

Productivity effects of reallocation in the corporate sector during the COVID-19 crisis

The COVID-19 crisis had highly heterogeneous effects on economic sectors and firms in Germany. As a result, it may have increased the reallocation of jobs. This could reinforce productivity growth if employees increasingly moved from less productive firms to more efficient ones in the same or another sector.

With regard to shifts in employment weights between the various sectors of the German economy, there have been hardly any productivity-enhancing effects over the past two years. However, this does not mean that the reallocation of jobs between sectors was weak. Instead, there were reductions in employment not only in sectors with below-average productivity, such as accommodation and food service activities, but also in highly productive sectors, such as manufacturing. At the same time, in addition to the highly productive information and communication sector, sectors that are less productive in arithmetical terms, such as human health and social work activities, also saw sharp rises in employment.

Productivity growth nevertheless benefited from job fluctuations within sectors. This counteracted the sharp decline in aggregate productivity, but was only able to absorb it in part. 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. Also for this reason, more productive firms hired considerably more new employees, or dismissed considerably fewer existing employees, over the course of 2020.

However, the estimated relationship between productivity and changes in employment at the firm level during the most recent recession was not especially pronounced in comparison with the pre-crisis period. Accordingly, there was no strengthening of the productivity-enhancing reallocation of jobs in Germany in 2020. By contrast, the number of business start-ups rose sharply last year, particularly in knowledge-intensive services sectors. This could bolster productivity growth over the medium term. This likewise holds true of the strong growth in corporate investment in hardware and software prompted by the pandemic over the past two years.

Even though the effects of government support measures were not investigated explicitly, it can be assumed that they played a role in the moderate impact of job reallocation on productivity. On the one hand, these measures were successful in mitigating the impact of the COVID-19 crisis on firms with sustainable business models as well as in preventing insolvencies. On the other hand, however, government assistance may have potentially prevented greater productivity-enhancing reallocation effects via the employment channel.

Corporate fluctuations and productivity effects during the COVID-19 crisis

Crisis affected different areas of the corporate sector to varying degrees ...

The coronavirus pandemic not only reduced economic activity, but also caused shifts in market shares, employment, and medium-term earnings prospects between firms in Germany. Although extensive government support measures helped to mitigate the declines in firms' turnover, the economy experienced a massive collapse in 2020. The magnitude of these economic losses varied very considerably between different areas of the economy. This was evident, for example, in the dispersion of output growth across sectors and industries. This reflected the differences in how severely the various segments of the corporate sector were impacted by the diverse and, in some cases, sweeping restrictions and behavioural adjustments affecting households and firms. For example, economic activity in contact-intensive industries, in which working-from-home solutions or other physical distancing measures were difficult to implement, came almost to a complete standstill at times. This held especially true for accommodation and food service activities, personal service activities and entertainment, parts of the travel sector, as well as some segments of the stationary retail trade sector. By contrast, there were booms in industries

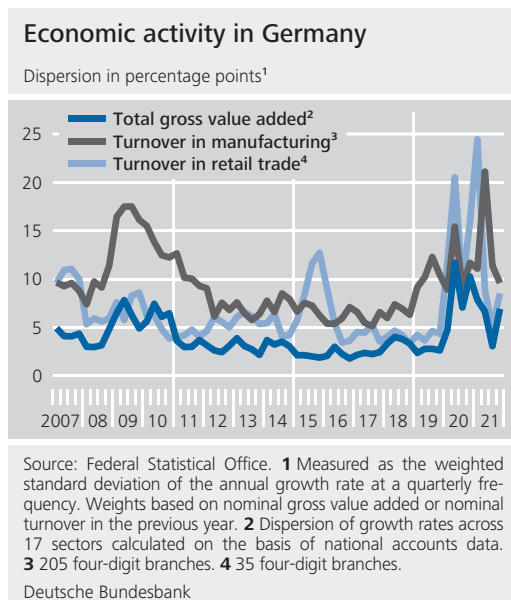
such as online retail trade and shipping services as well as in the demand for certain IT services and pharmaceutical products. Moreover, the manufacturing sector was also hit hard by the COVID-19 crisis. While production fell sharply at the beginning of the pandemic due to temporary closures resulting from a lack of demand and intermediate input deliveries, it suffered from wide-ranging supply chain issues during the subsequent recovery.

In principle, firms that had already gone digital prior to the pandemic or that had larger financial buffers were better able to respond to the challenges presented by the pandemic. For this reason, too, the pandemic-related effects on firms – even on those from the same sector – were, in some cases, very heterogeneous. These changes triggered by the pandemic, which also emerged in many other countries, were sometimes referred to as a “reallocation shock”.¹ In Germany, fluctuations in the corporate sector had declined sharply over the past two decades. This concerned, in particular, the number of corporate insolvencies, business closures, and start-ups. The COVID-19 crisis may therefore have interrupted this trend.

... and thus may have increased job reallocation in the corporate sector

The reallocation of economic resources and growth opportunities may have an impact on labour productivity in the corporate sector. If employment shares among firms shift from less efficient firms to more productive ones, this bolsters productivity growth.² First, this process may occur amongst incumbents