of these differences in entrepreneurship between low- and high-income households can also be ruled out.

11 Furthermore, a preliminary analysis of the 2021 GEM survey shows that there was no "catching-up" during 2021 for low- and medium-income households, while there was still a positive effect for high-income households, which was around half as large as that of 2020.

12 These results hold when controlling for education and age interacted with the recession dummies.

Chart B

Changes in entrepreneurship during COVID-19, by income

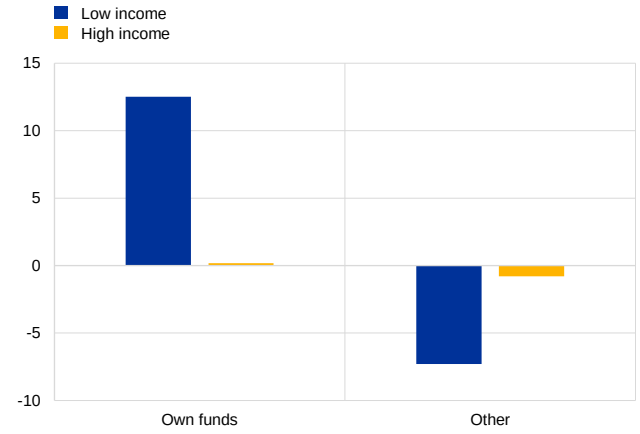


Notes: The graph depicts the changes in the probability of starting a firm during COVID-19 for high-income (highest tercile of income) and low-income (all other) households; and, conditional on starting a firm, the probability of starting a high-growth firm. Coefficients from an OLS regression – see Table 2, columns (1) and (2) of Albert et al. (2022) for more details on the exact specification and regression outcomes.

Third, a consequent exploration of differences in financing as a potential mechanism explaining this entrepreneurship gap during COVID-19 reveals that start-ups from low/middle-income households greatly increased the use of their own savings (relative to other sources), while the same increase is not observed for high-income households (Chart C). This finding is consistent with a tightening of financial conditions (in line with the findings of Ferrando and Ganoulis, 2020), suggesting that financial frictions have an important role to play in explaining the different performances of entrepreneurs along the income distribution.

Chart C

Changes in sources of funding during COVID-19, by income



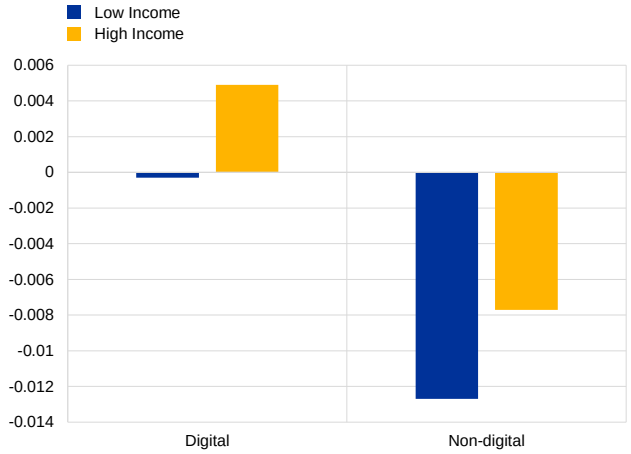
Notes: The graph depicts the changes in the percentage of funds originating from the source indicated: own funds (private savings), and other (which includes family savings, friends, subsidies, investors and crowdfunding), for high-income (highest tercile of income) and low-income (all other) households. The coefficient on bank funding is not depicted in the graph because it is not statistically significant. The coefficients are the second-stage results of a Heckman selection model – see Table 3, columns (4) and (6) of Albert et al. (2022) for more details on the exact specification and regression outcomes.

Last but not least, detailed information obtained from the GEM survey has been used to identify whether the COVID-19 recession created new opportunities for digital and internet businesses and whether these opportunities were taken proportionally among households. The findings show that

the fraction of digital businesses increased during COVID-19, and that this increase was entirely driven by high-income households (Chart D), among which a 70% increase in digital start-ups (relative to the 2011-2019 period) was observed.

Chart D

Changes in type of start-up founded during COVID-19, by income



Notes: The graph depicts the changes in the probability of starting a digital and non-digital firm during COVID-19 for high-income (highest tercile of income) and low-income (all other) households. Coefficients from an OLS regression – see Table 5, columns (2) and (4) of Albert et al. (2022) for more details on the exact specification and regression outcomes.

In a nutshell, Albert et al. (2022) show that the COVID-19 pandemic negatively affected the entrepreneurship decision, predominantly decisions made by low-income individuals. The pandemic also shifted the entry composition towards low-growth start-ups. This "missing generation" of firms might have long-term scarring effects on employment growth: the authors estimate that levels of employment among the 2020 cohort of firms is expected to be 2.4% smaller after 10 years. The evidence points to financial frictions being behind the different behaviour of low- and high-income individuals, and suggests that high-income individuals were better prepared to seize the new opportunities arising from COVID-19 by starting up more digital businesses. Overall, policymakers would do well to take the impact of shocks on entrepreneurship seriously, in view of the results presented in this box: support measures for incumbent firms should be accompanied by measures that aim to reduce the cost of credit for new potential entrepreneurs, especially those with low income.

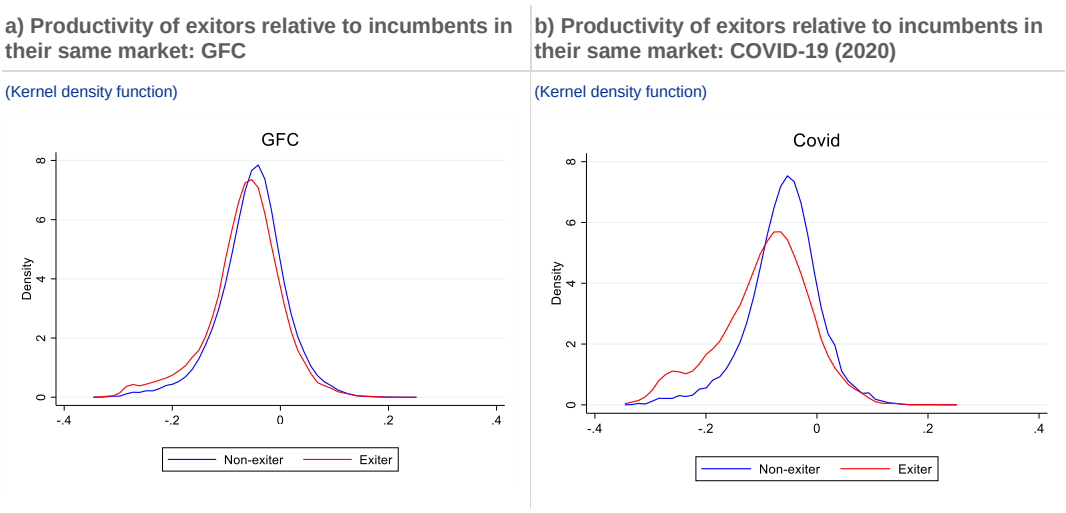
3.1.2 Did firm exit have a cleansing effect during the COVID-19 pandemic?

Only the less productive firms exited the market during the first year of the COVID-19 pandemic; however, the productivity threshold below which firms exit the market was lower than during the GFC. Chart 10 shows the Kernel density function of firm-level labour productivity, defined as real value added per employee, during the GFC and COVID-19 pandemic respectively, distinguishing between exitors (red line) and incumbents in their same market (blue line). It becomes apparent that while the productivity distribution of incumbents was similar during both crises, the distribution of productivity of exitors during COVID-19 was

clearly shifted to the left. This means that during the first year of the COVID-19 pandemic, only the less productive firms exited the market, which is consistent with a cleansing effect and ultimately positive for aggregate productivity growth. However, the fact that the shift of the distribution is much larger during COVID-19 signals that the productivity threshold to exit the market declined; in other words, firms with low productivity that would not have survived the GFC managed to survive during COVID-19. The reason for that shift in threshold can be traced back to Chart 9, which shows that firms below the median productivity level during COVID-19 had a better liquidity position relative to the GFC.

Chart 10

Productivity of firms exiting during GFC and COVID-19 pandemic



Source: Own calculations based on Orbis.
Notes: Data refer to Germany, France, Italy, Spain, Belgium and Portugal. GFC is defined as years 2008-09 and COVID-19 as year 2020. Labour productivity is defined as real value added of the firm divided by employees.

The lower probability of exit among less productive firms is confirmed through a regression analysis using firm-level data. Table 2 shows the results of a probit regression where the dependent variable takes the value 1 if the firm exited the market in a given year and 0 if it stayed. The main regressor is the lagged productivity of the firm relative to the average productivity of firms operating in the same country-sector-year (that is, in the same market). Following Foster et al. (2016), we interact the relative productivity of the firm with an indicator of economic crisis to analyse whether less productive firms have higher probability of exit during busts. We then test whether the cyclical properties of exit were any different during the first year of the COVID-19 pandemic. The results show that firms with productivity one standard deviation below the market average have a 6.3% higher probability of exit, increasing to 10% in a crisis. However, during COVID-19 the probability of exit of a relatively less productive firm was below that of other crises, and even below that in normal times (about 5% higher probability of exit than the average firm in the market).

Table 2

Probability of exit among less productive firms during the COVID-19 pandemic

(marginal effects)

Regressors	Exit
L. Productivity	-0.0634*** (0.0024)
L. Productivity * crisis	-0.0359*** (0.0016)
L. Productivity * crisis * covid	0,0593*** (0.0152)
Observations	11,267,835
Firm size class	YES
Sector FE	YES
Country FE	YES
Year FE	YES

Source: Own calculations based on ORBIS.
Notes: Pooled data for DE, ES, FR and IT from 2003 to 2020. Probit regression where the dependent variable is 1 if the firm exits and 0 if it stays in the market. Productivity is measured in % deviation to the average productivity in the country-sector-year of the firm. All single and double interaction terms are included in the regression but omitted for clarity. Firm controls include the age, size and liquidity ratio of the firm. Sector controls include the sector value added growth. Firm, sector, country and year fixed effects are included.

Overall, we find that the entry of firms dropped substantially during the first year of the COVID-19 pandemic in the euro area, which is in sharp contrast to developments in the United States. This drop in start-ups could have repercussions for productivity growth over the medium term, as shown in Box 3. Regarding exits, this section finds that: 1) fewer firms exited during the COVID-19-induced crisis relative to other crises; 2) firms that exited were relatively less productive than those that survived, and therefore the cleansing effect of the crisis was not severely distorted; 3) the probability of exit of a firm one standard deviation below average productivity was significantly lower than during other busts, and even below the probability of exit during normal times. This might be down to the large cash holdings in the hands of the corporate sector, which could in turn be traced back to the ample government support handed out.

3.2 Reallocation of resources across incumbents in the same sector

Despite the extensive policy support to sustain employment during the COVID-19 pandemic, incumbent firms recorded a drop in the number of employees. The micro-aggregated figures show that in response to the COVID-19 economic shock, incumbent firms saw a reduction in levels of employment across all countries analysed and switched from job creation to job destruction between the years 2019 and 2020.[13]

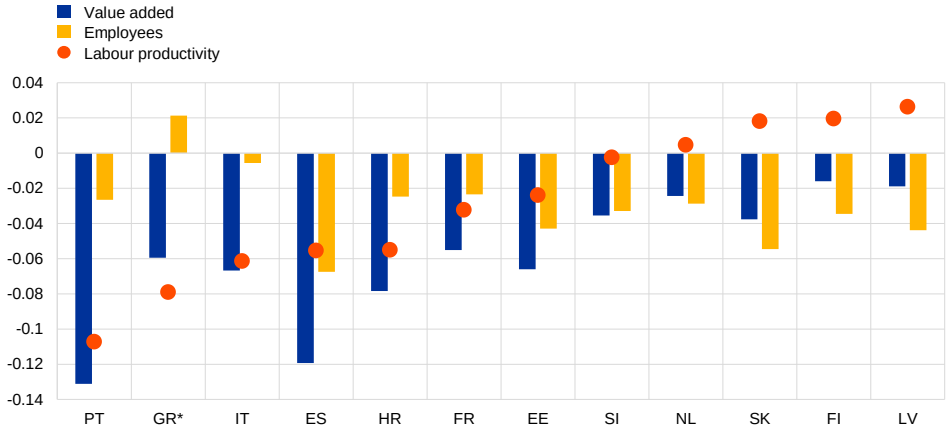
Employment adjustments were frequently smaller than the drop in value added and as a result labour productivity per employee dropped. All countries

[13] The different employment developments in Greece may be affected by the limited sample size.

witnessed negative average firm-level value added growth in the first year of the pandemic. Micro-aggregated labour productivity growth, measured in terms of employees, among continuing firms ranged from -10.7% to 2.6%. The intensive margin of the productivity growth remained positive in only four countries, where the average reduction in firm employment exceeded the year-on-year drop in value added.

Chart 11

Annual growth in productivity per employee among continuing firms in 2020

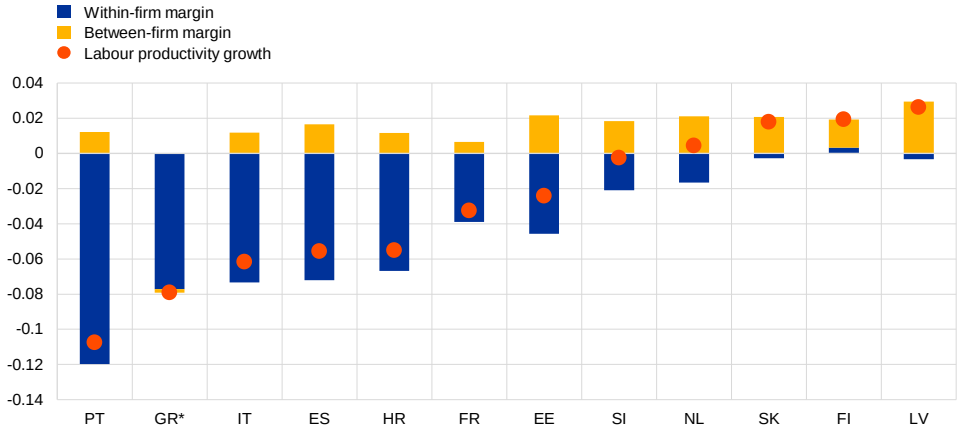


Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Notes: Micro-aggregated growth of productivity per employee. *Revenue-based productivity. The fact that Greece presented different employment trends may be due to the composition of the sample data retrieved from Orbis.

The decomposition of sector productivity growth into the within-firm and across-firm components shows that the main driver was the decline in productivity of incumbent firms; the contribution made by between-firm reallocation of resources was small and largely positive. Chart 12 shows that although the productivity developments of continuing firms are predominantly driven by the within-firm component, the contribution of between-firm reallocation is relatively higher than suggested by aggregate between-sector reallocation (as discussed in Section 2). Further analysis is needed to understand the role of within-sector reallocation and the extent of productivity-enhancing reallocation (PER).

Chart 12

Margins of labour productivity growth in 2020



Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Notes: Micro-aggregated growth of productivity per employee. *Revenue based productivity for Greece retrieved from Orbis.

Regression analysis confirms that resources were reallocated from low- to high-productive firms, albeit with country differences. Following Foster et al. (2016), we study the relationship over the cycle between firm employment growth and firm productivity relative to the sector average (see Box 4 for details). Results for the incumbent firms confirm that relatively more productive firms have on average higher employment growth than less productive firms in the period from 2015 to 2020. In selected countries, we can observe an acceleration in PER during contraction periods, proxied by an increase in the regional unemployment rate. This finding confirms the results obtained elsewhere showing that during crises, firm size adjustment is less costly (e.g. Caballero and Hammour, 1996). The cross-country heterogeneity may arise from the scale and allocation across firms of the pandemic policy support measures, though also from possible structural and business cycle differences between individual countries.[14]

Table 3

PER – Baseline estimates for continuing firms

	EE	ES	FI	FR	GR[1]	HR	IT	LV	NL	PT	SI	SK
Relative productivity	0.039***	0.062***	0.054***	0.012***	0.103***	0.044***	0.031***	0.050***	0.050***	0.039***	0.072***	0.038***
	(0.002)	(0.006)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.010)	(0.006)	(0.006)	(0.002)
Cycle	-2.71 ***	-3.90 ***	0.079	-1.79 *	-0.04 *	-0.24	0.083	-4.06 ***	0.788	-4.84 ***	0.764	-0.18
	(0.18)	(0.19)	(0.38)	(1.06)	(0.02)	(0.19)	(0.17)	(0.296)	(1.07)	(0.30)	(1.12)	(0.34)
Relative productivity #Cycle	0.292	0.772**	1.019***	-0.42	-0.03	0.143	-0.27	0.565*	1.729*	0.346	2.377***	0.527**
	(0.20)	(0.31)	(0.32)	(0.51)	(0.04)	(0.12)	(0.24)	(0.33)	(0.97)	(0.41)	(0.60)	(0.24)
N	87252	843984	265014	538308	75413	182826	1314083	127584	436933	661692	121534	202770
R2	0.064	0.096	0.060	0.038	0.158	0.062	0.048	0.062	0.057	0.044	0.087	0.085

Source: Authors' calculations based on individual firm data originating from the countries included in the study.

[14] As show in Chart A1 in the appendix, France or Italy, among other countries, did not experience an increase in aggregate unemployment in 2020.

Notes: OLS estimates with firm-level employment growth as the dependent variable, relative within-sector value added labour productivity and regional unemployment-based cycle as explanatory variables. Industry, size and year fixed effects included, though not presented. Estimates weighted by the firm's average employment over the whole sample period between 2015 and 2020. [1]Revenue based productivity and value-added based cycle, data retrieved from Orbis. Robust standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01.

Box 4
Productivity enhancing reallocation – methodology

Following Foster, Grin and Haltiwanger (2016), we estimate the relationship between a firm's employment growth (Yi) and its relative productivity (Xi) using this specification:

$$Y_{it} = \alpha + \beta X_{it-1} + \gamma Cycle_{rt} + \delta(X_{it-1} \times Cycle_{rt}) + \theta Z'_{it-1} + \tau_t + \varepsilon_{it},$$

where Y_{it} is the mid-point average growth of the number of employees at firm i in period t. Xi represents relative productivity of firm i measured in period t-1 as the deviation of the firm's labour productivity from its NACE two-digit industry mean value of labour productivity (defined as the log difference). We control for number of firm-level characteristics $Z'it-1$, including NACE two-digit level industry fixed effects, time fixed effects τt, and εit denotes an error term with conventional properties. Economic cycle $Cycle_{rt}$ is measured as the unemployment rate at NUTS2 level region.

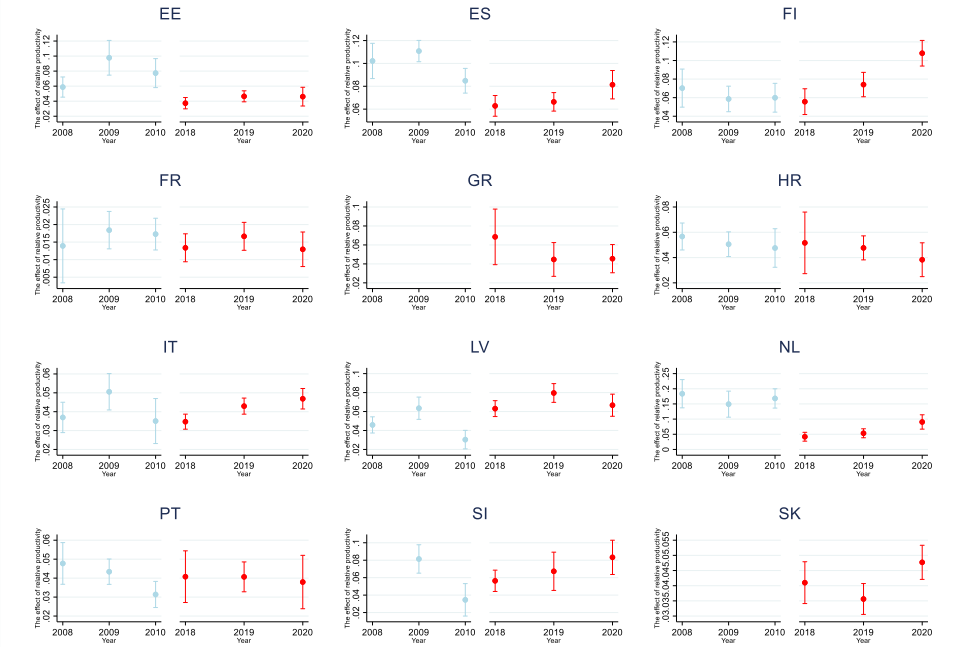
This approach allows us to investigate whether more productive firms tend to experience higher employment growth (when β is positive) and whether they grow faster during an economic downturn (when δ is positive), i.e., whether we observe productivity-enhancing reallocation (PER) towards more productive firms. The coefficient γ is expected to be negative, i.e. employment growth being lower during an economic downturn.

The results were obtained using a micro-distributed exercise, where a common code was distributed to partners at the NCBs having access to the relevant firm-level data (see Appendix for further details).

PER was somewhat weaker during COVID-19 relative to the Great Recession. Chart 13 shows the interaction between a firm's relative productivity and a year dummy in the previous regression framework. This interaction shows the strength of PER over time, between 2008 and 2020. The results obtained for those countries with sufficiently long data (presented in Chart 13) confirm increased PER during the Great Recession. However, during the first year of the COVID-19 pandemic we can observe two groups of countries, one with increased PER (covering Italy, Spain, Slovenia, Finland, the Netherlands and Slovakia) and the other with weaker PER (Estonia, France, Portugal, Greece, Latvia and Croatia).

Chart 13

PER – Great Recession versus COVID-19 pandemic



Source: Authors' calculations based on individual firm data originating from the countries included the study.
Notes: The figure plot values of β coefficients and 90% confidence bounds for interaction term between firm productivity and the year fixed effects from the simplified specification with the employment growth as the dependent variable. Revenue-based productivity and data retrieved from Orbis for Greece.

These findings related to the role of within-firm and between-firm contributions to productivity growth and PER are broadly confirmed for the German economy. The summary of the analysis published in the report of Deutsche Bundesbank (2022), as presented in Box 5, confirms the dominance of the within-firm margin of growth in productivity per employee and the small positive between-firm margin. At the same time, the authors find that the difference in employment growth between more and less productive firms was significantly lower in 2020 than in the pre-pandemic period. In other words, PER was quieter during the first year of the pandemic.

The key question is whether PER was more subdued due to the extensive pandemic policy support handed out. PER could weaken if less productive firms were supported by fiscal measures such that their employment dynamics become similar to those of their more productive counterparts. Additionally, PER could be muted because all firms – regardless of productivity – in a given sector were affected to a similar degree and therefore adjusted their employment structure to a similar extent. The only way to disentangle these two drivers of muted PER is to analyse which firms received fiscal support, this being the subject of Section 4. However, a first rough approach to this question would be to use the framework proposed in this section and investigate whether PER was significantly weaker in those sectors targeted by fiscal support. In most of the countries, COVID-19 subsidies were introduced for firms facing severe negative consequences, understood as more a drop in revenue of at least 20%. In fact, this criterion was not always fulfilled and

subsidies were frequently allocated to firms experiencing smaller declines or even small increases in revenue.[15] For the sake of simplicity, we consider a firm to be eligible for support if it recorded negative revenue growth. Following Lalinsky and Pal (2022), who found a strong correlation between the firm probability of being supported and a sectoral drop in sales, we define an eligibility dummy variable at the sectoral level as equal to 1 if the sector recorded negative growth in 2020, or 0 otherwise. The results presented in Table 4 show that firms from eligible two-digit sectors recorded lower employment growth than those operating in other sectors during the first year of the pandemic. This suggests that the support, despite safeguarding a significant number of jobs (Meriküll and Paulus, 2023), did not excessively alter employment growth and allowed for employment adjustments among the worst hit industries.

Table 4

Employment growth and support eligibility during COVID-19

	EE	FI	FR	HR	LV	NL	PT	SI	SK
Pandemic	-0.080***	-0.054***	0.010*	-0.014**	-0.144***	0.018**	-0.010	-0.012	-0.082***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.006)
Eligibility	0.006	-0.006	0.006	-0.014	-0.110	-0.011	0.053*	-0.074	0.067*
	(0.020)	(0.113)	(0.031)	(0.036)	(0.253)	(0.052)	(0.029)	(0.094)	(0.040)
Pandemic# Eligibility	-0.091***	-0.036***	-0.040***	-0.097***	-0.256***	-0.099***	0.007	-0.063***	-0.038***
	(0.015)	(0.010)	(0.007)	(0.013)	(0.031)	(0.016)	(0.007)	(0.016)	(0.010)
Employees	-0.373***	-0.377***	-0.335***	-0.378***	-0.408***	-0.415***	-0.400***	-0.366***	-0.393***
	(0.008)	(0.013)	(0.011)	(0.008)	(0.009)	(0.020)	(0.014)	(0.008)	(0.013)
N	267846	617028	1280192	386081	372354	877319	1473194	220965	401840
R2	0.284	0.285	0.213	0.265	0.283	0.277	0.279	0.332	0.212

Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Notes: Results for Italy and Spain unavailable due to collinearity. OLS estimates with firm-level employment growth as dependent variable, sectoral eligibility and pandemic dummy variables as explanatory variables. Industry and year fixed effects included, though not presented. Estimates weighted by the firm's average employment over the whole sample period. Robust standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01.

In most countries, PER was not significantly weaker in sectors most targeted by policy support. In the next step, we analyse to what extent PER was muted in eligible sectors by interacting the relative productivity of each firm to the dummy taking the value 1 if the sector of activity was eligible for support, as defined previously. The effect of eligibility on PER is largely statistically insignificant, suggesting that reallocation did not differ across sectors. Only the results for Estonia and Latvia suggest reduced PER in the severely hit sectors eligible for the pandemic support. However, this initial approach to the question of whether policy support reduced PER is based on a rough proxy for support eligibility defined at sector level. Section 4 will dwell on this question and examine firm-level data on productivity and support available for six countries to explore whether the allocation of fiscal support prevented or frustrated PER.

[15] In addition, the 20% is typically applied to the year-on-year change in monthly revenue. making it difficult to quantify a precise level for the threshold when working with annual balance sheet and income statement data. In an extreme case, a firm could experience a severe decline in revenue in only one month and grow for the rest of the accounting year.

Table 5

PER and eligibility for pandemic support

	EE	FI	FR	HR	LV	NL	PT	SI	SK
Relative productivity	0.093***	0.066***	0.040***	0.068***	0.054***	0.092***	0.098***	0.115***	0.073***
	(0.007)	(0.004)	(0.008)	(0.006)	(0.004)	(0.009)	(0.006)	(0.010)	(0.007)
Cycle	-2.442***	0.357	-0.922	0.126	-5.034***	0.559	-0.430*	0.923	-1.232***
	(0.169)	(0.288)	(0.591)	(0.168)	(0.258)	(0.408)	(0.259)	(0.849)	(0.387)
Eligibility	-0.013	-0.027	0.021	-0.039	-0.278	-0.018	0.035	-0.075	0.049
	(0.021)	(0.121)	(0.035)	(0.032)	(0.226)	(0.048)	(0.031)	(0.082)	(0.038)
Relative productivity #Cycle	0.805***	0.377	-0.311	0.210	1.595***	2.478***	1.013***	2.940***	1.855***
	(0.148)	(0.254)	(0.691)	(0.162)	(0.253)	(0.359)	(0.299)	(0.578)	(0.146)
Relative productivity #Eligibility	-0.020	0.059***	-0.021***	-0.005	-0.013	0.054**	0.038***	-0.043**	0.007
	(0.024)	(0.016)	(0.008)	(0.010)	(0.023)	(0.022)	(0.013)	(0.021)	(0.028)
Cycle#Eligibility	-2.019***	-0.169	-0.661	-1.120***	-6.915***	-4.832***	-0.443	-3.549***	0.004
	(0.389)	(0.388)	(0.665)	(0.226)	(1.069)	(0.664)	(0.322)	(0.935)	(0.538)
Relative productivity #Cycle# Eligibility	-1.897***	0.739	-0.010	-0.500	-2.963**	-1.338	0.339	-1.051	-1.685
	(0.732)	(0.773)	(0.799)	(0.316)	(1.395)	(1.113)	(0.414)	(1.809)	(1.118)
N	203672	617028	1105063	433951	326841	877319	1331549	241907	363200
R2	0.267	0.285	0.220	0.244	0.280	0.277	0.289	0.306	0.234

Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Notes: Results for Italy and Spain unavailable due to collinearity. OLS estimates with firm-level employment growth as dependent variable, relative within-sector value added labour productivity, regional unemployment-based cycle, sectoral eligibility and pandemic dummy variables as explanatory variables. Industry, size and year fixed effects included, though not presented. Estimates weighted by the firm's average employment over the whole sample period. Robust standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01.

A more precise identification of the effect of policy support on PER for a larger number of countries is impeded by several factors. Firm-level information on pandemic support is available for only a very limited number of countries. The granularity of the support data differs, and there is seldom sufficient information on both the size of the support and the number of supported jobs at individual firms. Moreover, sufficient balance sheet and income statement data is usually available for only the first year of the pandemic.

Overall, firm-level data from 12 euro area countries show that: 1) the trend in productivity per employee among incumbent firms was dominated by negative or significantly reduced within-firm productivity growth in most euro area countries; 2) between-firm reallocations of employment were productivity-enhancing but small; 3) the relatively more productive firms experienced on average higher employment gains or lower employment losses; 4) the productivity-enhancing reallocation observed was on average somewhat weaker during the first year of the COVID-19 pandemic than during the Great Recession.

Box 5

Pandemic productivity and reallocation in Germany

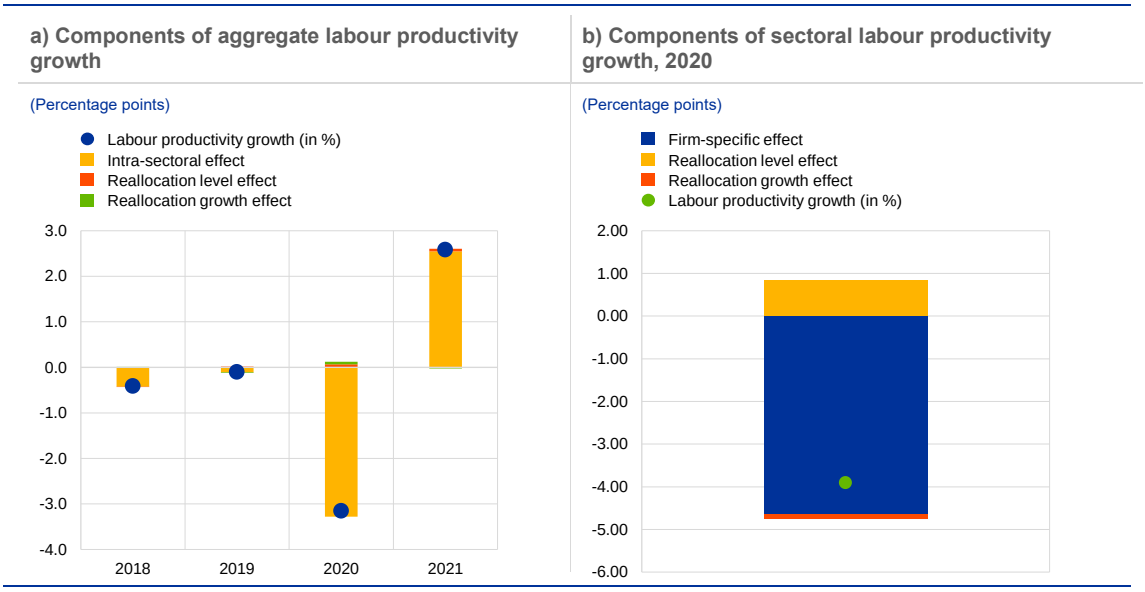
The COVID-19 crisis had highly heterogeneous effects on economic sectors and firms in Germany and may have led to increased job reallocation. This might have reinforced productivity growth if the

employees increasingly moved from less productive firms to more efficient ones in the same or different sector.[16]

Despite comprehensive government support measures, including generous job retention schemes, job growth dispersion across sectors increased in Germany during the pandemic compared to pre-crisis years, pointing to a rise in job reallocation across sectors. However, productivity-enhancing effects due to shifts in employment weights between sectors hardly occurred in 2020 and 2021. This is the result of a decomposition of labour productivity growth into growth contributions from between-sector job reallocation and an intra-sectoral effect using national accounts data for 20 sectors (Chart A, panel a).[17] The reason for this was the job cuts that took place during the pandemic, occurred not only in below-average-productivity sectors such as accommodation and food services, but also in highly productive sectors, such as manufacturing. At the same time, not only did the highly productive information and communication sector see a sharp increase in employment, but so did sectors that are less productive in arithmetical terms, such as human health and social work activities.

Chart A

Productivity per employee growth effects due to job reallocation between and within sectors



Sources: Federal Statistical Agency, Bundesbank Online Panel – Firms (BOP-F, Wave 5) and own calculations.
Notes: The panel a): chart depicts decompositions of annual growth rates of real gross value added per person employed. Decomposition based on data for 20 sectors. The panel b) chart depicts decompositions of annual growth rates of real gross value added per employee. Change in labour productivity approximated. Calculations following Bloom et al. (2020), based on data for 2,072 firms and using weighting factors. Sector results aggregated with employment weightings.

The large contribution of intra-sectoral effects to aggregate labour productivity growth during the pandemic reflects sector-specific developments, such as changes in total factor productivity (TFP) or capital intensity in a given sector. In addition, job reallocation – more precisely between firms in

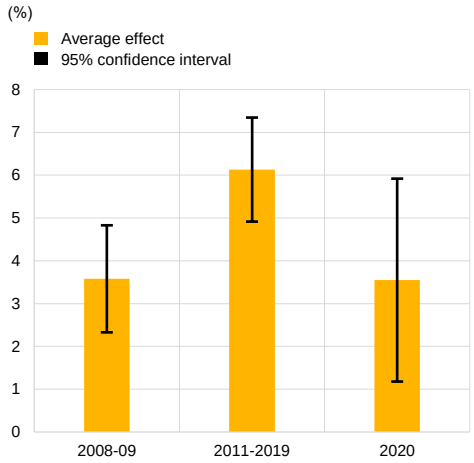
16 See Deutsche Bundesbank (2022) for a more detailed exposition of the analyses summarised in this box.

17 Labour productivity growth can be decomposed into three components. The first is based on the shift of jobs between sectors with different levels of productivity, the second on reallocation between sectors with different rates of productivity growth, and the third on productivity growth that not accompanied with shifts in jobs across sectors. The reallocation level effect is positive if employment shifts from less productive to more productive sectors, while the reallocation growth effect measures the contribution to growth of shifts in employees between sectors with different productivity dynamics.

the same sector – can also matter for this component. Indeed, a firm-level analysis based on data from Deutsche Bundesbank's online survey of firms shows that sector productivity growth benefited from job reallocation within sectors between incumbent firms in 2020 (Chart A, panel b). This effect counteracted only partially the sharp decline in total sector productivity, which was driven by within-firm productivity losses. The positive within-sector job reallocation effect was due to more productive firms hiring considerably more new employees, or dismissing considerably fewer existing employees when compared to less productive firms. This is consistent with the fact that larger, and generally more productive, firms suffered smaller production losses than other firms as a result of the pandemic.

Chart B

Relationship between employment growth and previous year's relative labour productivity



Sources: JANIS and own calculations.
Notes: Chart shows estimation coefficients for the relationship between employment growth (%) and one-year lagged labour productivity of corporations in manufacturing and retail trade in Germany, including the associated 95% confidence interval. The estimation equation controls for industry and year fixed effects and for firm age and size. The independent variable is measured as deviation of log labour productivity from the industry-specific mean lagged by one year (see also Foster et al., 2016 for a similar regression approach). Estimates weighted on the basis of extrapolation factors.

Further analysis based on firms in the German manufacturing and retail sectors shows that the estimated relationship between productivity and changes in employment at the firm level during the COVID-19 recession was not especially pronounced in comparison with the pre-crisis period (Chart B). Notably, while firms with a high level of productivity in the previous year added jobs at an accelerated pace in 2020, the average difference in employment growth between high- and low-productivity firms was larger during the years prior to the pandemic. This is consistent with the sharp decline in the number of corporate insolvencies and business closures observed over the past two years among micro firms in Germany, which are usually more vulnerable to crises and tend to be less productive. Furthermore, business closures decreased steeply above all in the accommodation and food service activities and retail trade sectors, which were hit hard by the pandemic and generally have low levels of productivity. Therefore, overall, the pandemic did not trigger a pronounced cleansing effect in Germany.

4 Pandemic support policies and productivity

As mentioned in the introduction, the COVID-19 shock was unprecedented not only in itself, but also because of the policy response of governments to support euro area businesses and households. While there is broad agreement that the policies put in place were successful in avoiding a wave of bankruptcies and in keeping workers attached to their firms and thereby enabling a quick recovery in production, there is some debate about the unintended potential impacts of the support. This section describes first the different policies used by governments in the euro area and the United States, highlighting the differences (Section 4.1). It then looks at the unconditional and conditional allocation of different types of support to firms of different characteristics, focusing on productivity levels (Section 4.2). The last part of the section explores the impact of policy support on firm leverage and "zombification" or the survival of otherwise non-viable firms.

4.1 Overview of fiscal support measures

Government support played a major stabilising role during the coronavirus crisis. However, it is hard to tell how this affected public finances, as evidenced by the wide variation in figures. The numbers cited may refer to public finances overall or just those at the central government level. Cyclical effects on the general government budget (the automatic stabilisers) may have been factored in, or the focus may rest solely on active measures. Furthermore, figures may include measures at different stages: already implemented, planned, anticipated or generally approved. The extensive authorisations required for government loan guarantees and capital support for enterprises are an example of this last category. In retrospect, it became clear that only a fraction of these funding envelopes were ultimately utilised.

This subsection reviews fiscal support measures in the euro area and compares them to those used in the United States. For this purpose, data from the European Commission and the International Monetary Fund are analysed, which partly includes unused budget authorisations. The COVID-19 pandemic and the subsequent suspension of most economic activities (lockdowns) for an extended period caused negative yet asymmetric effects across firms, sectors and countries. Faced with the risk of a deep recession, governments provided significant support to businesses and households. Although both the euro area and the United States responded to the pandemic swiftly by offering bold fiscal packages, employment and productivity developments in the two economies differed. This was due both to the inherent structural differences between these economies and to the different

approaches taken by their respective governments regarding support measures.[18] More precisely, euro area countries focused on employment support programmes, while the United States favoured measures to support household disposable income.

Although automatic stabilisers have proven to be effective policy tools in typical recessions, this time around the unprecedented economic disruption caused by the lockdown measures called for complementary fiscal measures.[19] In this context, governments swiftly introduced a wide range of discretionary fiscal support measures aimed at protecting employment and maintaining existing jobs, containing the drop in private consumption and supporting disposable income. The main fiscal support measures taken are grouped into two categories. First, we have directly budget-relevant measures, such as direct grants, cash transfers, tax deferrals and tax relief. Among these measures, job retention schemes[20] played an important role in supporting both businesses and households.[21] Second, we have fiscal measures to protect financial liquidity and solvency, including loan moratoria, public guarantees on loans, public/subsidised loans, government support for credit insurance and government equity participation (for example in airlines).

4.1.1 Euro area

In 2020 discretionary fiscal measures in the euro area amounted on average to about 4% of GDP, while loan guarantees and other measures to support firms' liquidity, with no direct budgetary effect, stood at about 17% of euro area GDP.[22] A second approach for measuring fiscal support relies on the primary surplus of the general government. The change in the primary surplus reflects the impact of both the discretionary measures introduced and expired or expected to expire, as well as the impact of automatic stabilisers (though not the liquidity and guarantees that have no direct fiscal impact). The cumulative change in the primary balance in the euro area from 2019 is estimated at 13.8% of GDP in 2020-21 and 17.0% of GDP in 2020-2022, or 17.9% of GDP if we also consider the Recovery and Resilience Facility (RRF).[23] Lastly, it should be noted that the support measures were largely lifted in the first half of 2022.

---

18 On the factors explaining the differences between advanced economies in the depth of the pandemic recession and their resilience, see Dimitropoulou and Theofilakou (2021).

19 See also Bouabdallah et al. (2020).

20 Employment support programmes can take three different forms. First, short-time work schemes, such as the Kurzarbeit in Germany, where companies facing difficulties due to COVID-19 and under certain conditions are able to temporarily reduce the working hours of their employees. Businesses bear only the cost of their employees' working hours, and employees receive income support from the State for the hours they did not work, thus ensuring their full employment income. Second, furlough schemes that subsidise workers whose contracts are suspended, such as the Spanish ERTE scheme. Third, wage subsidy schemes, which are about subsidising businesses to hire the unemployed, such as the Dutch emergency bridging measure (Noodmaatregel Overbrugging Werkgelegenheid, or NOW for short). The critical aspect of all the programmes is that employees retain their contracts with the employer even if activity is suspended. See OECD (2020), *Job retention schemes during the COVID-19 lockdown and beyond*.

21 For more details on the job retention schemes per country, see Eichhorst et al. (2022).

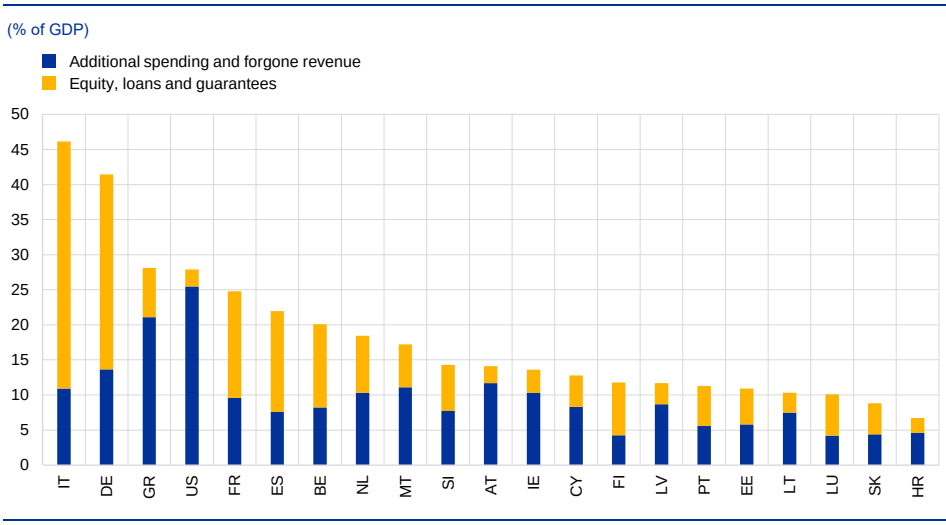
22 See European Commission, *Autumn 2020 Economic Forecast*.

23 See Licchetta et al. (2022).

In most euro area countries, support was targeted at households and small and medium-sized enterprises. The support measures for companies were aimed at protecting their financial liquidity, thus preventing layoffs or bankruptcies.[24] Significant steps were taken to facilitate business access to finance through public guarantees, loans, or subsidies. On the demand side, many countries moved to targeted income support for vulnerable groups and households or areas most affected by the restrictions, mainly in the form of direct transfers.

Chart 14

Discretionary fiscal response to the COVID-19 crisis in selected economies



Source: IMF Database of Country Fiscal Measures in Response to the COVID-19 Pandemic.
Notes: Estimates as of 5 June 2021. Numbers in U.S. dollar and percentage of GDP are based on July 2021 World Economic Outlook Update, unless otherwise stated.

There is substantial heterogeneity in terms of both the amount and mix of the measures taken across euro area countries. Chart 14 shows discretionary fiscal measures announced or implemented between January 2020 and June 2021 (with an implementation horizon from 2020 onwards); Italy and Germany stand out, with the total exceeding 45% and 40% of 2020 GDP respectively, followed by France with about 25% and Spain with 22%. The composition of measures is also quite different. Large European economies such as Germany, France, Italy and Spain announced loans and guarantees on a much larger scale than directly budget-relevant discretionary measures. Thus, the ranking changes when looking only at discretionary measures with a direct fiscal impact, with Greece ranking first with 17.5% of 2020 GDP, followed by Germany and Austria with about 15%, Italy with around 11%, France with 10% and Spain with 8%.[25] It is also worth noting that in the case of Germany, only a small fraction of the estimated volume of aid provided was ultimately used.

[24] Through the temporary SURE instrument, which provides all EU countries with financing (up to €100 billion) in the form of short-term loans granted on favourable terms, Member States can use the relevant financial resources to create new, or extend already existing, job retention programmes. The European Commission estimates that, in 2020, SURE supported around 31.5 million people and 2.5 million firms and that, in 2021, 9.0 million people participated in SURE-funded job retention programmes. See European Commission, *The European instrument for temporary Support to mitigate Unemployment Risks in an Emergency (SURE)*.

[25] See IMF (2021).

In Europe, most countries (including the United Kingdom) had relatively generous social security before the start of the pandemic, though also so-called short-time work schemes. With the outbreak of the pandemic, all euro area countries introduced new, or even scaled up, existing job retention programmes to preserve jobs and support income due to the restrictive measures.[26] Of course, there were significant differences in the design and implementation of these programmes between countries.[27]

4.1.2 United States

Total fiscal support in the United States, measured by the cumulative change in its primary balance compared to 2019, was higher than in the euro area, estimated at 14.9% of GDP in 2020-21 and 17.4% of GDP in 2020-2022.[28] However, in contrast to the euro area, the United States channelled most of the resources into directly budget-relevant measures. Thus, according to IMF data regarding discretionary fiscal measures announced or implemented with an implementation horizon from 2020 onwards, the amount of directly budget-relevant spending and tax measures announced in the United States was 25% of 2020 GDP out of a total of 28%.[29] Furthermore, according to Bruegel, the United States spent $561 billion on deferrals to facilitate financial liquidity for households and companies and a further $560 billion on other measures to provide liquidity through public loans and guarantees for businesses. The corresponding amount for immediate fiscal impulse, i.e. additional government spending (such as medical resources, keeping people employed, subsidising SMEs, public investment) and foregone revenues was $1.94 trillion.[30]

Specifically, the 2020 Coronavirus Aid, Relief, and Economic Security ("CARES Act")[31] provided direct financial assistance to employees, households, small businesses and industries and is estimated to be equivalent to approximately 11% of GDP ($2.3 trillion).[32] A prominent example of a large-scale cash transfer to households in the United States is the Economic Impact Payment, which corresponds to approximately 6% of GDP. Due to the huge increase in unemployment and the relatively modest unemployment benefits handed out in the United States (relative to Europe), the federal government decided to pay

---

26 In Germany, for example, the pre-existing short-term work programme was temporarily made more flexible, and its coverage was extended. According to data from the Federal Employment Agency, up to 6.0 million people were using Germany's short-term work scheme in April 2020, compared with a maximum of around 1.4 million during the global financial crisis.

27 For example, during the first wave of the crisis, jobs supported by work programmes accounted for 35.2% of total dependent employment in France, 30% in Italy, 20.5% in Spain and 15.5% in Germany. By May 2020, job retention programmes supported around 50 million jobs in OECD countries, around ten times more than during the global financial crisis. See OECD (2020).

28 See Licchetta et al. (2022).

29 It bears repeating that the change in the primary balance reflects the impact of discretionary measures and the impact of automatic stabilisers, but not measures without immediate fiscal impact, while the IMF definition includes measures with or without immediate budgetary impact while excluding the impact of automatic stabilisers.

30 See Bruegel, *The fiscal response to the economic fallout from the coronavirus*.

31 See U.S. Department of the Treasury, *About the CARES Act and the Consolidated Appropriations Act*.

32 See IMF, *Policy Responses to COVID-19*.

additional cash benefits to the unemployed to compensate (and often overcompensate) their income losses.[33] Income tax payers in the United States received financial assistance of up to $1,200 per eligible adult and $500 per dependent child.[34] Through the CARES Act, the federal government funded Short-Time Compensation (STC) programmes. However, because STCs were used very sparingly for various reasons, the federal government introduced several temporary wage subsidy programmes, such as the Paycheck Protection Program (PPP) and the Employee Retention Tax Credit (ERTC).[35] Under the PPP, businesses with up to 500 employees could apply for loans to cover payroll costs and therefore retain their workers. Meanwhile, the ERTC provides a tax credit to businesses that have experienced a drop in sales of more than 50%.[36] Nevertheless, most employers in the United States preferred the temporary dismissal path. Furthermore, many of the "recently" unemployed had no incentive to look for work as they received unemployment benefits and an additional $600 per week for four months through the CARES Act.[37]

Overall, both the euro area and the United States responded to the economic shock caused by the pandemic with unprecedented fiscal support. However, we encounter significant challenges in quantifying the fiscal measures rolled out in response to the COVID-19 crisis and in drawing reliable comparisons between euro area countries, and even more so between the euro area and the United States.[38] There are various reasons for this. First, Member States' initial fiscal cost estimates often underwent significant updates, particularly due to lower-than-expected actual uptake rates.[39] Second, the distinction between measures treated as discretionary and those pertaining to automatic stabilisers is not always clear. We would note that, traditionally, European economies have incorporated into their economies much stronger automatic stabilisers than the US economy. To achieve an equivalent

---

33 Benefit amounts for eligible workers vary by state, ranging from $783 in Massachusetts to $235 per week in Mississippi. See http://aboutunemployment.org/faqs/best-and-worst-states-for-unemployment-benefits.

34 As of March 2020, the CARES Act provided one-time payments of up to $1,200 per adult and $500 per child under 17, subject to conditions. Two consecutive rounds of such payments followed in December 2020 and March 2021. For a family of four, these financial impact payments provided a total of up to $3,400 in immediate financial relief. See U.S. Department of the Treasury: Economic Impact Payments.

35 The Paycheck Protection Program, established by the CARES Act, provides small businesses with funds to cover up to eight weeks of payroll costs including benefits. The funds can also be used to pay mortgage interest, rent and utilities. The Payroll Protection Program prioritises millions of Americans employed in small businesses, authorising up to $659 billion to preserve jobs. See U.S. Department of the Treasury: Paycheck Protection Program.

36 For businesses with fewer than 100 employees, the programme provides a tax refund credit of 50% of the wages of all employees, regardless of whether or not they continue to work. For larger businesses, the credit is available only for the wages of employees who are not working during the crisis. The maximum credit amount in total is set at a relatively low level of $10,000. See IRS: COVID-19-Related Employee Retention Credits: General Information FAQs.

37 See Springford and Tilford (2020).

38 EU Commission (2021), "The 2021 Stability and Convergence Programmes: An Overview, with an Assessment of the Euro Area Fiscal Stance", 16 July.

39 For many of the support programmes, the actual uptake is considerably lower and varies from country to country. The European Systemic Risk Board (ESRB) provides information on announced volumes as well as absorption based on reports from national macroprudential authorities. In the first quarter of 2021, the total volume of announced fiscal measures stood at 18.7% of GDP, compared to 14.6% in the third quarter of 2020 (excluding moratoria), while the actual total uptake of measures increased to 6.9% from 4.2% of GDP in the same period. See https://www.europarl.europa.eu/RegData/etudes/STUD/2022/689450/IPOL_STU(2022)689450_EN.pdf.

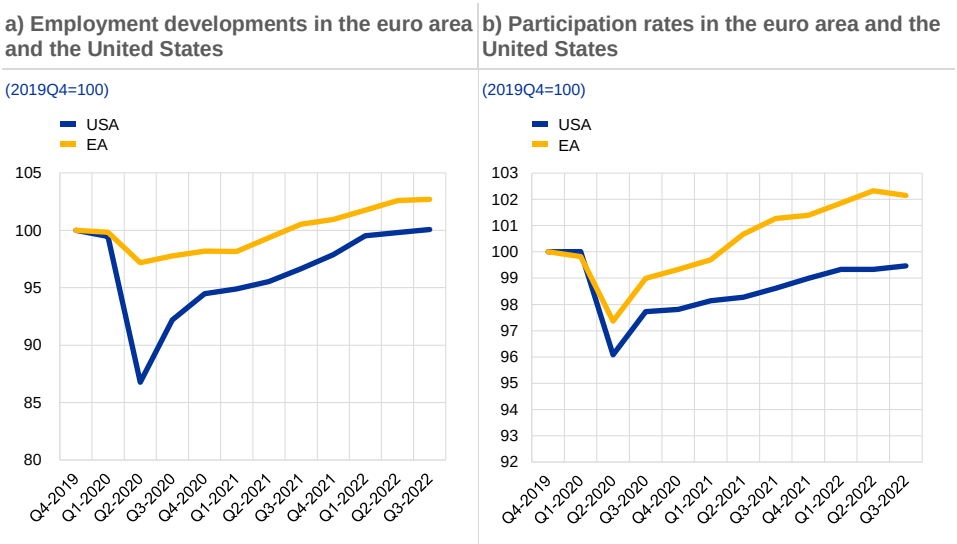
overall stabilisation effect, greater discretionary measures would have to be deployed in the United States than in Europe.

4.2 Impact of fiscal support on the labour market in the euro area and the United States

The different mix of support measures between the euro area and the United States resulted in different labour market impacts, and therefore productivity developments. While governments in the euro area aimed to protect jobs through various programmes, policies in the United States allowed unemployment to rise and targeted disposable income more directly through increased unemployment benefits and transfers. This resulted in major swings in employment in the United States compared to more stable developments in the euro area. More precisely, employment fell by 5.5% in 2020 in the United States, ultimately recovering to pre-pandemic levels in 2022 Q3 (Chart 15, panel a). In the euro area, the decline was 1.8% on average, while recovering to pre-pandemic levels in 2021 Q3, i.e. four quarters earlier than in the United States.

Chart 15

Employment and participation developments in the euro area and the United States

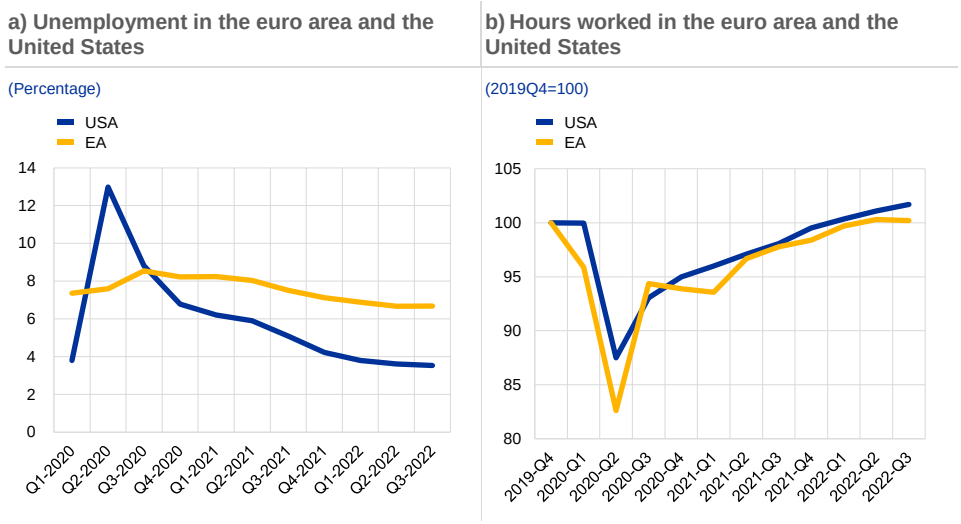


Source: OECD.

While labour force participation declined in both regions, the contraction was larger and longer lasting in the United States than in the euro area. Low labour participation rates are explained by the pandemic (caregiving needs and fear about the virus), though in the case of the United States they also coincide with record-high levels of voluntary quits from jobs (known as the “Great Resignation”). A recovery has since been observed in both regions, although rates are still below the pre-crisis level in the United States (Chart 15, panel b).

Chart 16

Unemployment and hours worked in the euro area and the United States



Source: OECD.

Sources: Eurostat and BLS.

The extended use of job retention schemes in the euro area explains the significant adjustment in hours worked, which also occurred in the United States, albeit to a smaller degree. Hours worked in the euro area already showed a sharp decline in the first quarter of 2020 as lockdowns measures were immediately imposed (Chart 16). During the first half of 2020, hours worked fell by 17%, far exceeding the drop in employment, which dipped by 2.3%. This difference is down to the widespread use of job retention schemes and the statistical recording of the affected individuals as employed. Meanwhile, the drop in hours worked in the United States was observed one quarter later. Hours worked in both regions started recovering in 2020 Q3, when lockdown measures were lifted. This recovery has been continuous for the United States, though not for the euro area; hours worked in the euro area stalled again in 2020 Q4 and 2021 Q1 as extensive lockdown measures were imposed once more.

The large shifts in labour indicators and in output led to swings in labour productivity in both regions. In the United States, labour productivity per person and also per hour was particularly high during the pandemic (Chart 17, panel a).[40] This might also reflect a composition effect, as most of the job losses were in low-wage industries or among low-wage workers, thus leading to increased average labour quality.[41] This effect waned as levels of activity recovered. As shown in Section 2, euro area productivity based on hours worked increased throughout the pandemic. However, productivity based on the number of persons temporarily decreased in the first two quarters of 2020, reflecting the stable employment headcount but large output adjustment, before increasing thereafter (Chart 17, panel

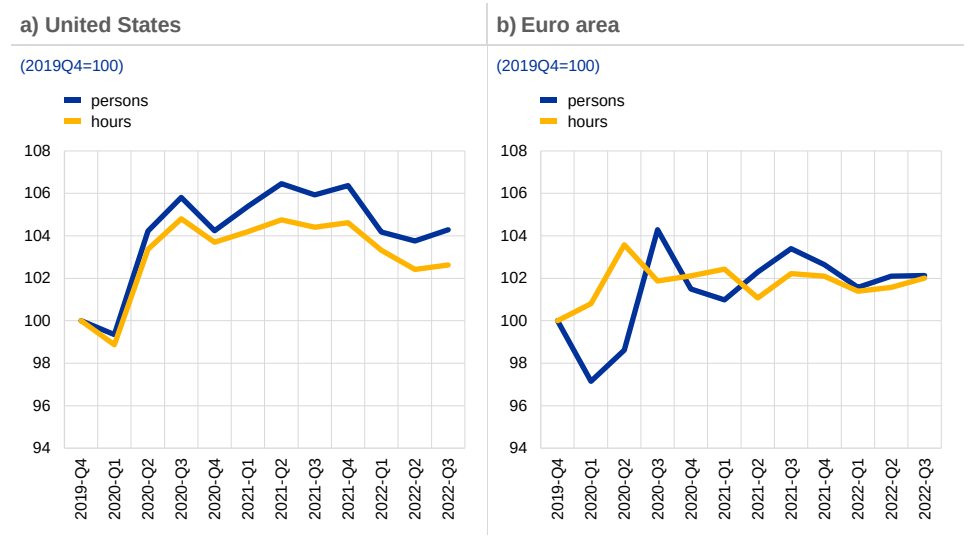
[40] In fact, productivity per hour exceeded the pre-crisis trend in both regions, although it was more pronounced in the United States. See Gomez-Salvador, R. and Soudan, M. (2022).

[41] See, for example, Stewart, J. (2022).

b). In both economies, labour productivity per hour and also per person decreased (year on year) in 2022.

Chart 17

Productivity developments in the United States and the euro area



Sources: BLS and OECD. Sources: Eurostat and OECD.

To conclude, labour market developments have been different across both regions, due, among other factors, to the different design of supporting policies. Governments in the euro area aimed to protect jobs through job retention programmes, while policies in the United States allowed unemployment to rise. Thus, the United States experienced a bigger and longer contraction in the labour market compared to the euro area. The labour market has recovered by now in both regions, except for the participation rate in the United States, which continues to lag behind the pre-crisis level. Moreover, labour productivity has been steadily increasing due to a temporary compositional effect that unwinds as activity recovers in the two regions.

4.3 Distribution of pandemic subsidies and guaranteed loans across firms

The COVID-19 pandemic and the ensuing steep decline in economic activity led to a significant reduction in firm sales, with relatively significant differences across individual firms, while the sector in which firms operated was the key factor explaining the impact of the pandemic and the allocation of the support. Firms providing in-person services were the hardest hit. The largest decline in revenue was recorded among firms from Accommodation and food services.[42] These firms, being the most eligible for the pandemic-related support, then received that support with the highest probability and were allocated one of the

[42] The sales of firms included in our sample dropped by more than 18% on average.

highest levels of support with respect to their revenue or labour costs.[43] The negative relationship between the revenue (or sales) growth and the size of support is confirmed also by the unconditional correlation for two-digit NACE sectors presented in Chart A2. In addition, Coad et al. (2023) find that despite statistically and economically significant differences in the impact of the pandemic across the distribution of sales growth, the COVID-19 effect was fairly flat across the various quantiles of labour productivity growth.

The pandemic policy support reached the intended recipients and firms that received the support were more adversely affected by the shock in relative terms. These findings were confirmed by studies based on both survey information and administrative data. Harasztosi et al. (2022) show that the support was allotted predominantly on the basis of sales losses incurred during the crisis and went to those firms most affected by the crisis. They do not find evidence that the support was tilted towards firms already weak before the crisis. Bighelli et al. (2023) confirm that only a small share of subsidies was allocated to zombie or declining firms.

In this section, we study the distribution of COVID-19 pandemic policy support by matching granular firm characteristics with corresponding firm-level information on government support in terms of subsidies and loan guarantees and moratoria. As discussed in Section 3.2, macro or industry-level data provide an incomplete answer to the question of whether policy support had unintended negative effects on aggregate productivity growth. In order to better understand the effect of policy support on productivity, we combine firm-level administrative data on firm performance with firm-level information on subsidies, loan moratoria and guarantees received by each firm during the pandemic. The data originate from national administrative sources and are representative of all non-financial firms.[44] They are harmonised using the CompNet approach (CompNet, 2021) to comply with micro-level confidentiality restrictions. The data are available for seven countries.[45]

Box 6
Allocation of policy support – methodology

In this box, we study the allocation of the policy support in three steps. First, we divide firms into quintiles based on their productivity and then compare the aggregate values of subsidies and loans distributed to the top and bottom quintiles of productivity.

Next, we analyse how the probability of receiving the policy support depends on firm characteristics, estimating logit regressions to assess the relationships between firm characteristics and the support received. We regress the dependent variable – binary dummy variable equal to 1 for a supported firm and 0 otherwise – on different explanatory variables of interest and a set of covariates:

43 As confirmed by the conditional analyses put forward in Bighelli et al. (2023) and Lalinsky and Pal (2022).

44 See Table A3 in the appendix for details on baseline firm-level data and Table A4 in the appendix for details on COVID-19 pandemic support data.

45 Data on wage subsidies are available for Croatia, Estonia, Latvia, Portugal, Slovakia and Spain, whereas data on loan support are available for Estonia, Portugal, Slovakia, Slovenia and Spain; see Box 7 for more details.

$$\Pr(Y_t = 1|X_{t-1}) = \frac{1}{1+\exp(-X_{t-1}\beta)} \quad (1)$$

where Pr(Yt=1|Xt-n) denotes the probability of receiving support for a firm in period t given Xt-n, which is a row vector of explanatory variables and β is the corresponding column vector of regression coefficients. The probability of a firm receiving government support depends on the firm's characteristics from the preceding year.

Lastly, we analyse to what extent the size of the support at the firm level depends on firm characteristics and we estimate OLS regressions with fixed effects following the equation:

$$Y_{it} = \alpha + \beta X_{it-1} + \varepsilon_{it} \quad (2)$$

where Yt denotes the relative size of the firm-level subsidy with respect to revenue and Xt-1 is a row vector of explanatory variables (including sector and size controls) and β is the corresponding column vector of regression coefficients. We investigate the effect of firm characteristics from the preceding year on the size of the support received during the pandemic years (2020, and 2021 if available).

4.3.1 Aggregate allocation of support to firms with different productivity levels

In 2020, around one third of wage subsidies in each country was allocated to firms in the top 20% of the pre-pandemic productivity distribution. Only a small share of subsidies went to non-productive firms, defined as firms in the lowest quintile of productivity distribution.[46]

[46] This does not necessarily hold for Spain, where non-productive firms received somewhat more subsidies than productive firms. However, this discrepancy may be driven by the fact that in the case of Spain, the information on wage subsidies is self-reported by firms, whereas results for other countries are based on administrative data. Due to the uncertainty related to the comparability issue, allocation of wage subsidies to productivity clusters in Spain is not shown in Chart 18.

Chart 18

Allocation of subsidies to firm productivity clusters

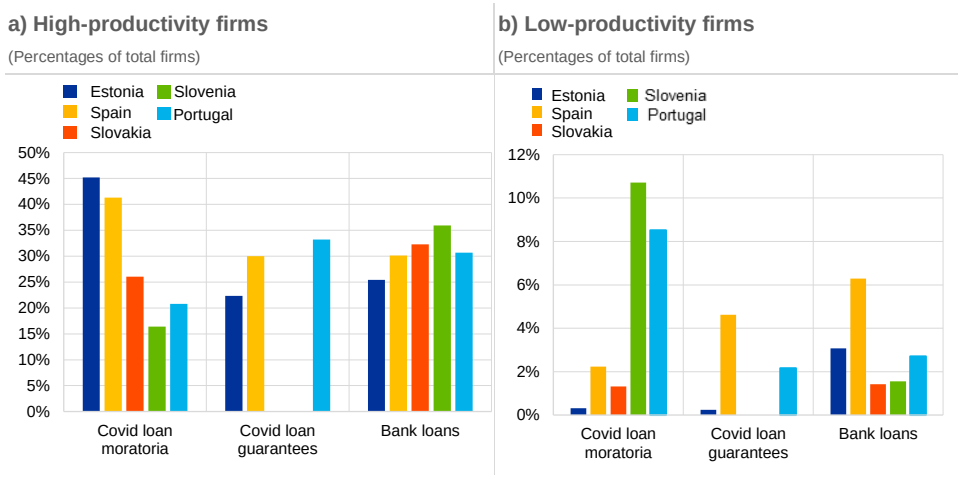
Notes: High- (low-) productivity firms are firms belonging to the highest (lowest) quintile of the labour productivity distribution. Information on subsidies distributed in 2021 in Estonia and Portugal is not available.
Source: Authors' own calculations based on microdata from the included countries.

The allocation of wage subsidies changed in 2021, favouring low-productivity firms to a larger extent. High-productivity firms were relatively quick to leave the support schemes, while low-productivity firms remained during the second year of the pandemic, 2021, as shown in Chart 18 by the increase in the share of wage subsidies allocated to low-productivity firms in 2021. In addition, cross-country heterogeneity increased in 2021, with relatively mild shifts in wage support distribution in Slovakia, but relatively robust shifts in Croatia.

In addition, high-productivity firms received more guarantees or moratoria than low-productivity firms in 2020. Firms from the top quintile of productivity received a higher share of loan support than their share in the firm population across almost all countries (Chart 19). At the same time, the allocation of pandemic loan moratoria and guarantees already showed higher heterogeneity across countries in 2020. COVID-19 guarantees, used less frequently than moratoria in general, targeted to a lesser extent high-productivity firms in Estonia and Spain, but not in Portugal.

Chart 19

Allocation of loan guarantees and moratoria to firm productivity clusters



Source: Authors' calculations based on microdata from the countries included in the study.
Note: High- (low-) productivity firms are firms belonging to the highest (lowest) quintile of the labour productivity distribution. Information on guarantees is not available for Slovenia and is insufficient for Slovakia, where this kind of guarantees started to be provided towards the end of 2020.

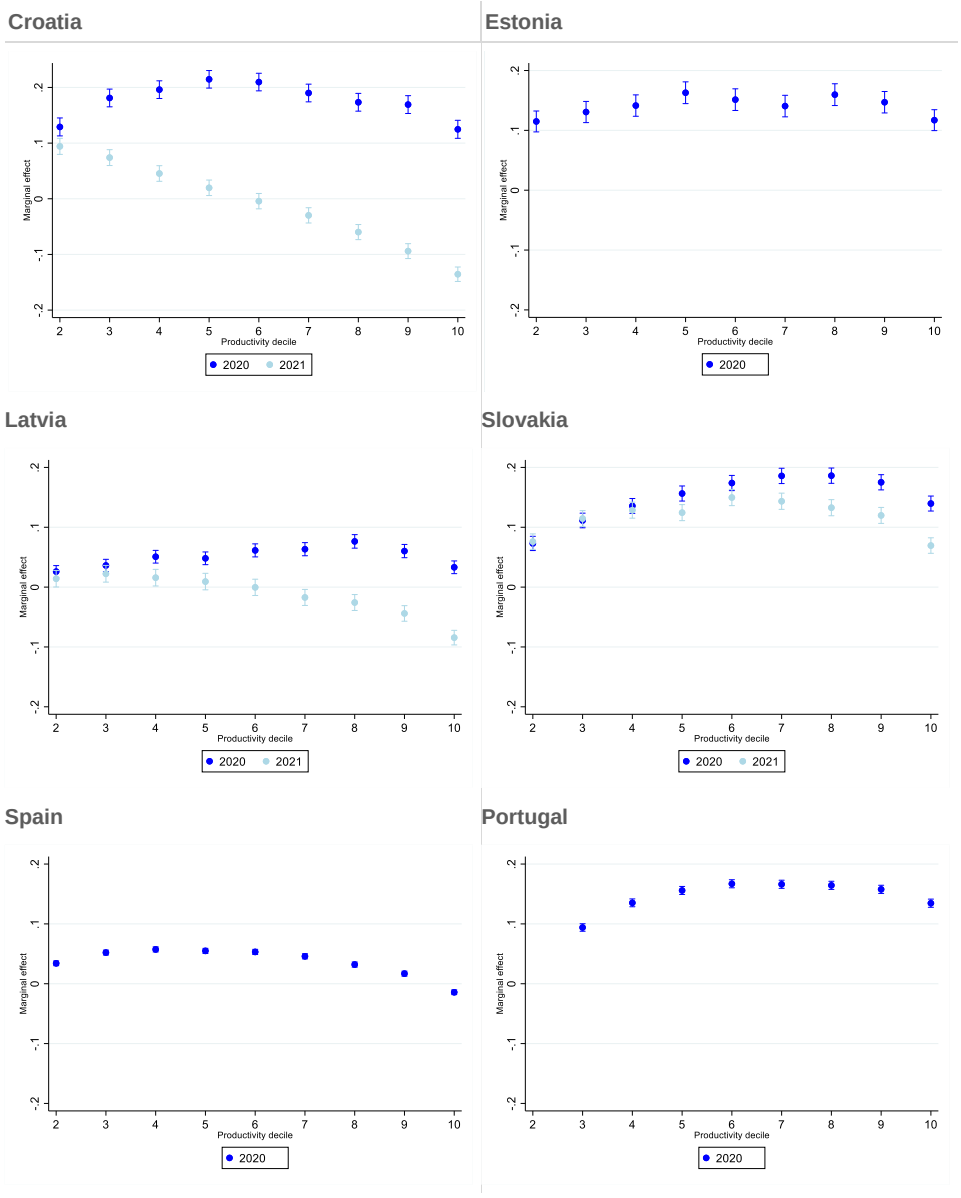
4.3.2 The conditional probability of receiving support among firms with different productivity levels

The relationship between the probability of receiving wage subsidies and firm productivity is non-linear, with the maximum probability around the median of the productivity distribution. We find that the chance of receiving support increases with firm productivity up to around the median of the productivity distribution and decreases thereafter, although the peak varies across countries (Chart 20). The positive relationship increases up to the 4th or 5th decile and then declines in Spain, Croatia and Estonia. In Portugal, Latvia and Slovakia, firms up to the 6th or 8th productivity deciles tend to be supported with higher degrees of probability and thereafter the probability declines.[47] For Spain we can observe somewhat lower non-linearity and lower marginal gains in 2020.

[47] As a robustness analysis, we run the same regressions for within-sector productivity deciles, with the results showing a similar pattern.

Chart 20

Firm probability of receiving wage subsidies – by productivity deciles



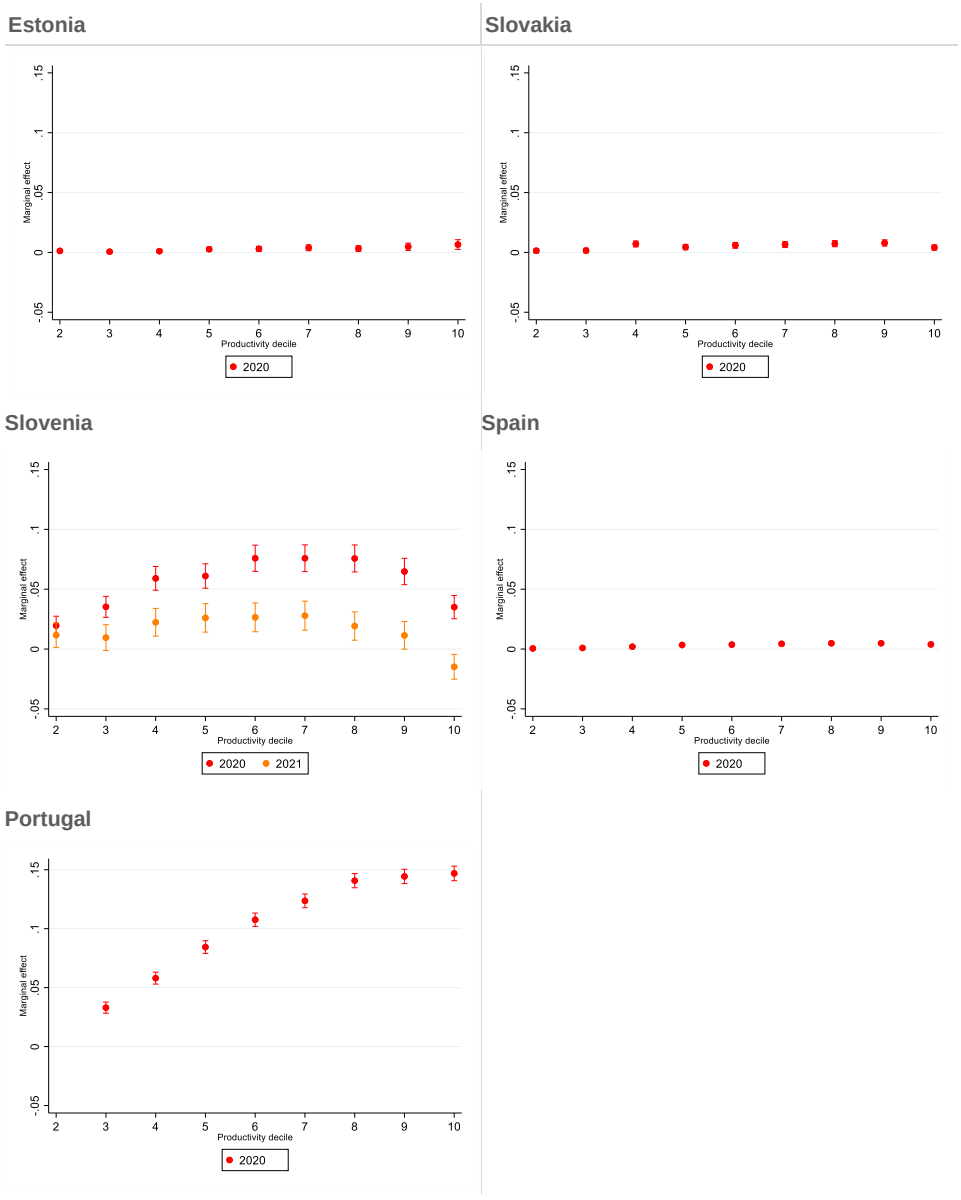
Source: Authors' calculations based on microdata from the countries included in the study.
Notes: Marginal effects from the logit regression for binary dummy representing receipt of COVID-19 government support. Effects of control variables with respect to base value – the lowest within-country labour productivity decile. The results for Spain rely on self-reported figures and may not be fully comparable with the results for other countries. The effects are conditional, the control variables for sectors and size classes were included in the model.

More productive firms had a higher chance than less productive firms to receive the support in the form of loan guarantees or moratoria. As illustrated in Chart 21, the relationship shows a lower degree of non-linearity for moratoria, and the differences in marginal effects across productivity deciles are generally smaller than for wage subsidies. The information on loan guarantees available for only three countries suggests a relatively linear increase in probability with respect to productivity for Portugal and Estonia. The effect is both statistically and economically

significant in Portugal, but weak in Estonia. For Spain, we find a non-linear relationship peaking at the 6th decile (Chart 22).[48]

Chart 21

Firm probability of receiving loan moratoria – by productivity deciles

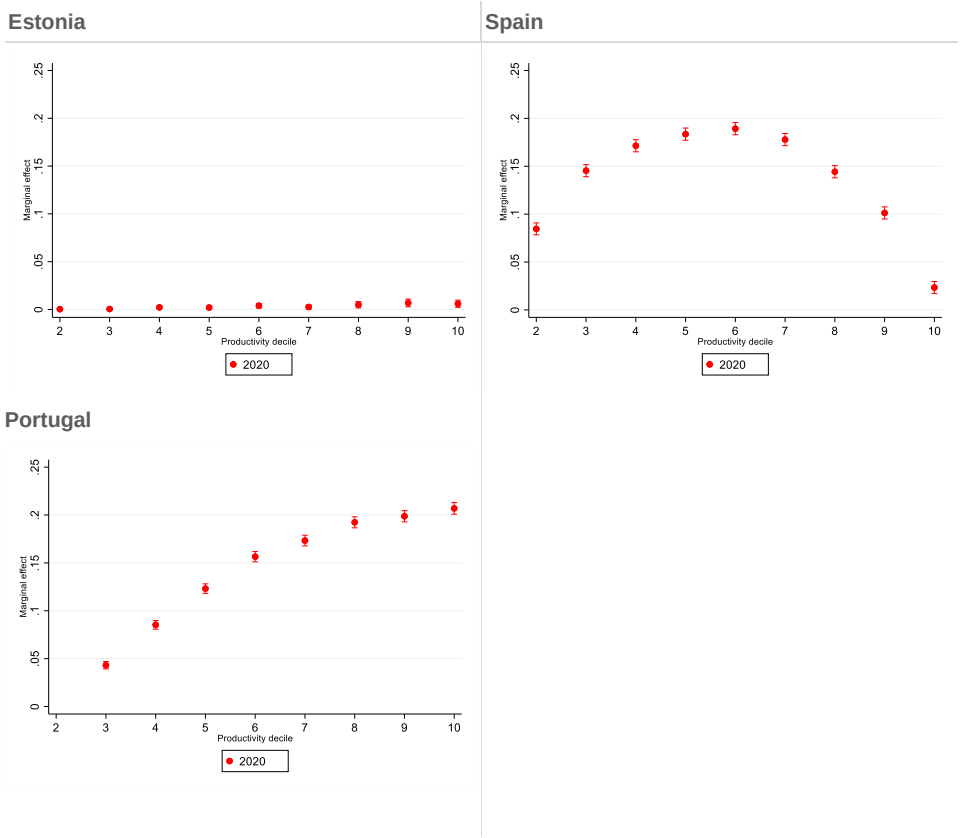


Source: Authors' calculations based on microdata from the countries included in the study.
Notes: Marginal effects from the logit regression for binary dummy representing receipt of COVID-19 pandemic loan moratoria. Effects of control variables with respect to base value – the lowest within-country labour productivity decile. The effects are conditional, the control variables for sectors and size classes were included in the model.

[48] Information on pandemic loan guarantees in Slovenia is not available. In Slovakia, the number of observations is insufficient, as the loan guarantees started to be provided only towards the end of 2020.

Chart 22

Firm probability of receiving loan guarantees – by productivity deciles



Source: Authors' calculations based on microdata from the countries included in the study.
Notes: Marginal effects from the logit regression for binary dummy representing receipt of COVID-19 pandemic loan guarantees. Effects of control variables with respect to base value – the lowest within-country labour productivity decile. The effects are conditional, the control variables for sectors and size classes were included in the model. Insufficient number of observations for Slovakia.

The link between firm productivity and receiving support weakened in the second year of the pandemic. As granular data become available with a certain time lag, individual firm-level balance sheet and income statements data and data on pandemic support are currently available for only a limited number of countries. As suggested by Chart 20, the probability of high-productivity firms receiving wage subsidies declined in the second year of the pandemic, and the distribution shifted leftwards, following the developments in Croatia, Latvia and Slovakia. Similar developments can be seen in Chart 21, when looking at COVID-19 loan moratoria in Slovenia.

4.3.3 Size of the support by productivity

More productive firms received more support in absolute terms than low productive firms, though less support in proportion to their revenue. The probability of a firm receiving support does not tell the whole story. To gauge the overall effect and allocation of the support, it is also important to analyse the size of the support received by each firm. In what follows we focus first on the absolute value of the support (in logarithm) and then on its level relative to firm revenue.

Table 6

Size of wage subsidy – by productivity

(2019-2020)

Variables	Croatia	Estonia	Latvia	Slovakia	Portugal
Labour productivity	0.08781***	0.17832***	0.15829***	0.08965***	0.14312***
	(0.00312)	(0.00606)	0.15829***	(0.00533)	(0.00454)
Constant	0.38576***	-0.21082***	-0.37299***	6.15581***	5.96789***
	(0.01118)	(0.02577)	(0.04703)	(0.05389)	(0.01735)
Control variables:					
Sector	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes
Observations	44,550	8,768	4,208	25,800	59,869
R-squared	0.79871	0.84611	0.56988	0.61155	0.60121

Notes: The table shows coefficients of OLS regressions for supported firms with the subsidies in logarithm as dependent variables. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

The relative size of the support decreases with firm productivity, after controlling for firm sector and size class. The relationship between the size of the subsidies and firm productivity is more linear than the relationship between productivity and the probability of receiving support.

Table 7

Relative size of wage subsidy – by productivity

(2019-2020)

Variable	Croatia	Estonia	Latvia	Slovakia	Portugal
Labour productivity	-0.0744***	-0.02382***	-0.03704***	-0.0078***	-0.0631***
	(0.0015)	(0.00165)	(0.00260)	(0.0002)	(0.0029)
Constant	-5.5331***	0.23276***	0.23648***	0.0452***	0.2242***
	(0.3031)	(0.01519)	(0.02496)	(0.0010)	(0.0111)
Control variables:					
Sector	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes
Observations	44,523	9,249	6,678	23,986	59,869
R-squared	0.1034	0.03679	0.04193	0.0764	0.00895

Notes: The table shows coefficients of OLS regressions for supported firms, with the share of firm subsidies on revenue as dependent variables. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

We find similar results for pandemic loan moratoria or guarantees. The size of the guarantee or moratorium increases with firm productivity, but because productivity tends to be higher for larger firms, the relative size of distributed COVID-19 moratoria or guarantees decreases with firm productivity, even after controlling for sectoral and size firm characteristics.

Table 8
Relative size of loan support– by productivity

(2019-2020)

	COVID-19 moratoria				COVID-19 guarantees		
Variables	Estonia	Slovakia	Spain	Portugal	Estonia	Spain	Portugal
Labour productivity	-0.03390**	-0.02693*	-0.01285	-0.05557***	-0.02926	-0.03508***	-0.03306***
	(0.01701)	(0.01462)	(0.05272)	(0.00123)	(0.04535)	(0.00168)	(0.00128)
Constant	0.30922***	0.56112***	0.89354***	0.20170***	0.13936	0.38505***	0.13426***
	(0.08054)	(0.14979)	(0.21889)	(0.00487)	(0.24750)	(0.00648)	(0.00485)
Control variables:							
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	675	1,375	35,825	87	152,116	38,340
R-squared	0.21789	0.15680	0.04193	0.06097	0.47171	0.02811	0.01974

Notes: The table shows coefficients of OLS regressions for supported firms, with the share of firm guarantees and moratoria on revenue as dependent variables. Insufficient number of observations for Slovakia. Continuous variables in logarithm. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

To conclude, the main findings of the micro-distributed analysis presented in this section suggest an efficient allocation of pandemic subsidies and loan moratoria and guarantees in 2020, given that more productive firms were more likely than less productive firms to receive support and moreover received more in the way of support, in absolute terms, although not in relation to their revenue. We also find that the link between firm productivity and receiving support weakened in the second year of the pandemic because more productive firms recovered more rapidly and were therefore quicker to leave the government support schemes.

Box 7
Data on policy support

Euro area countries implemented various types of policies to support businesses, ranging from employment subsidies and other direct and indirect subsidies to bank loan moratoria and guarantees. The scope and scale of this policy support differed across countries. In this section, we focus on the most frequently used wage subsidies, loan moratoria and loan subsidies, which are the most similar across countries in terms of conditions.

We employ a unique dataset combining individual firm-level policies with balance sheet data covering the seven countries listed in Table A below. We rely on a micro-distributed data analysis to ensure the confidentiality of the individual data, which would otherwise be unavailable for the analysis from outside the governing institutions. See Box 1 for more information on this micro-distributed analysis.

As shown in Table A, data availability differs across countries and support measures. The information on bank loan guarantees and moratoria originates from national credit registers, while the source of information on wage subsidies varies (see Table A4 in the appendix for more details).

Table A

Policy support measures included in the analysis

Country	Wage subsidies	Loan moratoria	Loan guarantees
Croatia	2020-2021	-	-
Estonia	2020	2020	2020
Latvia	2020-2021	-	-
Portugal	2020	2020	2020
Slovakia	2020-2021	2020	2020
Slovenia	-	2020-2021	-
Spain	2020	2020	2020

Note: Data on loan moratoria in Slovenia provide no indication of the size of the support. Data on wage subsidies in Spain are self-reported by firms and provide no indication of the size of the support.

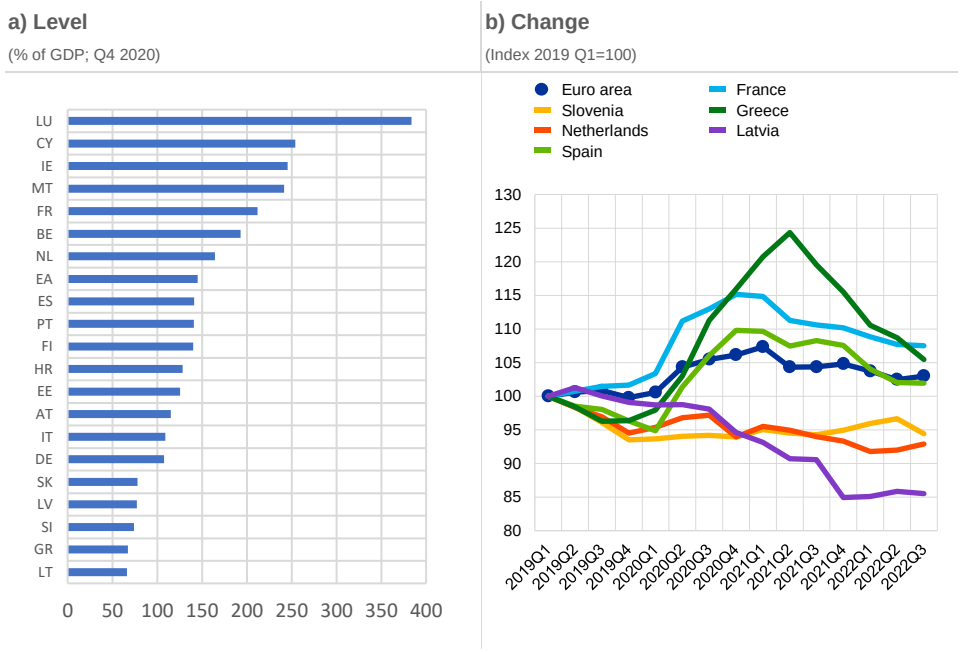
4.4 Pandemic support, indebtedness and zombification

In this section we investigate other possible indirect channels of impact of the pandemic and supporting policies on aggregate productivity. In particular, we analyse how the extensive support policies affected the leverage of firms with different productivity levels, especially zombie firms, meaning those firms unable to honour their interest obligations for three consecutive years.

As a result of the COVID-19 pandemic, levels of debt among non-financial corporations in the euro area steadily increased before peaking in the first quarter of 2021 and then gradually declining. As shown in Chart 23, the aggregate figures hide relatively high levels of heterogeneity across individual countries. In countries like Latvia or the Netherlands, the indebtedness actually declined and remained below the pre-COVID level throughout the pandemic. In Greece and France, the debt level increased somewhat. However, there is no clear relationship between the pre-pandemic level of the debt and its trend during the pandemic. For example, Greece and Latvia, which stood at opposite extremes of the debt dynamics seen during the pandemic, are countries with some of the lowest corporate debt levels in the euro area.

Chart 23

Corporate debt in the euro area during COVID-19

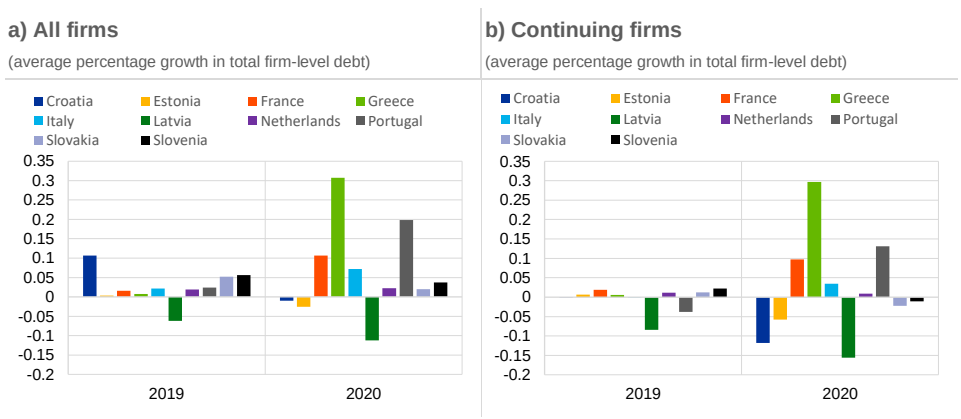


Source: Eurostat.
Note: Debt to GDP – Non-financial corporations.

Firm-level data confirm the aggregate findings and show that debt developments were driven by incumbent firms, rather than by firm entry and exit. As shown in Chart 24, the debt growth was somewhat higher in 2020 for the majority of the countries in our sample, and most of the dynamics originated from among the continuing firms.

Chart 24

Micro-aggregated leverage during COVID-19 – role of continuing firms



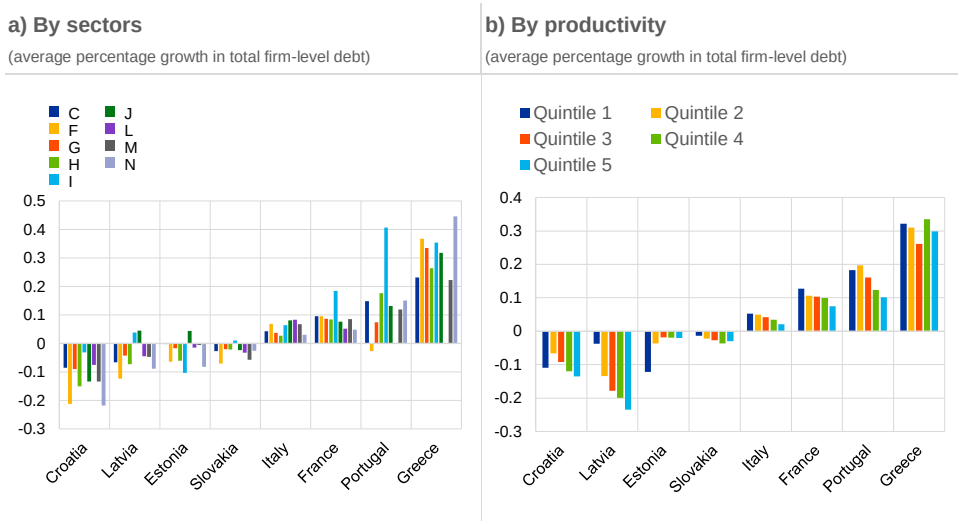
Source: Authors' calculations based on individual firm data originating from the countries included in the study.

The leverage ratio increased (or decreased less) in the most severely hit sectors, with some signs of reallocation of credit towards less productive firms. However, the pattern of higher leveraging (or lower deleveraging) in the severely hit accommodation and food services sector does not hold for all countries,

as shown in Chart 25, panel a), which shows the difference in total debt growth across the main sectors between 2020 and 2019. In Chart 25, panel b) we can see some signs of reallocation of credit towards less productive firms (with some exceptions) in the first year of the COVID-19 pandemic, when less productive firms experienced higher debt growth or lower debt reduction.

Chart 25

Micro-aggregated leverage in 2020 – by sectors and productivity deciles



Source: Authors' calculations based on firm-level data originating from the countries included in the study.

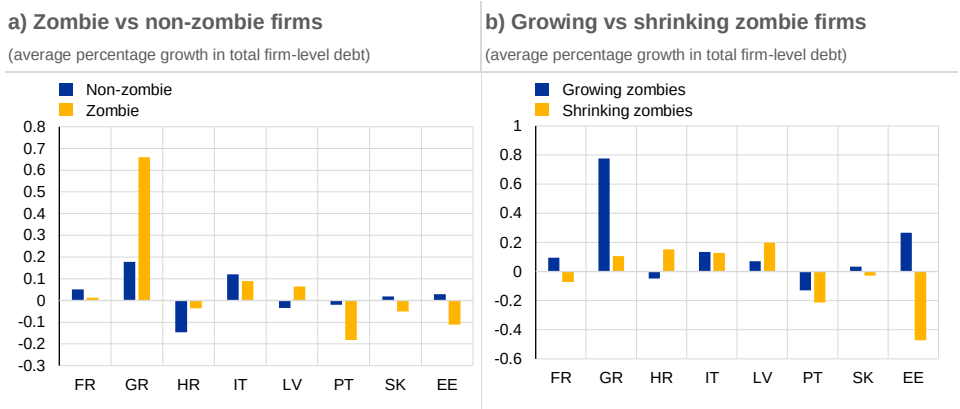
We find that on average zombie firms decreased their total debt level or increased it less than non-zombie firms. We observe a greater increase in the debt level of zombie firms in Greece[49] and Latvia only. Following the approach applied in the monetary policy workstream report (Valderrama et al., 2023), we observe that it was predominantly growing zombies that experienced higher debt growth or a smaller decline in their overall debt.[50]

[49] Developments in Greece may be affected by the limited sample size (233 continuing zombie firms).

[50] Except Latvia and Croatia, though as shown in Chart 26, corporate debt has declined in these countries.

Chart 26

Micro-aggregated leverage during COVID-19 – by zombie status



Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Note: Zombie = Interest payments exceeding EBIT over three years.

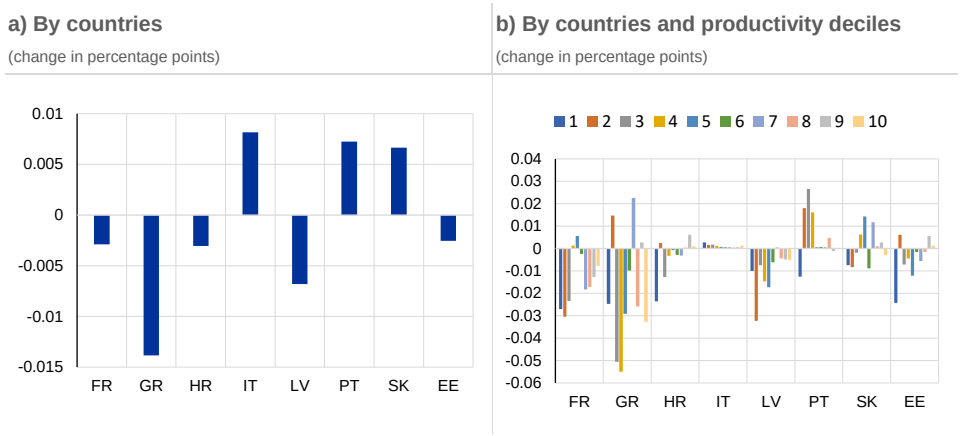
The trend in zombie debt was not driven by the extensive margin, meaning a significant increase or decrease in the number of zombies. The change in zombie prevalence depends on the definition of zombies, though if we follow the default definition used by the Monetary policy workstream (Valderrama et al., 2023),[51] we do not find any significant change in the share of zombies (Chart 27, panel a). The zombie prevalence increased somewhat in three out of eight countries, though the changes in the share of zombies were mostly within 1 percentage point (which represents -12.8% to 11.3% of the prevalence rate, depending on the country).[52] As shown in Chart 27, panel b), changes in zombie shares by productivity deciles do not show any clear common pattern, though perhaps with a somewhat larger decline in low-productivity zombies in those countries with a declining overall share of zombies.

51 Interest payments exceeding EBIT for at least three years.

52 Note that the decreased prevalence of zombie firms in Greece in 2020 does not necessarily imply that support measures were channelled towards zombie firms. Greek data come from Orbis, meaning that registration is not mandatory and delays in registering are widely observed.

Chart 27

Change in zombie prevalence in 2020



Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Note: Zombie – interest payments exceeding EBIT for over least three years.

The conditional negative link between the probability of being a zombie and productivity did not change during the COVID-19 pandemic. The relationship remained largely unchanged in 2020, weakening somewhat (compared to 2019) in only four countries (Estonia, Greece, Portugal and Slovakia), in which certain productive firms were vulnerable to becoming zombies during the COVID-19 pandemic, or as indicated by the unconditional figures, in which the share of low-productivity zombies was able to decline more than the share of productive zombies.

Table 9

Zombie probability by productivity deciles

a) 2019

	EE	FR	GR	HR	IT	LT	NL	PT	SI	SK
Decile 2	-0.052***	-0.072***	-0.101***	-0.058***	-0.023***	0.001	-0.128***	-0.051***	-0.057*	-0.113***
	(0.019)	(0.005)	(0.033)	(0.022)	(0.002)	(0.015)	(0.009)	(0.008)	(0.029)	(0.019)
Decile 3	-0.050***	-0.156***	-0.103***	-0.081***	-0.033***	-0.014	-0.192***	-0.106***	-0.144***	-0.170***
	(0.019)	(0.006)	(0.033)	(0.019)	(0.002)	(0.015)	(0.008)	(0.008)	(0.026)	(0.018)
Decile 4	-0.060***	-0.245***	-0.116***	-0.090***	-0.040***	-0.033**	-0.226***	-0.133***	-0.172***	-0.213***
	(0.018)	(0.006)	(0.033)	(0.019)	(0.002)	(0.014)	(0.008)	(0.008)	(0.025)	(0.017)
Decile 5	-0.072***	-0.315***	-0.133***	-0.103***	-0.045***	-0.030**	-0.249***	-0.144***	-0.172***	-0.237***
	(0.018)	(0.005)	(0.032)	(0.019)	(0.002)	(0.014)	(0.008)	(0.007)	(0.025)	(0.017)
Decile 6	-0.078***	-0.385***	-0.156***	-0.115***	-0.052***	-0.044***	-0.270***	-0.159***	-0.175***	-0.236***
	(0.018)	(0.005)	(0.032)	(0.018)	(0.002)	(0.013)	(0.007)	(0.007)	(0.025)	(0.017)
Decile 7	-0.081***	-0.439***	-0.165***	-0.116***	-0.057***	-0.062***	-0.277***	-0.165***	-0.204***	-0.253***
	(0.018)	(0.005)	(0.032)	(0.018)	(0.002)	(0.013)	(0.007)	(0.007)	(0.024)	(0.017)
Decile 8	-0.086***	-0.482***	-0.132***	-0.121***	-0.062***	-0.063***	-0.286***	-0.172***	-0.214***	-0.249***
	(0.017)	(0.005)	(0.033)	(0.018)	(0.002)	(0.013)	(0.007)	(0.007)	(0.024)	(0.017)
Decile 9	-0.099***	-0.519***	-0.168***	-0.121***	-0.065***	-0.071***	-0.294***	-0.170***	-0.209***	-0.258***
	(0.017)	(0.005)	(0.032)	(0.018)	(0.002)	(0.012)	(0.007)	(0.007)	(0.024)	(0.017)
Decile 10	-0.101***	-0.519***	-0.142***	-0.117***	-0.068***	-0.082***	-0.302***	-0.173***	-0.221***	-0.279***
	(0.017)	(0.005)	(0.035)	(0.018)	(0.002)	(0.012)	(0.007)	(0.007)	(0.024)	(0.017)

Obs.	12,592	146,592	3,928	14,126	367,122	13,368	71,037	69,348	7,474	28,153

a) 2020

	EE	FR	GR	HR	IT	LT	NL	PT	SI	SK
Decile 2	-0.017	-0.076***	-0.035	-0.052***	-0.019***	-0.031**	-0.128***	-0.020***	-0.059**	-0.116***
	(0.017)	(0.005)	(0.029)	(0.017)	(0.002)	(0.014)	(0.009)	(0.007)	(0.029)	(0.017)
Decile 3	-0.024	-0.164***	-0.102***	-0.062***	-0.030***	-0.014	-0.193***	-0.056***	-0.155***	-0.163***
	(0.016)	(0.006)	(0.028)	(0.016)	(0.002)	(0.014)	(0.008)	(0.007)	(0.026)	(0.016)
Decile 4	-0.033**	-0.236***	-0.125***	-0.086***	-0.037***	-0.043***	-0.226***	-0.090***	-0.173***	-0.196***
	(0.015)	(0.006)	(0.028)	(0.016)	(0.002)	(0.013)	(0.008)	(0.007)	(0.025)	(0.015)
Decile 5	-0.052***	-0.307***	-0.121	-0.102***	-0.046***	-0.045***	-0.250***	-0.115***	-0.177***	-0.215***
	(0.015)	(0.005)	(0.029)	(0.016)	(0.002)	(0.013)	(0.008)	(0.006)	(0.025)	(0.015)
Decile 6	-0.050***	-0.382***	-0.127	-0.104***	-0.050***	-0.044***	-0.270***	-0.130***	-0.177***	-0.236***
	(0.015)	(0.005)	(0.028)	(0.016)	(0.002)	(0.013)	(0.007)	(0.006)	(0.025)	(0.015)
Decile 7	-0.057***	-0.447***	-0.106	-0.112***	-0.056***	-0.060***	-0.278***	-0.135***	-0.205***	-0.234***
	(0.015)	(0.005)	(0.029)	(0.016)	(0.002)	(0.013)	(0.007)	(0.006)	(0.024)	(0.015)
Decile 8	-0.058***	-0.484***	-0.122	-0.116***	-0.060***	-0.063***	-0.287***	-0.140***	-0.214***	-0.242***
	(0.015)	(0.005)	(0.029)	(0.016)	(0.002)	(0.012)	(0.007)	(0.006)	(0.024)	(0.015)
Decile 9	-0.063***	-0.518***	-0.128	-0.124***	-0.064***	-0.073***	-0.295***	-0.143***	-0.211***	-0.250***
	(0.015)	(0.005)	(0.029)	(0.015)	(0.002)	(0.012)	(0.007)	(0.006)	(0.024)	(0.015)
Decile 10	-0.070***	-0.512***	-0.139***	-0.117***	-0.066***	-0.082***	-0.302***	-0.144***	-0.223***	-0.278***
	(0.014)	(0.005)	(0.029)	(0.016)	(0.002)	(0.012)	(0.007)	(0.006)	(0.024)	(0.014)
Obs.	12,446	143,229	3,449	15,446	326,866	12,799	71,001	72,364	7,474	29,031

Source: Authors' calculations based on individual firm data originating from the countries included in the study.
Note: The table shows average marginal effects from the logit regression for a binary dummy representing zombie firm. Sector and size control variables included. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Box 8
Zombie prevalence by productivity – methodology

In this box we investigate the relationship between productivity and zombification using logit regressions for binary dummy variable (Yt), with various firm-level explanatory variables (Xt-1) and sectoral or regional control variables:

$$\Pr(Y_t = 1|X_{t-1}) = \frac{1}{1+\exp(-X_{t-1}\beta)} \qquad (1)$$

where Pr(Yt=1|Xt-1) denotes the probability of being a zombie firm in period t given Xt-1, which is a row vector of explanatory variables and β is the corresponding column vector of regression coefficients.[53] The probability of a firm becoming a zombie depends on the firm's characteristics from the preceding year.

Zombie prevalence and indebtedness do not seem to be significantly affected by the COVID-19 policy support. The share of support allocated in 2020 to firms defined as zombies in 2019 was lower than their share among the firm population

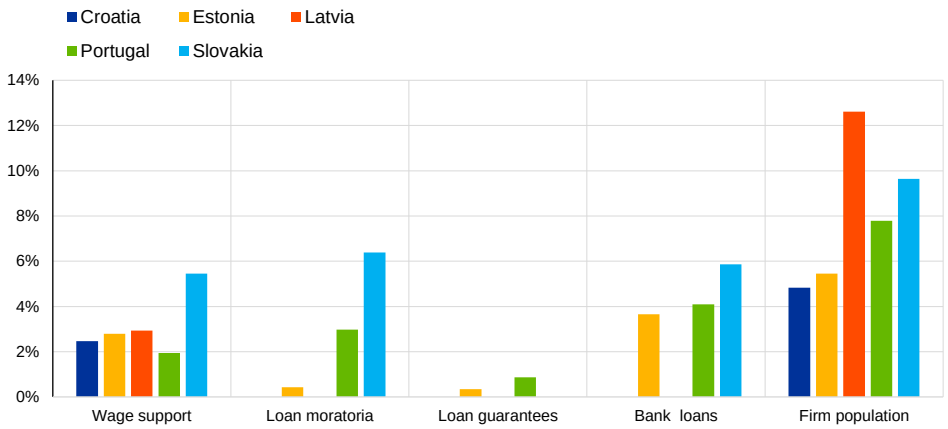
[53] The vector Xt-n contains main control variables (sector, size and region), various continuous explanatory variables (e.g. labour productivity, wage share or price-cost margin) and binary explanatory variables (e.g. for firm liquidity, ownership or financial distress). Continuous explanatory variables enter the model in logarithm.

(Chart 28). The same finding holds also for loan moratoria and guarantees. The share of loan support provided to zombie firms was also lower than the share of all bank loans provided to zombies, except for Slovakia, where the share of loan moratoria allocated to zombie firms was somewhat higher than the share of bank loans provided to zombie firms.

Chart 28

COVID-19 subsidies and loans to zombie firms

(Percentage of total firms)



Source: Authors' calculations based on microdata from the countries included in the study.
Note: Zombie = interest payments exceeding operating profit for three straight years.

A regression analysis confirms the lower probability of zombie firms receiving support. As suggested by the results presented in Table 10, zombie firms had lower (or statistically insignificant) probability of receiving COVID-19 loan moratoria or guarantees during the pandemic in comparison to non-zombie firms.

Table 10

Firm probability of receiving loan support – zombie firms

(2019-2020)

	COVID-19 moratoria				COVID-19 guarantees	
Variables	Estonia	Portugal	Slovenia	Slovakia	Estonia	Portugal
Zombie	-0.00338	-0.02126**	-0.05090***	0.00297	-0.00331	-0.24514***
	(0.00229)	(0.00874)	(0.01347)	(0.00314)	(0.00318)	(0.00629)
Control variables:						
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Size class	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,631	47,623	12,350	27,536	7,598	47,623

Source: Authors' calculations based on microdata from the countries included in the study.
Note: Marginal effects from the logit regression for binary dummy representing receipt of pandemic loan moratoria and guarantees. The effects are conditional, the control variables for sectors, size classes and productivity were included in the model.

In summary, the temporary increase in aggregate euro area corporate debt during the first year of the COVID-19 pandemic hides important country-, sector- and firm-

level heterogeneity. As presented in this section, we observed somewhat higher leveraging or lower deleveraging in the most severely hit sectors and certain signs of reallocation of credit towards less productive firms. The pandemic did not lead to an increase in zombie shares and zombie status continued to depend on the firm's productivity. Results based on granular data suggest that zombie prevalence and indebtedness was not significantly affected by the COVID-19 policy support.

5 Productivity impacts in the long run

Long-standing consumption and production habits changed during the COVID-19 period, and especially during the lockdown periods. Certain economic activities had to be halted altogether for sanitary reasons, while others had to be restructured, such as global value chains. A large part of the workforce was temporarily unemployed or could work part-time only. Households were affected too, as they were soon confronted with store closures, leading to a surge in online sales, or disrupted import channels, obliging then to buy more locally. As a result, firms had to learn to produce differently, though also to sell differently. These rapid developments presented opportunities for some existing or new companies, while having a detrimental impact on others. Firms and households alike learned to adapt to this new environment and the resulting impacts on both the economy and productivity. The key question now is which changes are here to stay, and which have ultimately been a temporary fix to a temporary phenomenon.

At the time of writing, answering this question is a tentative exercise. Describing the possible long-term consequences of COVID-19 on productivity is indeed difficult, for at least four reasons. Firstly, it is difficult to isolate the long-term effects of COVID-19, because recent data are simply not yet available. Secondly, the impact on productivity of several new "trends" is not clear yet, and relevant literature is scarce or unavailable. In addition, the COVID-19 pandemic is not yet fully over. In several cases, it is therefore difficult to distinguish the (long-term) consequences of COVID-19 from temporary changes. To complicate matters further and make it harder to isolate the effects of COVID-19, we have experienced another (energy) crisis since the pandemic, which has also had a heavy impact on the economy. In this section we focus on long-term impacts, in contrast to the rest of the report, and in doing so we rely on data that are as recent as possible, normally extending up to 2022.

This section therefore focuses on certain trends and structural breaks which might have a longer-lasting impact on productivity. More precisely, we discuss changes in consumer preferences, the digitalisation uptake and changes in working habits, and labour market scarring and changes in labour force capabilities, in that order.

5.1 Changes in consumer preferences

5.1.1 E-commerce and online shopping

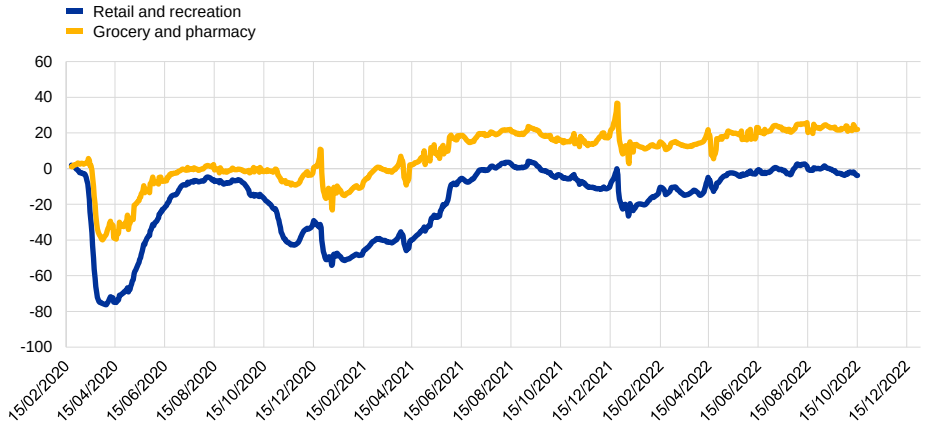
There was a huge surge in the use of e-commerce and online shopping during the COVID-19 period. While online shopping was largely unavoidable then, due to all the store closures and successive lockdowns, consumers may also have discovered other advantages, such as the ease of choosing from a large available

supply and being able to compare prices, without having to leave the house. Therefore, even after the restrictions were lifted, online shopping may have become permanently more relevant. However, some consumers still prefer shops and like having the physical presence of sellers or want to get personal advice. There are also ecological considerations about the roads being permanently filled with delivery vans, and other aspects, which may weigh on the continued growth of e-commerce. This particular argument can be illustrated by looking at daily mobility data, which shows that the sharp declines in retail-related and recreational mobility and in mobility towards groceries and pharmacies soon reversed from around mid-2021 onward (Chart 29).

Chart 29

Daily mobility

(euro area[1]; % change from baseline[2], 7 days: moving average)



Source: Google Mobility Reports.
Note: [1] Data for 18 euro area countries (no data available for Cyprus), weighted using population; [2] The baseline is the median value for the corresponding day of the week, during the five-week period running from 3 January to 6 February 2020.

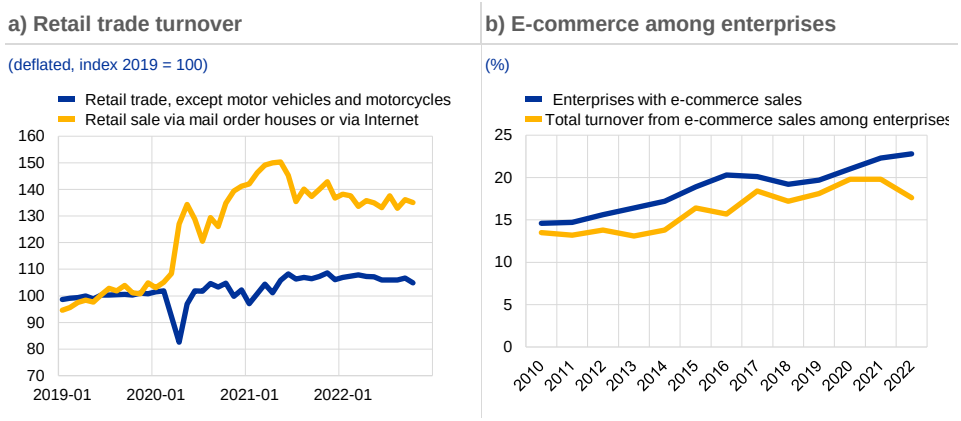
The increase in online shopping outpaced the increase in overall sales. At the beginning of the COVID-19 crisis, deflated turnover data in the retail trade dropped considerably, by around 20% (Chart 30, panel a). In mid-2020, turnover returned to the pre-COVID-19 level and even exceeded it. Online shopping, by contrast, increased sharply with COVID-19. In 2020, deflated online turnover was some 30% higher than in 2019 and in 2021 it increased even further. In 2022 it slowed down somewhat, but still remained some 30-40% above the pre-COVID-19 situation.

The share of enterprises reporting e-commerce sales, which had appeared to stabilise following 2016, began to surge once again with the onset of the COVID-19 crisis, and in 2022 about 23% of total firms sold online. This percentage is the highest in “Accommodation and food service activities” and in “Wholesale and retail trade”, and is higher for larger firms. During the COVID-19 period, e-commerce sales rose to about one fifth of firms’ turnover, though in 2022 this share decreased again, to around 18%. It was highest in “Electricity and gas”, “Manufacturing” and “Information and communication”, and was once again more significant among larger companies (Chart 30, panel b) and Table 11). Therefore, e-commerce will likely remain more relevant than what it was before the COVID-19 crisis, though there is

some evidence to suggest that its share will not remain as high as it was during the crisis.

Chart 30

E-commerce and online shopping



Source: Eurostat.

Table 11

E-commerce in enterprises

(EU27; 2022; %)

	Enterprises with e-commerce sales	Total turnover from e-commerce sales among enterprises
Total	22.8	17.6
By sector		
Manufacturing	21.1	21.4
Electricity, gas, …	12.0	23.4
Construction	6.0	1.7
Wholesale and retail trade	37.1	18.3
Transportation and storage	15.7	15.3
Accommodation and food service activities	39.8	11.6
Information and communication	25.8	20.8
Professional, scientific and technical activities	11.3	4.5
Administrative and support service activities	14.6	9.4
By size		
10-49 employees	20.8	7.9
50-249 employees	29.9	14.7
250 employees or more	44.1	23.1

Source: Eurostat.

This sudden surge in e-commerce brought with it a considerable change in certain economic activities, with possible impacts on productivity. However, economic literature on the link between e-commerce and productivity remains rather limited. OECD (2021b) found a positive effect of online platform diffusion on productivity growth among incumbent firms. These productivity gains are the result of increases in value added rather than reductions in employment, indicating that online platforms generate larger business opportunities. The productivity effect is larger for small companies and for firms in the middle of the productivity distribution. As such, online platforms can help to level the competitive playing field between small and large firms, narrow the productivity gaps among firms, and contribute to aggregate productivity growth by making laggard firms more productive. Relying on South Korean data, Chun and Shin (2022) found that online retailers primarily contribute to industry productivity through post-entry productivity growth. Low entry costs encourage the large-scale entry of online retailers, which then enter the market with lower productivity. Yet surviving online retailers grow faster than offline entrants. The low productivity of the entrants could decrease industry productivity until their growth potential is realised.

5.1.2 Buying locally and concerns about the environment

Environmental awareness among consumers increased while they remained confined to their homes during the COVID-19 lockdowns. For instance, now that they were in closer contact with their waste, they became more aware of just how much packaging there was. Moreover, the curtailment of international trade flows made consumers more aware about the origin of their daily purchases. According to the Consumer conditions survey of the European Commission, in 2020 56% of EU27 consumers considered the environmental impact of at least one purchase and 23% took this impact into consideration for most, if not all, of their purchases. In addition, 67% of consumers said that they bought products that were better for the environment, even if those products were more expensive. A further 81% claimed they shopped closer to home and supported local businesses.

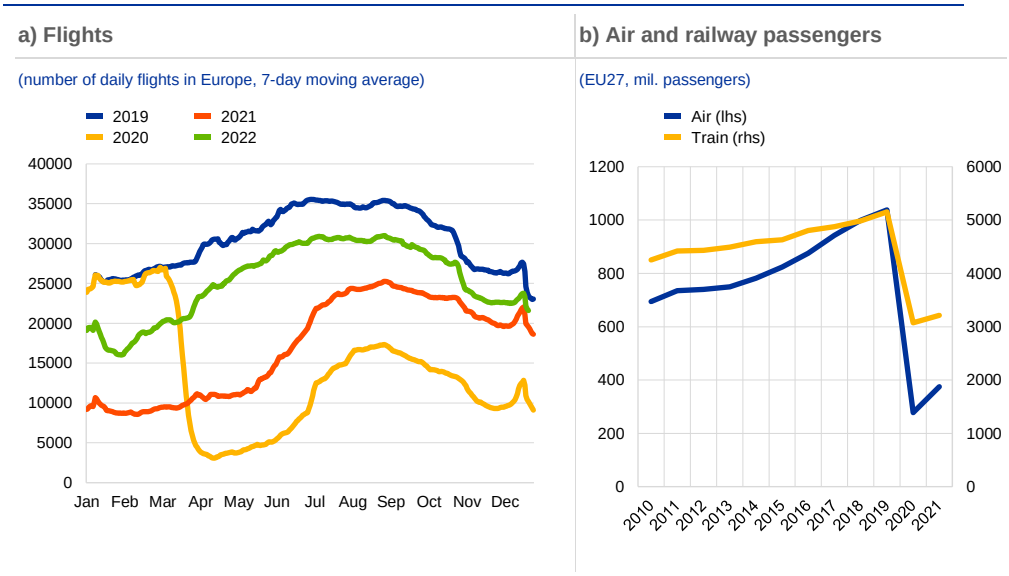
The question remains whether this increased awareness will persist. According to trade volume data, over the first nine months of 2022, intra-EU import volumes were 6% higher than in 2019, while EU27 imports from the rest of the world increased by 12% on average. The increase was more pronounced for imports coming from countries like Iran, China and Taiwan (35 to 42% increase) and India and Egypt (30% increase). Although trends relating to specific products may be behind these changes, there appears to be no strong indication that international trade would have shifted from extra- to intra-EU flows. Of course, international trade flow figures provide no indication of the extent to which households buy locally. In order to analyse this, detailed business-to-consumer data would be needed, which are not available.

5.1.3 Travel

Travel plans were put on hold during the pandemic, though travel did recover afterwards. In Spring 2020, a massive drop in the number of flights was observed. By the end of the summer, the usual seasonal pattern was observed again, but the number of flights was at a much lower level than before COVID-19. A gradual recovery then took place throughout 2021 and 2022, although at the end of 2022 the number of daily flights was still lower than during the corresponding period of 2019 (Chart 31, panel a). In particular, while the transport of goods by air was in 2020 "only" 9% lower than the year before and in 2021 already 10% higher than in 2019, the number of air passengers dropped by more than 70% in 2020. The number of train passengers also decreased during the COVID-19 crisis, albeit to a lesser extent (40% reduction). Although both air and train passenger numbers rose again in 2021, they were still way below the pre-COVID-19 situation. Preliminary data on air passengers point to a further recovery during the first two quarters of 2022. However, during that period the number of air passengers would still have been some 30% below the figures for the corresponding period of 2019.

It remains uncertain whether the observed changes in travel habits are permanent or not. This assessment is further complicated by the subsequent energy crisis, as fares increased due to rising fuel prices. In addition, aviation will become more fully integrated in the EU ETS in the coming years, implying that higher emission prices will lead to higher fares. It will therefore be interesting to see whether travel will be permanently lower and/or remain more volatile, and whether there will be permanent changes in preferences with regard to distance (e.g. shift towards spending holidays in nearby destinations) and type of travel (e.g. train instead of plane).

Chart 31
Trend in travel habits over time



Sources: Eurocontrol and Eurostat.

In conclusion, many long-established consumption habits and sales trends changed abruptly during the COVID-19 pandemic, some permanently and others only temporarily. For instance, levels of environmental awareness among consumers and travel intensity are now close to where they were prior to the pandemic, whereas increased use of e-commerce and online shopping are expected to remain and will likely have a longer-lasting impact on productivity.

5.2 Digitalisation uptake and changes in working habits

The COVID-19 pandemic has led to a significant increase in the prevalence of home office compared to the pre-COVID-19 period, enabled by mass digitalisation[54]. At the same time, employees have grown accustomed to the new working habits and teleworking seems to be here to stay. This will have long-term consequences for productivity and help make several changes in consumer preferences become permanent and thereby impact productivity (when people continue to spend more days working from home).

5.2.1 Teleworking

One of the main consequences of the COVID-19 outbreak and related containment measures was a large number of people working from home due to the lockdowns imposed by governments around the world.[55] The unprecedented shift towards telework raises a number of crucial questions about its implications for the future of work, the policies needed to ensure that employees and employers alike adapt to the new conditions of digital transformation, and the further adoption of teleworking practices within the EU. The changes brought about by the pandemic are already seen as a harbinger of labour market trends to come rather than as a parenthesis that will close once the current crisis is over.

The use of teleworking increased sharply in the spring of 2020 following the introduction of social distancing measures to control the spread of the COVID-19 pandemic. In May 2020, the European Commission, in its communication on country-specific recommendations, referred to the important role of teleworking not only in protecting existing jobs, but also in creating new jobs.[56] According to Eurofound estimates, around 40% of employees in the EU started working full-time from home as a result of the pandemic.[57] Daily mobility data confirm this trend: during lockdown periods, transport to and from workplaces fell drastically, while mobility around places of residence rose substantially. Yet the initial peak observed during the first COVID-19 wave was not repeated afterwards, and mobility trends

54 Naturally, this topic is addressed more thoroughly in the report of the Digitalisation and productivity workstream (Anghel et al., 2023).

55 "Work from home" qualifies as teleworking, while "work at home" refers to work done using one's home as a primary place of work, often involving self-employment, and without the use of ICT.

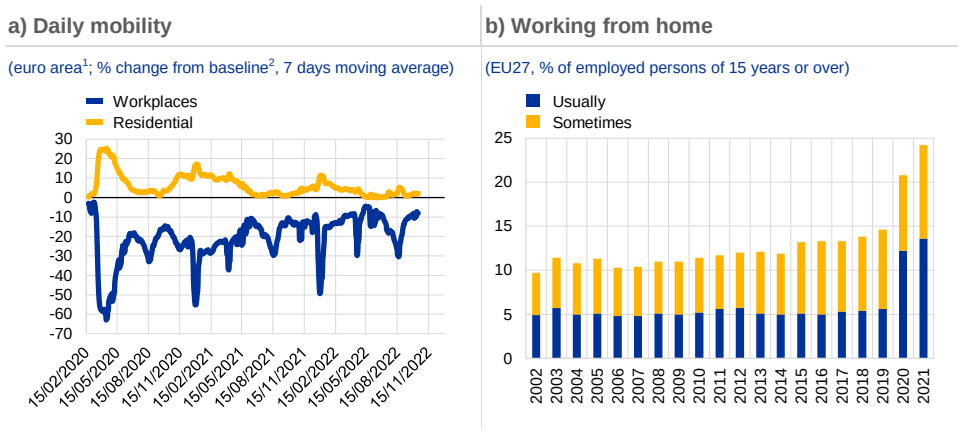
56 European Commission Communication, 2020 European Semester: country-specific recommendations, COM(2020) 500 final, Brussels, 20.5.2020.

57 Eurofound (2020).

steadily returned to their pre-COVID-19 levels (Chart 32, panel a). According to the EU labour force survey, the percentage of employees working frequently or occasionally from home increased sharply in 2020, and rose further to almost 25% in 2021. Most notably, the share of people usually working from home boomed strongly during that period (Chart 32, panel b). This contrasts with the situation seen prior to the pandemic, when the prevalence of teleworking varied considerably across EU Member States: in countries such as Sweden, Finland, Luxembourg and the Netherlands, the share of people working from home regularly, or at least sometimes, was above 30%, whereas it stood below 10% in almost half of EU Member States. Moreover, teleworking was more prevalent in knowledge- and ICT-intensive services: on average in 2018 in the EU, over 40% of workers in ICT services were already regular or frequent teleworkers and this proportion was also high (above 20%) in finance and insurance. Before the outbreak of the pandemic, teleworking had predominantly been used by high-skilled workers and managers, who do most of their work on a computer and enjoy a high degree of autonomy.[58] Teleworking was also more widespread in countries with the highest shares of employment in knowledge- and ICT-intensive services.[59]

Chart 32

Developments in working from home over time



Note: [1] Data for 18 euro area countries (no data available for Cyprus), weighted using population; [2] The baseline is the median value for the corresponding day of the week, during the five-week period running from 3 January to 6 February 2020.

The process of adjusting to the new teleworking regime depended on the level of previous experience with more flexible forms of work. The cost of the lockdown was likely lower for countries that already recorded higher shares of employees using some form of remote work. Teleworkable occupations during the lockdown period are those with the highest proportion of highly educated workers and with the highest average wage levels.[60] More generally, countries that enjoyed a relatively advanced level of technological or digital maturity in terms of infrastructure and skills (such as the Nordic countries), organisational readiness, and management capabilities were able to adapt more quickly and more easily to the pandemic-

58 It should be noted that some jobs are not teleworkable, while others are exclusively performed away from the employer's premises but do not entail the use of ICT.

59 See Sostero et al. (2020).

60 See Fana et al. (2020).

induced high demand for remote work. A firm's preparedness to switch to teleworking mode is key to a comprehensive business continuity plan.

Teleworking will continue to be used more often than before the COVID-19 period, as the system has clear advantages for both employers and employees, despite also having certain drawbacks. For instance, employees no longer have to spend considerable time commuting and can work more flexibly, allowing for a better work-life balance. Meanwhile, teleworking arrangements can save employers money, as less office space is needed. In addition, during the energy crisis, firms used teleworking to shut down heating in part of their buildings or during certain periods of the year. Teleworking has some societal advantages too, such as the resulting reduction in traffic jams, as home-work movements are reduced. Despite these clear advantages, telework also presents certain drawbacks. For employees, the distinction between work and private life can become blurred, as both activities happen in the same place, and working and private activities can easily and continuously flow over into each other. For employers, significant ICT investments must be made (such as to make data flows secure), and things become more complicated if they wish to monitor the work of their employees.

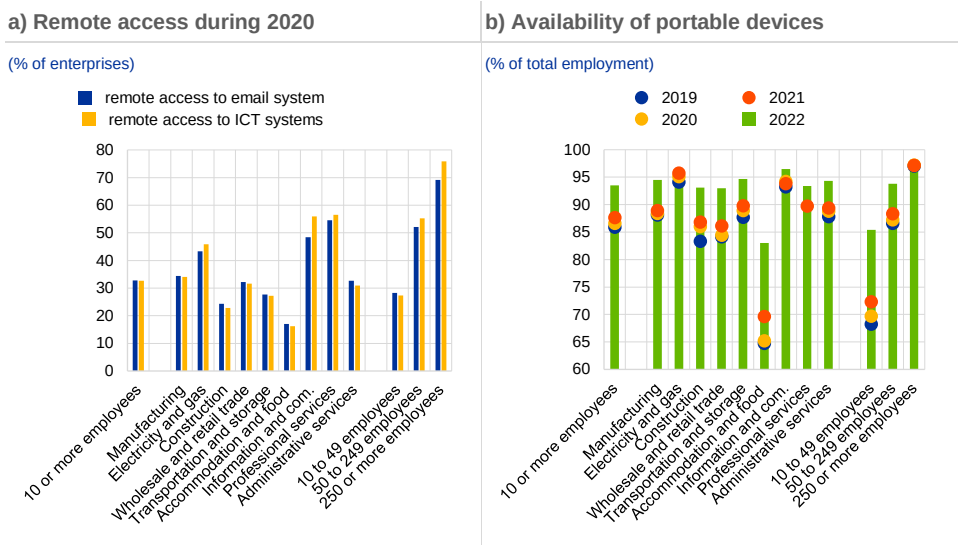
Increased teleworking as a result of the COVID-19 pandemic could have favourable effects on firm-level productivity, particularly through the accelerated diffusion of technologies. However, adequate preparation and appropriate policies are needed, so that businesses and workers can reap all the benefits offered by a more widespread use of teleworking. This in turn could have positive effects on aggregate productivity and worker well-being, as well as on other areas such as climate change.

5.2.2 Digitalisation

Linked to the development of teleworking, a large share of firms invested heavily in digitalisation. During 2020, some 30% of enterprises increased the share of employees having remote access to the corporate e-mail and ICT systems. The same percentage of companies provided their employees with portable devices allowing for a mobile connection to the internet for business use (Chart 33, panel a). In 2022, a further sharp increase was observed in the share of employees having a portable device of their employer at their disposal (Chart 33, panel b). Without a doubt, this digitalisation trend among firms is permanent, as ICT infrastructure, security, hardware and software imply large fixed investment costs. However, there is also a significant degree of heterogeneity between firms, given that some sectors (such as "Accommodation and food services") lag behind, and also between size classes, as larger enterprises make greater efforts towards digitalisation. Observed trends in internet speed suggest that teleworking has been facilitated also by a strong speeding-up of internet connections (Chart 34).

Chart 33

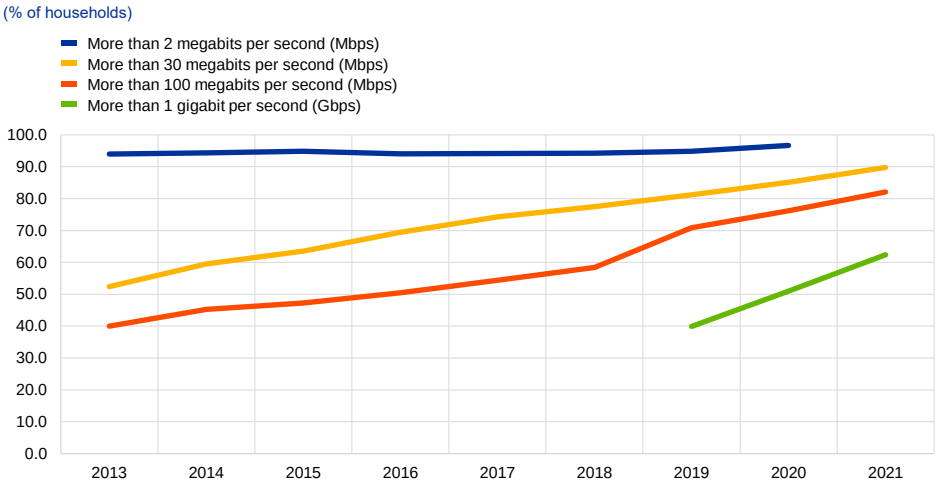
Digitalisation in the euro area per sector and firm size



Source: Eurostat.
Notes: Panel a): Enterprises that have increased the percentage of employees having remote access to the company's email system or ICT systems. Panel b): Employees who receive portable devices from their company, allowing for a mobile connection to the internet for business use. Sectoral division for the aggregate group of enterprises with ten or more employees.

Chart 34

Internet speed in the European Union over time



Source: Eurostat.

Box 9

Impact of the pandemic on capital deepening and possible long-term implications

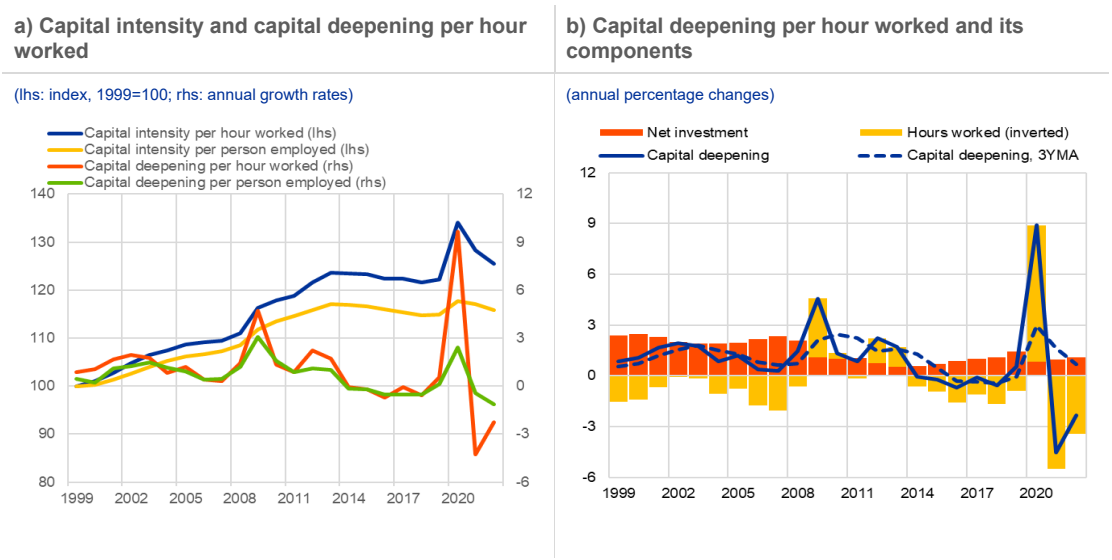
Capital deepening is a major source of longer-term productivity growth. The standard growth accounting framework typically differentiates two main sources of longer-term productivity growth: (i) capital deepening – i.e. giving each unit of labour more capital to work with; and (ii) total factor productivity – the part of aggregate productivity growth that cannot be explained by changes in capital or labour. While much has already been written elsewhere in this paper about the impact of lockdown practices and job retention schemes on measured productivity growth over this period,

somewhat less attention has been paid (also in the wider literature) to the longer-term repercussions of the pandemic on capital deepening. This box makes a first attempt to fill that void. Given the distortions in labour measurement since the pandemic due to the widespread use of job retention schemes, we focus principally on capital deepening per hour worked.

Until the onset of the pandemic, euro area capital deepening had looked to have stagnated in the aftermath of the double dip recession of 2008-13. Over the course of Economic and Monetary Union (EMU), "capital intensity" (the estimated net capital stock per hour worked) has risen by around 25% on its 1999 levels (Chart A, panel a). Measured per person employed, it has risen by just 16%, reflecting the lower growth in employment than in total hours worked. The average rate of "capital deepening" (the rate of change in the capital intensity per hour worked) was thus just 1% per year (0.6% per year per person employed), according to the European Commission's latest AMECO estimates.[61] Much of the growth seen in the rate of capital deepening had been achieved in the first decade of EMU, largely driven by ostensibly strong rates of net investment, which more than outpaced increases in labour input (Chart A, panel b). In the aftermath of the Global Financial Crisis (GFC), the rate of capital deepening slowed sharply, reflecting a strong decline in the rate of investment growth,[62] before falling into negative territory in the six years to 2019, as employment and hours worked gradually rebounded. This occurred despite the interval between the end of the double dip recession and of the pandemic being a period of record low interest rates and slowly increasing hourly wages.

Chart A

Capital intensity and capital deepening throughout EMU



Sources: Eurostat, AMECO and ECB staff calculations.
Notes: Capital intensity measured as a ratio of net capital stock per unit of labour; capital deepening is the rate of change in capital intensity; see https://darwin.escb.eu/livelink/livelink/app/nodes/1735454546, "Charts (May 2023)".

61 As AMECO data do not include estimates of capital deepening in terms of hours worked, the results presented here are derived using the latest national accounts data on hours worked. AMECO data on investment and employment have also been slightly adjusted to reflect the latest revised national accounts data.

62 The abrupt declines since the onset of the GFC in 2008 in part reflect the marked decline in the rate of construction investment growth following strong corrections to overheated housing markets in some euro area countries.

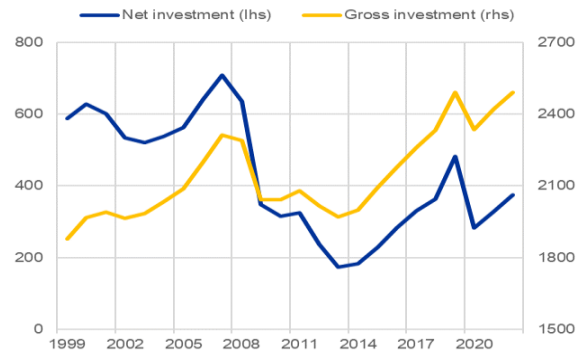
The strong decline in hours worked over the lockdowns of 2020 led to a sharp spike in the rate of euro area capital deepening, though the increase looks to have been short-lived. While net investment retreated significantly in 2020, this decline was dwarfed by the substantial contraction in hours worked in that year, leading to a strong surge in measured capital deepening for the year.[63] Since 2020, however, net investment has expanded modestly (albeit merely back to the average rates of growth seen in the run-up to the pandemic), while the sharp rebound in hours worked since 2020 has tipped rates of capital deepening back into strongly negative territory. Over the three years since the onset of the pandemic, capital deepening per hour worked has averaged around 1% per year (0.6% per person employed) – i.e. back towards the EMU average and slightly better than the rebound years following the double dip. Notably, this was a result of still subdued hours worked, rather than stronger investment, and left overall capital intensity barely above the levels seen in 2014.

Not all investment is equally productive. Aside from aggregate developments in capital deepening and its drivers, longer-term productivity growth also depends substantially on the composition of the net investments made in recent years. Aggregate investment encompasses a wide variety of asset classes, including less directly "productive" investments in, for example, housing and "valuables", which tend to be less productivity-enhancing in the longer run, as well as more standard business investments in machinery and equipment or R&D. In an effort to glean signals as to the productive nature of the investments made over the pandemic, and in the absence of a breakdown of real net investment by asset class, we take a brief look at developments in real gross investment per hour worked, splitting aggregate investment into the two main (and now broadly equally sized) subcomponents available from regular national accounts data, namely, the less productive "construction" segment (including housing investment) and the typically more productive "non-construction" component (the closest national accounts' proxy for business investment) relative to total hours worked. While at the aggregate level, net investment tends to be considerably more volatile than gross investment, the two series have co-moved closely in the wake of the double dip recession (see Chart B), with a correlation coefficient of over 0.9, following the strong increase in capital consumption (and depreciation of net assets) that resulted from the 2008-13 crisis.

Chart B

Net and gross investment throughout EMU

(both EUR billion, 2015 prices)



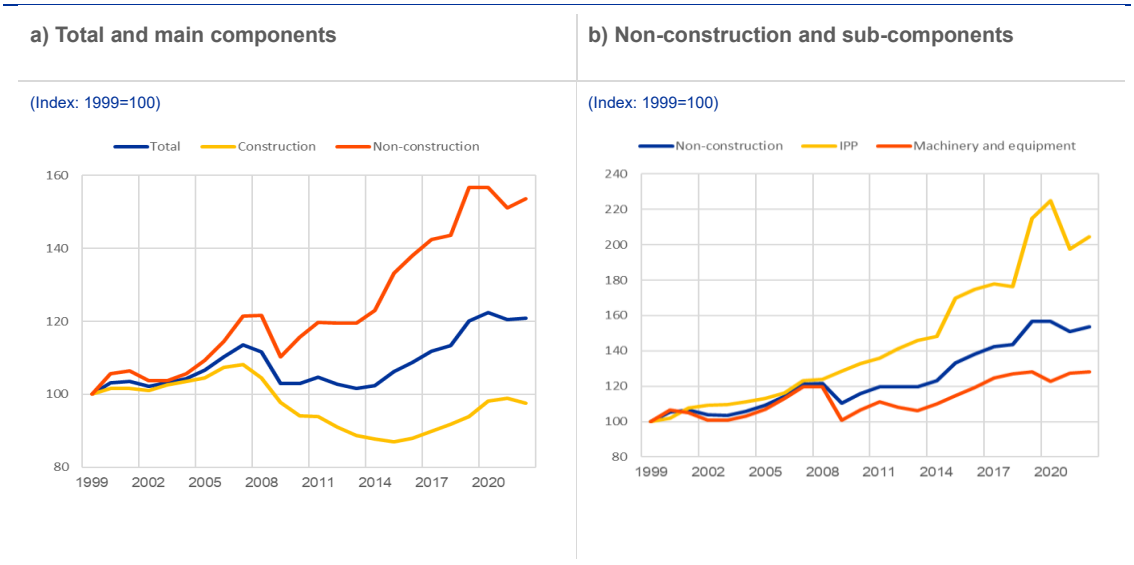
Sources: AMECO and ECB staff calculations; see https://darwin.escb.eu/livelink/livelink/app/nodes/1735454546.

63 The change was much smaller when measured in headcount employment, given the widespread use of job retention schemes, which kept employment high, even though activity fell sharply.

At face value, the pandemic does not appear to have affected the investment-to-labour ratio to the same lasting extent as the GFC. Differences in depreciation rates across asset classes notwithstanding,[64] Chart C (panel a) suggests that, so far at least, neither construction nor non-construction investment per hour worked has suffered the strong and continued declines seen in the wake of the GFC. Indeed, after a marked unwinding in 2021 from the pandemic-induced peak in 2020, the potentially more productive non-construction ratio seemed by 2022 to be rebounding back towards the stronger rates of growth seen immediately prior to the pandemic. However, if we decompose non-construction investment further into its two main sub-divisions (Chart C, panel b) – those of tangible investments in "machinery and equipment" (akin to the traditional business-related notions of "physical capital" and "fixed assets") and intangible investment (covered in the national accounts as "intellectual property products" (IPP), encompassing, inter alia, investments in R&D, software and databases) – we find some evidence of a stagnation in the growth of the machinery and equipment investment-to-hours worked ratio, while the slight rebound seen of late in the overall non-construction investment-to-hours worked ratio has been driven exclusively by the revival in IPP (following some corrections in 2021). While it may be tempting to conclude that these increases may reflect the first signs of a structural transformation under way towards a more digital economy in the aftermath of the pandemic, it should be remembered that this large and swiftly growing sub-component of total investment has, over the past decade, included a number of large-scale transfers of intellectual property rights by multinational enterprises domiciled outside the euro area, rather than domestically-produced R&D or enhanced IT operations.[65]

Chart C

Trend in euro area real investment per hour worked



Sources: Eurostat and ECB staff calculations; see https://darwin.escb.eu/livelink/livelink/app/nodes/1735454546, tab "index,INVperHW".

64 National accounts data record gross investment only, i.e. without any adjustment for rates of depreciation or obsolescence. While depreciation rates may vary substantially across asset classes, estimates also vary considerably in the economic literature and there are, as far as we are aware, as yet no assessments as to how depreciation rates for different asset classes may themselves have been accelerated over the recent crisis years. This aspect warrants serious attention moving forward.

65 For a succinct discussion, see the Boxes titled "Non-construction investment in the euro area and the United States" and "Intangible assets of multinational enterprises in Ireland and their impact on euro area GDP" in Issues 5/2022 and 3/2023, respectively, of the Economic Bulletin.

Overall, aggregate capital deepening has increased modestly over the course of the pandemic, albeit at still below pre-pandemic levels of hours worked. Our findings suggest that the legacy of the pandemic has not, so far, led to any lasting damage to the rates of capital deepening seen prior to the crisis, with capital deepening broadly back to EMU averages. This is in spite of substantial national and EU-wide efforts to support the investment needed for a greener and more digital post-pandemic economy. With total hours worked still not back to pre-pandemic levels, and recent interest rate hikes likely to constrain the rate of investment looking ahead, the rate of capital deepening may well fall further. Understanding the full implications for future productivity growth of the modest increase in capital deepening seen since the onset of the pandemic will likely take some time. Although it may take several years for the full effects of the pandemic on capital deepening to be seen – and potentially decades before the full gains of recent investments are reaped – further attention to this important underlying source of potential productivity growth seems urgently warranted.

5.2.3 Impact on productivity

The literature describes various channels through which teleworking can positively affect productivity[66] and bring significant benefits to employees, firms and society at large. For employees, working from home offers increased flexibility and a better work-life balance, as well as significant savings on daily commuting costs. For firms, a widespread adoption of teleworking practices could boost productivity, while also allow for the recruitment and retention of younger employees from a broader geographic region, thereby facilitating access to a wider talent pool and reducing operating costs and absenteeism. For society at large, teleworking has multiplier effects, as, in addition to visible environmental benefits (traffic congestion relief, spatial decentralisation, reduced air pollution), flexible work arrangements can help create new jobs not only for the most vulnerable groups (long-term unemployed, women, people with disabilities), but also for those living in remote and distressed areas, thus fostering a more inclusive labour market.

However, teleworking also entails a number of risks for employees. These include limited social interaction and isolation, monotony and routine, longer working hours and difficulty in “disconnecting” from work, reduced teamwork, fewer opportunities for professional development, employees bearing the costs related to working from home, lack of labour protection, including unpaid overtime and parental leave. Teleworking also carries risks for businesses, which may face difficulty in building a strong corporate culture, higher technological infrastructure costs, information security and employee health and safety issues, and difficulties in monitoring and coordinating employees. Pre-pandemic studies are inconclusive as to the net benefits or costs of teleworking.[67] More and more studies are focusing on the effects of teleworking and especially its impact on productivity.

66 See, for example, Arntz et al. (2020).

67 By way of illustration, an experimental study showed that teleworkers were much more productive, exhibiting an increase of about 20% in their productivity, more satisfied and less likely to quit. Yet they also had fewer opportunities for career advancement than other employees with a comparable level of performance. See Bloom et al. (2015).

An OECD study listed some factors that affect the impact of teleworking on worker efficiency and firm performance (Criscuolo et al, 2020). A first element is worker satisfaction, which can be raised (e.g. better work-life balance, less commuting) or lowered (e.g. solitude, hidden overtime) by working from home. Secondly, telework can lead to cost reductions for the firm, for instance because of reduced office space needs. Thirdly, communication, knowledge flows and managerial oversight might become impaired due to the lower levels of interaction caused by teleworking, leading to lower efficiency. The authors conclude that for firm productivity to grow, teleworking should increase worker satisfaction enough to offset the potentially negative effects, which tend to increase as the intensity of teleworking rises. As a result, an inverted U-shaped relationship would exist between the amount of time spent teleworking and worker efficiency: worker efficiency would improve at low levels of teleworking but would decrease with "excessive teleworking", implying that productivity peaks at intermediate levels of teleworking. The exact form of this relationship likely varies, depending on the relative importance of these factors by sector and occupation.

Behrens et al. (2021) confirmed the existence of an inverted U-shaped relationship between teleworking and productivity. Increasing the relatively small proportion of home workers allows firms to exploit more intensively the potential of ICT, though beyond a certain level, a smaller share of office workers reduces knowledge and causes information spillovers.

An OECD analysis based on an online survey in 25 countries found that managers and workers held a broadly positive view of teleworking, and wished to increase substantially the share of regular teleworkers from pre-crisis levels (Criscuolo et al, 2021). The ideal amount of teleworking would be around 2-3 days per week, in line with the idea that the benefits (less commuting, fewer distractions, etc.) and costs (impaired communication and knowledge flows, etc.) need to be balanced at an intermediate level of teleworking intensity.

Barrero et al. (2021a) conducted a study in the United States and found that as a result of increased working from home, productivity would be higher in the post-pandemic economy due to re-optimised working arrangements. Adrjan et al. (2021) concluded that in order to enhance productivity, workers must be provided with an appropriate working environment and best managerial practices must be disseminated (e.g. by shifting from presenteeism to an output-oriented assessment of worker productivity). The authorities have a role to play here too, such as by ensuring that there are no blind spots in terms of access to a fast, reliable and secure IT infrastructure, and by providing sufficient childcare options. Due to the link with teleworking, Barrero et al (2021b) find that providing a high-quality, fully reliable internet for all US citizens would considerably increase productivity in the United States.

However, Escudero and Kleinman (2022) qualify these positive findings by referring to the fact that several of these studies are based on the subjective perception of workers about working from home. Employees feeling more productive while working from home during the pandemic often failed to realise that their hours worked had increased or that they were working during the hours they

used to spend commuting to work. In addition, workers' perception of teleworking depends on multiple factors, such as the complexity of the work performed, the need for interaction (or not) with other colleagues to complete certain tasks, the awareness of being observed and evaluated, and family and workspace conditions at home.

Criscuolo et al. (2020) conclude that teleworking has the potential to improve productivity and a range of other economic and social indicators (including worker well-being, gender equality, regional inequalities, housing, and emissions) in the longer run, but that its overall impact is ambiguous and carries risks for innovation and worker satisfaction. Therefore, policymakers should ensure that teleworking remains a choice and that "hidden overtime" is avoided. To improve the productivity and innovation gains from the more widespread use of teleworking, policymakers would do well to promote managerial best practices, self-management and ICT skills, investments in home offices, and fast and reliable broadband across the country.

A common finding among the existing studies is that teleworking is expected to have a more positive impact on productivity if all parties involved are adequately prepared and trained for this type of work. First, employees need to have not only hard skills, but also complementary social and emotional skills and values (soft skills). Amid these new working conditions, new skills in self-management and self-organisation are beginning to emerge, such as active learning, resilience, stress tolerance and flexibility. Second, managers need to adapt to the opportunities and challenges posed by teleworking and embrace the best managerial practices developed by other firms in response to the increased use of teleworking. Adherence to outdated managerial practices may discourage the uptake of teleworking, thus negating its inherent benefits. In teleworking arrangements, monitoring work effort becomes much more difficult and therefore requires a higher level of trust. Against this backdrop, managers should shift their work culture and encourage employees to telework.

This is confirmed by sector-level data showing that productivity growth was higher during COVID-19 in highly digitalised sectors. Using sector data for 22 advanced European economies, Jaumotte et al. (2023) found that, in 2020, the sectoral labour productivity loss in response to the pandemic shock was 20% smaller for highly digitalised sectors than for less digitalised sectors. In 2021, these less digitalised sectors rebounded somewhat more strongly than their more digitalised counterparts, but were still unable to close the gap completely. The association between digitalisation and productivity was more pronounced in non-contact-intensive sectors. Looking at the trend in TFP among publicly-listed firms in the United States and advanced European economies, the authors found that firms that were ex ante more digitalised left the COVID-19 crisis somewhat faster than less digitalised firms. In particular, within-firm TFP growth in 2021 was relatively larger among the ex ante more digital-intensive firms. However, it is unclear whether these results also hold for non-listed or smaller firms. The extent to which pandemic-induced digitalisation led to structural changes within the economy is also less clear.

In general, it is difficult to evaluate the effect of teleworking on productivity. This is due to selection biases linked to the fact that employees who are willing to work from home are often those who are more motivated, put more effort into their work and would perform better anyway. The impact of teleworking on productivity also depends on the type of job, in the sense of whether the tasks are creative or repetitive. Despite these caveats, Box 10 shows that after controlling for job and worker characteristics, there is still a significant positive correlation between a firm's TFP and the share of teleworkers.

Box 10
Teleworking and productivity

In a recent article (Bergeaud, Cette and Drapala, 2023) a new survey conducted among French companies both in 2019 and during the first COVID-19 lockdown questioned the usage of teleworking. A sample of around 1,600 firms were asked various questions about the share of workers that teleworked in 2019, during the lockdown and shortly afterwards (in September 2020) as well as the number of days, potential obstacles, and objectives for the longer run. The study aimed to gain insights into the relationship between teleworking and productivity by combining the survey data with financial information retrieved from the companies' balance sheets and income statements,.

Potential channels

The literature has put forward three channels through which teleworking can increase (measure) productivity. The first channel is through greater worker efficiency, thanks to the time saved in commuting, which partly translates into longer working hours (Aksoy et al., 2023). The second channel is through a reduction in the stock of capital (especially real estate) needed to operate (see Bergeaud and Ray, 2020). The potential gain from an increase in teleworking can result in cost savings for companies in terms of space and real estate. This, in turn, can lead to an improvement in total factor productivity, which considers both labour productivity and capital productivity. However, it is important to note that these benefits will likely only be seen in the medium to long term. Additionally, a sustained rise in teleworking may ultimately push down city centre real estate prices, due to reduced space needs among both companies and workers, who may opt for cheaper housing options away from the city centre as they no longer have to commute to work as frequently (see Gupta et al, 2022 or Bergeaud et al, 2022 for early evidence). The literature often highlights a third channel through which teleworking can have a positive impact: the accelerated uptake of digital technology. The COVID-19 crisis has facilitated this shift, leading to the earlier realisation of the productivity gains associated with the digital revolution. However, like the previous impacts mentioned, this effect will likely be gradual and only become significant in the medium to long term.

Findings

The study examines various factors affecting productivity with respect to teleworking. Predominantly, prior to the COVID-19 pandemic, it was observed that companies that embraced teleworking often had less in the way of office space per employee (three square metres less per employee on average) and a higher proportion of IT and intangible assets. This, in turn, resulted in higher productivity. The research indicates a positive correlation between teleworking and productivity, with an estimated 0.6% increase in Total Factor Productivity (TFP) for every 1

percentage point increase in the share of teleworkers. These results were obtained using a production function approach to estimate TFP at the firm level in 2019 following Ackerberg et al. (2015) and run the following model on a set of firms indexed by i:

$$\log(Y_i) = \alpha_{s(i)} + \beta PTW_i^{2019} + \gamma X_i + \varepsilon_i \quad (1)$$

Where Y is the level of TFP in 2019, s(i) the sector of the firm, PTW the proportion of teleworkers in 2019, and X a set of control variables to ensure that the estimation of β with the OLS is conditional on firms being similar in size, average wage, number of hours worked and a measure of how constrained the firm is in its labour utilisation (SC measures the share of outsourced and temporary workers in the firms and PCU the utilisation rate of its production factors). The results are presented in the table below (reproduced from Table 4 of Bergeaud, Cette et Drapala, 2023).

Table A

Correlation between teleworking intensity and TFP in 2019

Variable explained (as a log):	TFP (1)	TFP (2)	TFP (3)
PTW	1.058*** (0.223)	0.612*** (0.197)	0.643*** (0.207)
Average wage in 2018 (log)		0.818*** (0.069)	0.824*** (0.070)
Employment in 2018 (log)		-0.072*** (0.010)	-0.073*** (0.010)
Number of hours worked (log)			-0.005 (0.017)
SC			0.088 (0.076)
PCU			0.002** (0.001)
Sector fixed effects	Yes	Yes	Yes
Adjusted R2	0.273	0.466	0.472
Number of observations	1,375	1,375	1,375

Notes: Result of the estimation of relationship (1) using the OLS method. The standard errors indicated in brackets are estimated by allowing for autocorrelation within the same department (geographical counties of France). The observations are weighted using the survey weights. Significance at *** p<0.01, ** p<0.05, * p<0.1. See Bergeaud, Cette et Drapala (2023) for more details.
Sources: Banque de France UFP survey (2021) and FIBEN.

These estimates are obtained using the dependent variable in 2019. However, during the COVID-19 lockdown, the between TFP and PWT correlation was less distinct, illustrating the importance of proper preparation and agreement between employees and employers for teleworking to be productive. Nevertheless, companies that had prior experience in teleworking proved to be more resilient during the pandemic and are now more inclined to increase their teleworking arrangements in the future. All in all, if we extrapolate the measured effect to the entire French economy following a likely rise in the proportion of remote workers from 5% to 20-25%, the development of teleworking could result in a 10% increase in TFP.

The study also supports the conclusion of other studies, such as Criscuolo et al. (2021), that an optimal level of productivity-enhancing teleworking does exist. This optimal level is estimated to be around two days of teleworking per week.

To conclude, in response to the COVID-19 pandemic, ensuing lockdowns and other social distancing measures, we observed a significant increase in the share of employees working from home. The widespread use of teleworking was facilitated by faster internet connections and heavier investments in digitalisation. Besides some corrections, the extent of teleworking is likely to remain above pre-pandemic levels.

As confirmed by several studies, and despite an inverted U-shaped relationship, working from home does have a positive impact on productivity.

5.3 Labour market scarring and changes in labour force capabilities

The pandemic has potentially several long-lasting consequences for labour force capabilities that may bring about longer-lasting scarring that extends beyond the acute phase. The first of these is the impact on the human capital of future workers caused by school shutdowns and disruptions to education. The second relates to current workers and how containment measures and sharply reduced output affected unemployment, disrupted firm-worker relationships and potentially reduced skills and human capital. Last but not least, some people infected by COVID-19 have acquired a longer-running, chronic condition that could impair their ability to work for a prolonged period.[68]

5.3.1 Impact on the future labour force

Research has highlighted a durable impact of previous pandemics on educational attainment. Almond (2006) and Beach et al. (2018) find that children affected by the 1918 influenza pandemic had lower socioeconomic status in adulthood and lower probability of graduating from high school, including relative to siblings in the same household. Caruso and Miller (2015) also find that such events can lead to intergenerational impacts. Since parental educational attainment affects child educational outcomes, the scarring can transmit across generations, especially for girls.

It is still too early to know the long-run consequences of the pandemic shutdowns on educational attainment, though some studies have identified an impact on educational attainment during the COVID-19 pandemic. Engzell et al. (2021) find a three percentile drop in educational attainment among Dutch children during 2020, with much larger impacts for children in disadvantaged households, despite a relatively short shutdown of eight weeks in the Netherlands. Kuhfeld et al. (2022) similarly find evidence for a significant decline in educational attainment in the United States.

There is a clear heterogeneity of experiences across the European Union, with shutdowns varying in length and with different degrees of access to online provision of education during those periods. For example, Champeaux et al.

[68] Two further impacts can be envisaged. First, increased mortality reduced the population. To the extent that most deaths were of people that had already left the labour force, the impact is likely to raise GDP per capita, but not affect output per worker. Second, future Covid waves could lead to higher rates of absences relative to the past. This would reduce average hours and consequently output per worker. There are a range of factors that could influence the impact of future waves, including the effectiveness of protection provided by prior infections, vaccines and other treatments, though the overall severity remains unknown. Given that euro area absences for all reasons have broadly returned to pre-pandemic rates, this channel is not discussed further here.

(2022) find that while 65% of primary school children in Italy were offered online teaching, only 20% of French primary-aged children were. Fuchs-Schündeln et al. (2022) estimate the average present value loss of lifetime earnings to be around 2.1% for affected children, with the effects much larger for children in households with lower parental education or lower assets.

The exact long-term impact will depend on the ability of those affected to catch up, if possible, on lost educational attainment in the future. At the same time, the pandemic and lockdowns accelerated the use of distance learning, which may improve the opportunities for future education, widen access to higher education and, as a result, help those affected catch up with the lost education.

5.3.2 Impact on the current labour force

Turning to the impact on current workers, previous large recessions, such as the Global Financial Crisis, typically resulted in large upswings in unemployment and longer-term scarring effects as the unemployed lose skills and human capital. In contrast, during the COVID-19 pandemic, despite unprecedented declines in output, the impact on unemployment was more muted. Euro area unemployment was 7.7% when Lehman Brothers collapsed in September 2008, and did not return back to that rate until March 2019 – 126 months later. In contrast, it took “only” 20 months from the pre-Covid trough in unemployment of 7.2% in March 2020 to return to that rate. Governments put in place a range of job retention schemes whereby workers remained with their firms, worked fewer hours and were compensated for some of the hours lost. Ando et al. (2022) estimate that without these job retention schemes, euro area unemployment would have been 2.5 pp higher in 2020, so the schemes are likely to have reduced permanent scarring effects, largely because many of them were successful in protecting the worker-employer relationship, thus enabling a swifter return to higher working hours.

The other channel of impact among current workers is through more lasting forms of disability arising from COVID-19. Exact definitions of long COVID-19 vary, but broadly include otherwise unexplained symptoms that persist for longer than three months following the acute phase of the infection. There is an extensive range of reported symptoms, though three sets in particular can have a negative impact on the ability to work: organ damage, including to heart, lungs, liver and kidneys; chronic fatigue; and cognitive impairment, notably to memory and concentration, often referred to as “brain fog”.

Estimates as to the prevalence of long COVID-19 differ widely, and care is needed when attempting to compare studies. Hanson et al. (2022), in a meta-analysis of 54 studies covering 1.2 million individuals across 22 countries, find a prevalence of 6.2% after three months, and of 0.9% after one year, following a symptomatic COVID-19 infection. However, the cases relied on self-reporting of symptoms, which is known within epidemiological research to pose problems in terms of statistical validity. The Central Institute of Statutory Health Care in Germany noted around 300,000 long COVID-19 diagnoses by 2021 Q1, equivalent to around

6% of total infections based on administrative data. However, it also noted that 97% of the subjects had previously received treatments for pre-existing somatic or psychiatric diagnoses.

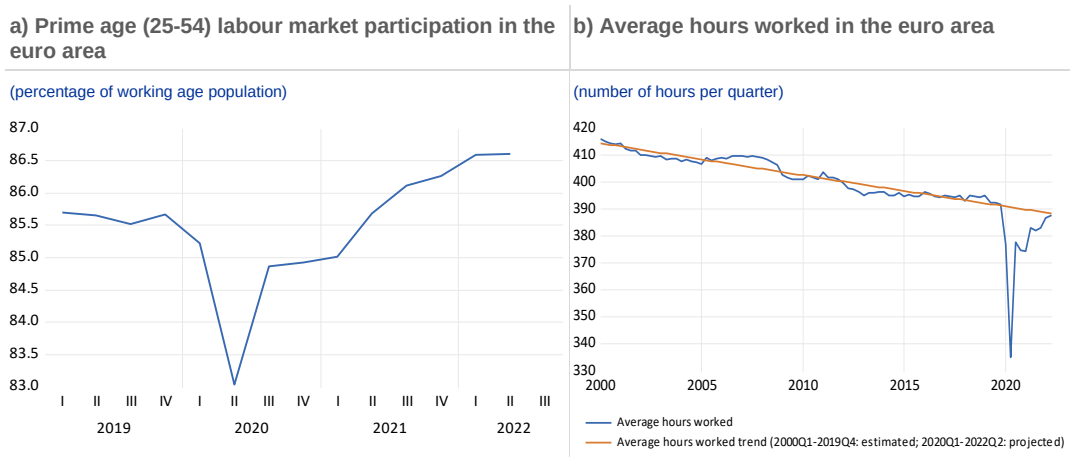
5.3.3 Consequences for productivity

There is some international evidence showing a reduction in labour supply and productivity arising from COVID-19. For example, Goda and Soltas (2022) find that workers in the United States who have a week-long absence from work due to COVID-19 are 7% less likely to be in the labour force one year later, suggesting a reduction in the labour force to date of around 0.2 pp. Ham (2022) finds that those affected by long COVID-19 but who remain in employment are likely to work fewer hours. Meanwhile, Techniker Krankenkasse – a major public health insurer in Germany – finds cases of workers who were infected by COVID-19 in 2020 and who continued to miss work the following year due to a long COVID-19 diagnosis.[69] While these workers missed a substantial number of days of work (105 on average in 2021), the numbers affected were small – less than 0.1% of the total workforce.

Aggregate labour market data for the euro area do not appear at present to support a marked continuing negative impact from COVID-19. Scarring could be expected in the form of higher unemployment, workers leaving the labour force, or those with long COVID-19 working shorter hours, including through increased absences. Yet at the end of 2022, unemployment was nearly 1 pp below its February 2020 rate. Labour force participation, including among older workers, has now surpassed its pre-pandemic rate, by around 1 pp (Chart 35, panel a). While average hours worked is still around 1% below the pre-pandemic level, it falls just shy (by 0.2%) of its longer-term declining trend (Chart 35, panel b). Thus, any negative impacts from scarring and long COVID-19 appear to be more than outweighed by other factors.

[69] See Techniker Krankenkasse (2022).

Chart 35
Euro area labour market developments



Source: Eurostat, Labour Force Survey.

Sources: Eurostat, Quarterly National Accounts, ECB calculations.

There are several potential explanations for why there does not appear to be a significant impact on the labour market. First, it might be that the impact of COVID-19 on the labour market may indeed be very limited in the long run. Second, it is still unclear how durable long COVID-19 symptoms will be for individuals, nor how long COVID-19 substitutes for, or adds to, the prevalence of already known longer-term health disorders with a similar clinical picture. On the other hand, a larger impact than that currently visible from existing labour market data may become evident over time to the extent that i) diagnosis of the condition may be delayed; ii) some impacts, notably the educational ones, may take time to manifest; and iii) repeated infections and successive variant waves may cause higher rates of health disorders among the population.

Box 11
The impact of NGEU funds on productivity

This box outlines the findings of the WGF expert team on the impact of Next Generation EU (NGEU) funds on euro area potential output and productivity, more specifically the updates prepared in the context of the 2022 Annual Supply Side Review. The expert team used two methods to assess the impact of fiscal measures and structural reforms in the context of NGEU. First, the seven participating national central banks (NCBs) employed regular tools to estimate potential output in the Broad Macroeconomic Projection Exercises (BMPEs) and to build a counterfactual scenario without the NGEU, and six scenarios with the NGEU that differed in the degree of implementation of fiscal expenditure and reforms. Second, the EAGLE model was used to estimate the impact of NGEU on the four largest euro area countries and for the euro area as a whole.

The updated results show that at the euro area aggregate level, NGEU might be able to lift the level of potential output by around 1.3% by 2030. The growth rate of potential output might increase by 0.15 pp in 2030, which is quite significant given that the average potential growth of the seven countries studied was estimated to be 1.2% in 2019. It should be noted that the estimated impact is highly uncertain and will largely depend on the success of reform implementation.

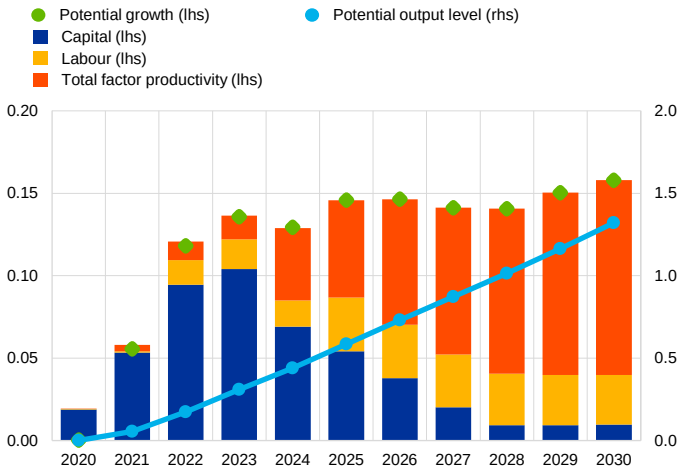
Over the current projection horizon of 2022-2025, most of the impact comes from fiscal expenditure, lifting the capital contribution to potential output. Over the extended, longer-term horizon (until 2030), this impact fades and the effect of structural reforms becomes more prominent, stemming mainly from Spain, Italy and Greece. This is signalled by an estimated increase in the impact on the TFP contribution. Initially, there is no visible expected increase in the TFP contribution and trend TFP growth. From around 2024, when structural reforms are expected to be implemented and their impact unfolds, the TFP contribution to potential growth could be 0.1 pp higher than in the absence of the NGEU-related reforms.

The estimated impact is heterogeneous across countries, depending on the ambition of expenditure and reform plans. According to NCB estimates, in Italy, Spain and Greece – the three countries with the most ambitious plans – the overall impact of NGEU on the level of potential output could amount to 4.0%, 4.1% and 5.3%, respectively, while the impact on the TFP contributions could reach 0.4 pp, 0.3 pp and 0.4 pp, respectively, by 2030.

Chart A

Impact of NGEU on euro area potential output and its components

(percentage points, average among seven euro area countries)



Source: WGF expert team on the impact of NGEU on potential output.
Notes: The participating NCBs were Germany, France, Italy, Spain, Greece, Portugal and Malta.

In summary, despite several long-lasting consequences of previous crises on labour force capabilities and aggregate productivity, the long-term negative impact of the COVID-19 pandemic was largely mitigated by support policy measures. Online provision of schooling reduced the negative effect of the pandemic lockdowns on the educational attainment and future prospects of the affected individuals. Meanwhile, the extensive government employment subsidies prevented large upswings in unemployment and maintained worker-employer relationships. The post-pandemic period now brings new challenges, though also opportunities, such as NGEU funds, which may help EU Member States become more productive.

6 Conclusions and lessons learnt

The COVID-19 pandemic had a significant impact on short-term productivity developments. The trends seen within the European Union differed from those observed during the Great Recession and those in the United States. The interpretation of productivity developments in the EU largely depends on how we define productivity. While labour productivity per person employed temporarily declined, labour productivity per hour worked temporarily increased. These striking differences can be explained by the historically high government wage subsidies and other types of policy support measures rolled out.

Government policy support had more of an effect on the extensive than the intensive productivity growth margin. We observed a temporary decline in firm entries and significantly fewer firm exits. The massive liquidity support together with the freeze on insolvencies largely explains the decline in exits. However, the firms that exited in 2020 were significantly less productive than those that survived.

Our findings, based on unique micro-distributed exercises utilising granular firm-level data from a majority of euro area countries, show that within-firm productivity growth was significantly reduced. Labour hoarding, supported also by the use of job retention schemes and lower capacity utilisation of capital, explains the decline in productivity among incumbent firms in the short term.

Further findings from our micro-distributed exercises confirm that productive incumbent firms continued to show higher employment growth than non-productive firms; i.e. there was productivity-enhancing reallocation of resources. Although the link between productivity and employment growth at the firm level was somewhat weaker than during the Great Recession, the government support did not excessively alter productivity-enhancing reallocation within the euro area.

Granular data on the distribution of wage subsidies, loan guarantees and moratoria confirm that productive firms received more support than non-productive firms in 2020. However, high productive firms exited the support schemes earlier so the allocation of support in 2021 was tilted towards less productive firms. The evidence shows that the support mainly went to moderately productive firms and that the size of the support increased with a firm's productivity. At the same time, productive firms received lower relative support with respect to their revenue.

The support did not lead to a significant or longer-lasting increase in corporate indebtedness or zombification during the pandemic. However, the preliminary findings for certain countries suggest certain shifts in distribution of the support to less productive and more financially distressed firms in the second year of the pandemic.

The COVID-19 pandemic, accompanied by various containment measures and lockdown periods, has changed several long-established consumption and production habits, which could potentially have long-lasting consequences for productivity. The pandemic has accelerated trends in e-commerce (online shopping) and teleworking. These trends are expected to have positive, long-lasting impact on productivity. At the same time, threats with a potentially negative impact on productivity in the longer run, such as loss of skills and human capital or lower school attainment rates, seem to have been largely mitigated through employment subsidies or the provision of online schooling.

Russia's invasion of Ukraine and the ensuing energy crisis, followed by a period of heightened inflation, has created new challenges for economic growth and productivity within the EU. These more recent events have also made it difficult to disentangle the medium- and long-term effects of the pandemic and related policy support on productivity from other concurrent shocks. At the same time, new opportunities now lie ahead, such as the Next Generation EU funds and the green and digital transitions.

Appendix

Table A1

Contributions to percentage change in productivity per person employed, 2020

	A	B-E	F	G-I	J	K	L	M_N	O-Q	R-U	Total
EU27	0.1	-0.9	-0.3	-1.7	0.1	0.0	-0.1	-0.4	-0.7	-0.5	-4.3
EA19	0.1	-1.0	-0.3	-1.8	0.0	0.0	-0.1	-0.4	-0.8	-0.4	-4.6
BE	0.1	-0.5	-0.4	-2.3	0.0	0.0	0.0	-0.6	-1.3	-0.4	-5.4
BG	-0.1	-1.2	0.1	0.3	0.1	0.6	-0.7	-0.3	0.2	-0.5	-1.7
CZ	0.2	-2.2	-0.4	-1.6	0.3	0.2	0.0	-0.1	-0.1	0.0	-3.9
DK	0.1	-0.3	-0.1	-0.3	0.1	0.1	0.2	0.1	-0.6	-0.3	-0.9
DE	0.1	-1.3	0.0	-0.7	0.0	0.1	0.1	-0.3	-0.5	-0.3	-2.9
EE	0.3	-0.1	0.4	0.7	0.8	0.4	0.1	0.0	0.2	-0.5	2.2
IE	0.0	6.9	0.2	0.0	2.3	-0.7	-0.2	0.6	-0.4	0.4	9.3
EL	0.1	0.5	0.0	-4.3	0.1	-0.3	-2.1	-0.2	-0.3	-0.8	-7.3
ES	0.4	-1.8	-0.6	-3.6	-0.2	0.2	0.0	-1.1	-0.4	-0.4	-7.5
FR	-0.1	-1.4	-0.9	-2.0	-0.1	-0.2	-0.2	-0.4	-1.3	-0.7	-7.1
HR	0.1	-1.3	-0.3	-4.8	0.8	-1.0	-0.4	-0.9	0.5	-0.1	-7.5
IT	0.0	-2.1	-0.4	-2.7	0.0	0.1	-0.5	-0.2	-0.7	-0.5	-7.0
CY	-0.1	-0.2	-0.8	-4.7	1.2	2.4	0.0	-0.5	0.0	-0.7	-3.2

LV	0.0	1.0	-0.1	-0.7	0.0	0.0	-0.1	0.2	0.3	-0.4	0.1
LT	1.4	0.6	0.4	0.4	0.1	-0.3	0.3	-0.8	-0.3	-0.2	1.6
LU	0.0	0.1	-0.9	-1.0	-0.7	1.4	-0.2	-0.5	-0.5	-0.2	-2.5
HU	-0.4	-1.0	-0.7	-0.4	0.2	0.2	0.0	-0.7	-0.3	-0.4	-3.5
MT	0.3	0.0	-0.7	-7.8	-0.5	0.2	-0.3	-2.4	-0.5	0.5	-11.1
NL	0.0	-0.3	-0.2	-1.4	0.1	-0.1	0.1	-0.1	-0.9	-0.5	-3.4
AT	-0.1	-0.9	-0.1	-1.9	-0.1	-0.1	0.0	-0.2	-0.9	-0.4	-4.9
PL	-0.1	-0.1	-0.6	-0.8	0.2	-0.6	0.3	-0.1	0.4	-0.7	-2.0
PT	0.0	-1.0	-0.1	-4.1	0.2	0.1	-0.3	-0.1	-1.0	-0.3	-6.6
RO	0.4	-0.6	0.0	-0.9	0.2	0.8	-0.4	-0.4	-0.1	-0.5	-1.7
SI	0.4	-0.9	-0.4	-1.6	0.0	0.1	-0.1	-0.7	-0.1	-0.6	-3.7
SK	0.2	-2.7	-0.4	-0.2	0.0	0.0	0.6	0.8	0.7	-0.6	-1.5
FI	0.0	-0.1	0.1	-0.1	0.2	0.1	0.1	0.0	-0.8	0.0	-0.5
SE	-0.1	-0.1	0.2	-0.4	0.2	0.1	-0.2	0.1	-0.6	-0.2	-0.8

Sources: Eurostat and own calculations.

Table A2

Contributions to percentage change in productivity per hour worked, 2020

	A	B-E	F	G-I	J	K	L	M_N	O-Q	R-U	Total
EU27	0.1	-0.1	0.1	0.7	0.2	0.1	0.0	0.3	0.0	0.0	1.2
EA19	0.1	-0.2	0.2	1.2	0.2	0.1	0.0	0.5	0.0	0.1	2.1
BE	0.0	0.4	0.1	0.5	0.1	0.0	0.1	1.9	-0.4	0.5	3.2
BG	0.1	-0.8	0.3	1.3	0.1	0.7	-0.8	-0.2	0.4	-0.4	0.8
CZ	0.3	-0.7	-0.2	0.4	0.3	0.3	0.1	0.3	1.1	0.5	2.4
DK	0.2	-0.7	-0.3	0.9	0.5	0.5	0.6	0.4	-0.6	-0.5	1.0
DE	0.2	-1.1	0.2	0.7	0.1	0.3	0.1	0.5	0.1	-0.1	1.0
EE	0.4	0.7	0.7	1.9	0.9	0.5	0.3	0.5	0.1	-0.2	5.8
IE	0.4	8.5	1.2	2.6	2.8	-0.8	-0.1	1.4	0.6	1.1	17.5
EL	-0.3	1.1	0.3	1.7	0.2	-0.1	-2.0	0.3	1.1	0.2	2.6
ES	-0.1	0.7	-0.1	-0.1	0.1	-0.1	0.0	0.0	-0.2	0.0	0.0
FR	0.1	-0.6	-0.2	1.6	0.1	-0.1	-0.1	0.7	-0.8	-0.1	0.5
HR	-0.2	-1.1	0.2	-5.6	1.2	-0.8	-0.3	-1.0	0.7	-0.4	-7.3
IT	0.2	-0.2	0.3	1.4	0.1	0.1	-0.3	0.9	-0.1	0.5	3.0
CY	0.0	0.2	-0.2	-1.4	1.2	2.5	0.0	-0.1	0.1	-0.2	2.1
LV	0.2	2.0	0.1	-0.3	0.2	0.1	0.0	0.4	1.0	-0.1	3.6
LT	1.5	1.3	0.8	1.9	0.2	-0.2	0.3	-0.3	0.4	0.2	6.1

LU	0.0	0.7	-0.1	1.7	-0.5	1.1	-0.1	0.3	0.1	0.2	3.4
HU	0.5	0.0	2.7	-4.1	-1.4	-1.3	-0.6	2.0	1.5	0.9	0.3
NL	0.0	0.0	0.1	-0.3	0.1	-0.1	0.1	-0.1	-0.5	-0.3	-1.1
AT	-0.4	-0.2	0.2	1.4	0.2	-0.1	0.1	0.6	0.4	0.3	2.5
PL	0.0	0.0	-0.4	-0.6	0.2	-0.6	0.3	-0.1	0.4	-0.5	-1.3
PT	0.1	-0.1	0.0	0.0	0.1	0.0	-0.1	0.2	0.0	0.1	0.3
RO	0.2	0.3	0.2	-0.1	0.2	0.8	-0.4	-0.3	0.5	-0.4	1.0
SI	0.1	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.7
SK	0.3	-1.6	0.2	2.6	0.1	0.1	0.7	1.9	1.9	-0.4	6.0
FI	0.0	-0.1	0.1	0.4	0.2	0.1	0.1	0.0	-0.7	0.0	0.1
SE	-0.1	0.5	0.5	0.3	0.4	0.1	-0.3	0.6	-0.7	-0.2	1.1

Sources: Eurostat and own calculations.

Table A3

Individual firm data sources for micro-distributed exercises

Country	Data source	Sample period	Number of firms
Croatia	Financial Agency (FINA)	2002-2021	79,423
Estonia	Business Register, Tax and Customs Board, Customs data Statistics Estonia	2004–2020	52,922
Finland	Statistics Finland	1999–2020	100,464
France	Fiben	2000-2020	242,379
Greece	Orbis	2012-2020	110,163
Italy	Cerved Centrale dei Bilanci, Istituto Nazionale Previdenza Sociale (INPS)	2001–2020	467,134
Latvia	Central Statistical Bureau of Latvia and State Revenue Service of Latvia	2007–2020	63,676
Netherlands	Statistics Netherlands	2000–2021	164,248
Portugal	Central Balance Sheet Database	2006–2020	260,855
Slovenia	Slovenian Business Register (AJPES)	2008-2021	113,607
Slovakia	Statistics Slovakia and Bisnode	2015–2020	89,097
Spain	Central Balance Sheet Database	1995–2020	409,853

Notes: Number of firms with non-missing information on number of employees in 2020. The number of observations in individual regression specifications may differ. The sources and coverage of additional exercise specific data are described in the relevant sections of the report.

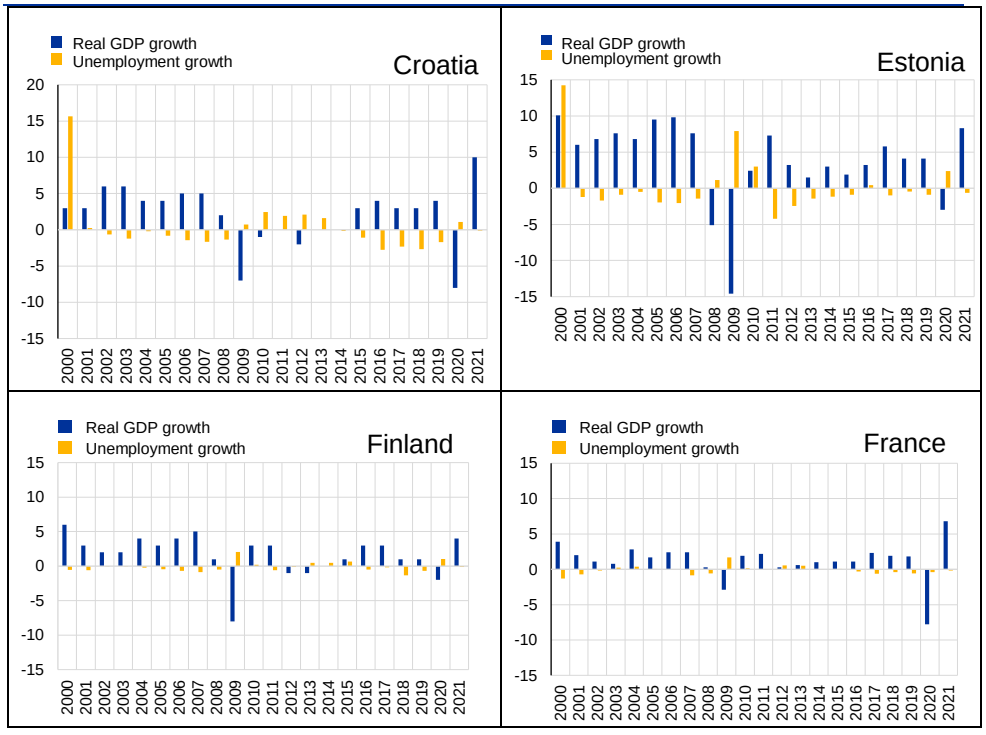
Table A4

Sources of pandemic support data

Country	Data source	Sample period
Croatia	Croatian Employment Service (HZZ)	2020-2021
Estonia	Business Register, Tax and Customs Board	2020
Latvia	Central Statistical Bureau of Latvia	2020–2021
Portugal	Central Balance Sheet Database	2020
Slovenia	Monetary financial institutions reporting (PORFI)	2020-2021
Slovakia	Register of bank credit and guarantees, Transparency International Slovakia	2020
Spain	Central Balance Sheet database, Central Credit Registry	2020

Chart A1

Unemployment and value-added cycle in euro area countries



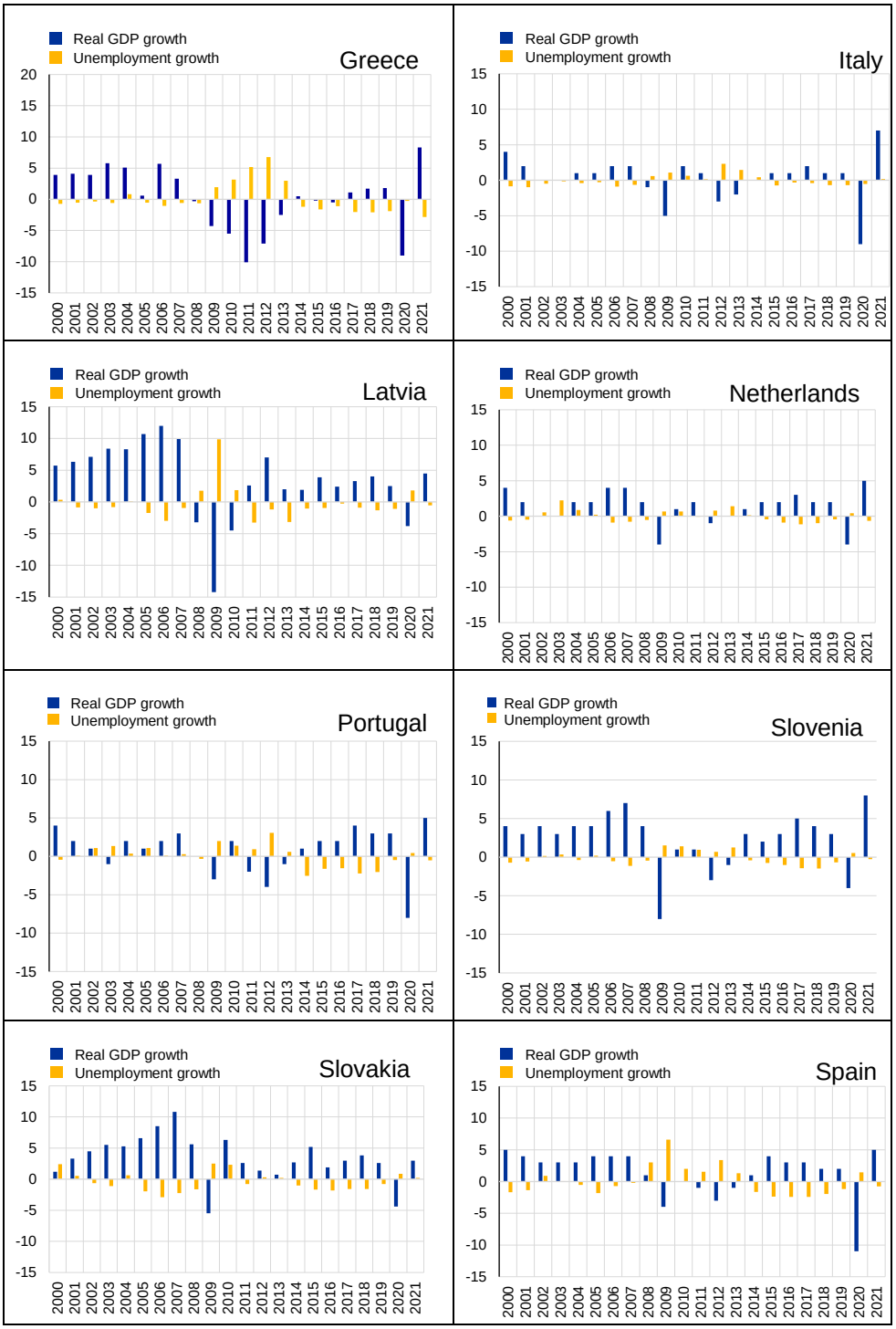
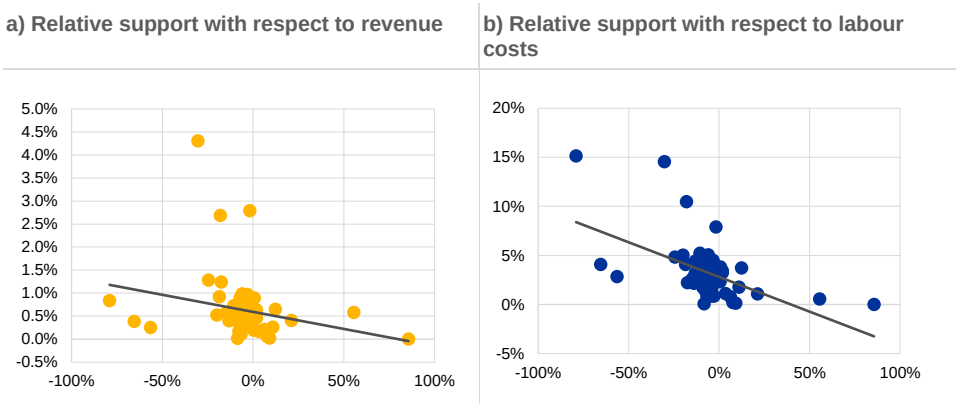

Real GDP growth
Unemployment growth
Greece
Italy
Latvia
Netherlands
Portugal
Slovenia
Slovakia
Spain

Chart A2

Wage support and revenue growth in two-digit sectors



Source: Authors' calculations based on microdata from Slovakia.
Notes: X-axis: revenue growth in 2020; Y-axis: sum of wage subsidies allocated in 2020 divided by revenue or labour costs in 2019.

References

Ackerberg, D.A., Caves, K. and Frazer, G. (2015), "Identification Properties of Recent Production Function Estimators", *Econometrica*, Vol. 83, No 6, pp. 2411-2451.

Adrjan P., Ciminelli, G., Judes, A., Koelle, M., Schwellnus, C. and Sinclair, T. (2021), "Will it stay or will it go? Analysing developments in telework during COVID-19 using online job postings data", *OECD Productivity Working Papers*, No 30.

Aksoy, C.G., Barrero, J.M., Bloom, N., Davis, S.J., Dolls, M. and P. Zarate (2023), "Time Savings When Working from Home", *NBER Working Paper*, No. 30866.

Albert, C., Caggese, A., González, B. and Martín-Sánchez, V. (2022), "Income Inequality and Entrepreneurship: Lessons from the 2020 COVID Recession", *Economics Working Papers*, No 1852, Department of Economics and Business, Universitat Pompeu Fabra.

Almond, D. (2006), "Is the 1918 Influenza Pandemic Over? Long Term Effects of In Utero Influenza Exposure in the Post-1940 U.S. Population", *Journal of Political Economy*, 114(4), pp. 672–712.

Ando, S. et al. (2022), "European Labor Markets and the COVID-19 Pandemic Fallout and the Path Ahead", *Departmental Paper Series*, No 2022/0004, European Department, International Monetary Fund.

Anghel, B., Bunel, S., Bijnens, G., Botelho, V., Falck, E., Labhard, V., Lamo, A., Röhe, O., Schroth, J., Sellner, R., and Strobel, J. (2024), *"Digitalisation and productivity: a report by the ESCB expert group on productivity, innovation and technological change*", *Occasional Paper Series*, No 339, ECB, Frankfurt am Main, February.

Arntz, M., Gregory, T. and Zierahn, U. (2020), "Digitalization and the future of work: Macroeconomic consequences", *Handbook of Labor, Human Resources and Population Economics*.

Barrero, J.M., Bloom, N. and Davis, S.J. (2021a), "Why Working from Home Will Stick", *NBER Working Paper*, No 28731.

Barrero, J.M., Bloom, N. and Davis, S.J. (2021b), "Internet Access and its Implications for Productivity, Inequality, and Resilience", *Hoover Institution Economics Working Papers*, 21115.

Beach, B., Ferrie, J. and Saavedra, M. (2018) "Fetal Shock or Selection? The 1918 Influenza Pandemic and Human Capital Development", *NBER Working Paper*, No 24725.

Behrens K., Kichko, S. and Thisse, J.-F. (2021), "Working From Home: Too Much of a Good Thing?", *CESifo Working Papers*, No 8831.

Bergeaud, A. and Ray, S. (2020), “The macroeconomics of teleworking”, *Banque de France Bulletin*, No 231, Article 2.

Bergeaud, A., Eyméoud, J.-B., Garcia, T. and Henricot, D. (2022), “Working from home and corporate real estate”, *CEP Discussion Paper*, 1831.

Bernard, A.B. and Jensen J.B. (1995), “Exporters, Jobs, and Wages in U.S. Manufacturing: 1976-1987”, Brookings Papers on Economic Activity, Vol. 26, Microeconomics, 67-119.

Bernard, A.B. and Jensen, J.B. (1999), “Exceptional exporter performance: cause, effect, or both?”, *Journal of International Economics*, Elsevier, Vol. 47(1), pp. 1-25, February.

Bighelli, T., Lalinsky, T. and Vanhala, J. (2023), “Cross-country evidence on the allocation of COVID-19 government subsidies and consequences for productivity”, *Journal of the Japanese and International Economies*, Vol. 68.

Bijnens, G., Anyfantaki, S., Colciago, A., De Mulder, J., Falck, E., Labhard, V., Lopez-Garcia, P., Lourenço, N., Meriküll, J., Parker, M., Röhe, O., Schroth, J., Schulte, P., and Strobel, J. (2024), “The impact of climate change and policies on productivity: a report by the ESCB expert group on productivity, innovation and technological change”, *Occasional Paper Series*, No 340, ECB, Frankfurt am Main, February.

Bloom, N., Bunn, P., Mizen, P., Smietanka, P. and Thwaites, G. (2020), “The impact of Covid-19 on productivity”, *NBER Working Paper*, No 28233.

Bloom, N., Liang, J., Roberts, J. and Ying, Z.J. (2015), “Does Working from Home Work? Evidence from a Chinese Experiment”, *The Quarterly Journal of Economics*, Vol. 130(1), pp. 165-218.

Boeri, T., Bruecker, H., Fuchs-Schündein, N. and Mayer, T. (2011), “Short-Time Work Benefits Revisited: Some Lessons from the Great Recession”, *Economic Policy*, Vol. 26, No 68, pp. 697-765.

Bouabdallah, O., Checherita-Westphal, C., Freier, M., Nerlich, C. and Sławińska, K. (2020) “Automatic fiscal stabilisers in the euro area and the COVID-19 crisis”, *ECB Economic Bulletin*, Issue 6/2020.

Bricongne, J.-C., Carluccio, J., Fontagné, L., Gaulier, G. and Stumpner, S. (2022), “From Macro to Micro: Heterogeneous Exporters in the Pandemic”, *Banque de France Working Paper Series*, 881.

Brussevich M., Papageorgiou, C. and Wibaux, P. (2022), “Trade and the COVID-19 pandemic: lessons from French firms,” *IMF Working Paper*, No 22/81, International Monetary Fund.

Caballero, R. and Hammour, M. (1996), “On the timing and efficiency of creative destruction”, Quarterly Journal of Economics, Vol. 111, Issue 3, pp. 805-852.

Caruso, G. & Miller, S. (2015), “Long run effects and intergenerational transmission of natural disasters: A case study on the 1970 Ancash Earthquake”, *Journal of Development Economics*, Vol. 117, pp. 134-150.

Champeaux, H., Mangiavacchi, L., Marchetta, F. and Piccoli, L. (2022), “Child development and distance learning in the age of COVID-19”, *Review of Economics of the Household*, 20, pp. 659-685.

Chun, H. and Shin, D. (2022), “The entry of online retailers and productivity dynamics in the retail trade sector”, *Economics Letters*, Vol. 222.

Coad, A., Bauer, P., Domnick, C., Harasztosi, P., Pál, R. and Teruel, M. (2023), “Which European firms were hardest hit by COVID-19?”, *EIB Working Papers 2023/05*, European Investment Bank.

CompNet (2021), *User Guide for the 8th Vintage of the CompNet Dataset*.

Criscuolo, C., Nicoletti, G., Gal, P. and Leidecker, T. (2020), “Productivity gains from teleworking in the post COVID-19 era: How can public policies make it happen?”, *OECD Policy Responses to Coronavirus (COVID-19)*, 7 September.

Criscuolo, C., Gal, P., Leidecker, T., Losma, F. and Nicoletti, G. (2021), “The role of telework for productivity during and post-COVID-19: Results from an OECD survey among managers and workers”, *OECD Productivity Working Papers* 31.

Deutsche Bundesbank (2022), *Productivity effects of reallocation in the corporate sector during the COVID-19 crisis*, Monthly Report, September.

Dimitropoulou, D. and Theofilakou, A. (2021), “Explaining the cross-country differences in the economic fallout during the COVID-19 pandemic crisis”, *Economic Bulletin*, Issue 53, pp. 29-48, Bank of Greece.

Eichhorst, W., Marx, P., Rinne, U. and Brunner, J. (2022), “Job retention schemes during COVID-19: A review of policy responses”, *IZA Policy Paper* No 187, IZA Institute of Labor Economics.

Engzell, P., Frey, A. & Verhagen, M. (2021), “Learning loss due to school closures during the COVID-19 pandemic”, *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 118, No 17.

Escudero, C. and Kleinman, M. (2022), “How did working from home during Covid-19 impact productivity? A literature review”, King’s College London, April.

Eurofound (2020), “Living, working and COVID-19”, *COVID-19 series*, Publications Office of the European Union.

Fana, M., Tolan, S., Torrejón, S., Urzi Brancati, C. and Fernández-Macías, E. (2020), “The COVID confinement measures and EU labour markets”, Publications Office of the European Union.

Ferrando, A. and Ganoulis, I. (2020), “Firms’ expectations on access to finance at the early stages of the Covid-19 pandemic”, *ECB Working Paper*, No 20202446.

Foster, L., Grim, C. and Haltiwanger, J. (2016), “Reallocation in the Great Recession: Cleansing or Not?”, *Journal of Labor Economics*, 2016, Vol. 34, issue S1, S293-S331.

Fuchs-Schündeln, N., Krueger, D., Ludwig, A. and Popova, I. (2022), “The Long-Term Distributional and Welfare Effects of Covid-19 School Closures”, *The Economic Journal*, Vol. 132, No 645, pp. 1647-1683.

Goda, G.S. and Soltas, E.J. (2022), “The Impacts of Covid-19 Illnesses on Workers”, *NBER Working Paper*, No 30435, National Bureau of Economic Research.

Gomez-Salvador, R. and Soudan, M. (2022), “The US labour market after the COVID-19 recession”, *ECB Occasional Paper Series*, No 298.

Gupta, A., Mittal, V. and Van Nieuwerburgh, S. (2022), “Work From Home and the Office Real Estate Apocalypse”, *NBER Working Papers* 30526, National Bureau of Economic Research.

Ham, D. (2022), “Long-Haulers and Labor Market Outcomes”, *Institute Working Paper*, No 60, Federal Reserve Bank of Minneapolis.

Hanson et al. (2022), “Estimated Global Proportions of Individuals With Persistent Fatigue, Cognitive, and Respiratory Symptom Clusters Following Symptomatic COVID-19 in 2020 and 2021”, *Journal of the American Medical Association*, Vol. 328, No 16, pp. 1604-1615.

Harasztosi, P., Maurin, L., Pál, R., Revoltella, D. and van der Wielen, W. (2022), “Firm-level policy support during the crisis: So far, so good?”, *International Economics*, Vol. 171, pp. 30-48.

IMF (2021), *Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic*, October 2021, IMF Fiscal Affairs Department, Washington, DC.

Jaumotte F., Li, L., Medici, A., Oikonomou, M., Pizzinelli, C., Shibata, I., Soh, J. and Tavares, M.M. (2023), “Digitalization during the COVID-19 Crisis: Implications for Productivity and Labor Markets”, *IMF Staff Discussion Notes*, SDN/2023/003.

Jovanovic, B. (1982), “Selection and the Evolution of Industry”, *Econometrica*, Vol. 50, No 3, pp. 649-70.

Kozlowski, J., Veldkamp, L. and Venkateswaran, V. (2020), “Scarring Body and Mind: The Long-Term Belief-Scarring Effects of COVID-19”, *NBER Working Papers*, 27439, National Bureau of Economic Research.

Kuhfeld, M., Soland, J. and Lewis, K. (2022), “Test Score Patterns Across Three COVID-19-Impacted School Years”, *Educational Researcher*, forthcoming.

Lalinsky, T. and Pal, R. (2022), “Distribution of COVID-19 government support and its consequences for firm liquidity and solvency”, *Structural Change and Economic Dynamics*, Elsevier, Vol. 61(C), pp. 305-335.

Lebastard, L., Matani, M. and Serafini, R. (2023), “GVC exporter performance during the COVID-19 pandemic: the role of supply bottlenecks”, *Working Paper Series*, No 2766, ECB.

Licchetta, M., Mattozzi, G., Raciborski, R. and Willis, R. (2022), “Economic adjustment in the euro area and the United States during the COVID-19 crisis”, *European Economy Discussion Paper* 160, European Commission.

Mayer, T., and Ottaviano, G. (2007), “The Happy Few: The Internationalisation of European Firms: New Facts Based on Firm-Level Evidence”, Brussels: Bruegel.

McMillan, M. and Rodrik, D. (2011), “Globalization, Structural Change and Productivity Growth”, *NBER Working Paper*, No 17143, June.

Meriküll, J. and Paulus, A. (2023), “The impact of the Covid-19 job retention support on employment”, *Economics Letters*, 222, 110963.

Modery et al. (2021), “Key factors behind productivity trends in EU countries”, *ECB Occasional Paper*, No 286.

OECD (2020), *Job retention schemes during the COVID-19 lockdown and beyond*.

OECD (2021a), *One year of SME and entrepreneurship policy responses to COVID-19: Lessons learned to “build back better”*, OECD Policy Responses to Coronavirus (COVID-19).

OECD (2021b), *Harnessing the productivity benefits of online platforms: Background paper*.

Schumpeter, J.A. (2013), “Capitalism, Socialism and Democracy”, Routledge.

Sostero, M., Milasi, S., Hurley, J., Fernández-Macías, E. and Bisello, M. (2020), “Teleworkability and the COVID-19 crisis: a new digital divide?”, Seville: European Commission, *JRC Technical Report*.

Springford, J. and Tilford, S. (2020), “Is the US or Europe more resilient to COVID-19?”, Policy Brief Centre for European Reform.

Stewart, J. (2022), “Why was labor growth so high during the COVID-19 pandemic? The role of labor composition”, *BLS Working Papers*, No 545.

Techniker Krankenkasse (2022), “Gesundheitsreport 2022 mit dem Schwerpunkt Long-COVID: Wie geht es Deutschlands Beschäftigten?” Teil 2, pp. 23-38.

Valderrama, M. T., Bonfim, D., Ferrando, A., Gonzalez, B., Khametshin, D., Kastritis, E., Modhurima, O., Lalinsky, T. Vanhala, J., Sellner, R., Lopez-Garcia, P., Colciago, A., Bunel, S. (2024), “The impact of monetary policy on productivity: A

report of the ESCB Expert Group on Productivity, Innovation and Technological Change", *Occasional Paper Series*, ECB, Frankfurt am Main, (forthcoming).

Acknowledgements
This report has been jointly prepared by the ESCB Working Group on Forecasting (WGF) Expert Group on Productivity, Innovation and Technological Changes – COVID-19 and Productivity Workstream, comprising staff from the European Central Bank (ECB) and the national central banks (NCBs) of the EU member states. This report is one in a series of reports produced by the WGF Expert Group on Productivity, Innovation and Technological Changes. More results of the expert group are published in the report of the Digitalisation and Productivity Workstream (Anghel et al. 2024), in the report of the Climate and Productivity Workstream (Bijnens et al. 2024) and in the report of the Monetary Policy and Productivity Workstream (Valderrama et al. 2024).

The expert group on productivity, innovation and technological change is chaired by Wolfgang Modery and coordinated by Paloma Lopez-Garcia, both from the Economics Directorate of the ECB.

Contributors to the report

Tibor Lalinsky – workstream coordinator
Národná banka Slovenska, Bratislava, Slovakia;
email tibor.lalinsky@nbs.sk

Marianthi Anastasatou
Bank of Greece, Athens, Greece

Sofia Anyfantaki
Bank of Greece, Athens, Greece

Konstantins Benkovskis
Latvijas Banka, Riga, Latvia

Antonin Bergeaud
Banque de France/HEC Paris, Paris, France

Maurice Bun
De Nederlandsche Bank, Amsterdam, The Netherlands

Simon Bunel
Banque de France, Paris, France

Andrea Colciago
European Central Bank, Frankfurt am Main, Germany

Jan De Mulder
Nationale Bank van België/Banque Nationale de Belgique, Brussels, Belgium

Davide Fantino
Banca d'Italia, Rome, Italy

Beatriz Gonzalez Lopez
Banco de España

Jiri Havel
European Central Bank, Frankfurt am Main, Germany

Valerie Jarvis
European Central Bank, Frankfurt am Main, Germany

Dmitry Khametshin
Banco de España, Madrid, Spain

Tetie Kolaiti
De Nederlandsche Bank, Amsterdam, The Netherlands

Olegs Krasnopjorovs
Latvijas Banka, Riga, Latvia

Laura Lebastard
European Central Bank, Frankfurt am Main, Germany

Paloma Lopez-Garcia
European Central Bank, Frankfurt am Main, Germany

Fernando Martins
Banco de Portugal, Lisbon, Portugal

Philipp Meinen
Deutsche Bundesbank, Frankfurt am Main, Germany

Jaanika Meriküll
Eesti Pank, Tallinn, Estonia

Miles Parker
European Central Bank, Frankfurt am Main, Germany

Josip Raos
Hrvatska narodna banka, Zagreb, Croatia

Roberta Serafini
European Central Bank, Frankfurt am Main, Germany

Domagoj Šelebaj
Hrvatska narodna banka, Zagreb, Croatia

Béla Szörfi
European Central Bank, Frankfurt am Main, Germany

Milan Vaňko
Národná banka Slovenska, Bratislava, Slovakia

Juuso Vanhala
Suomen Pankki – Finlands Bank, Helsinki, Finland

Matjaž Volk
Banka Slovenije, Ljubljana, Slovenia

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

PDF ISBN 978-92-899-6409-8, ISSN 1725-6534, doi:10.2866/295565, QB-AQ-24-005-EN-N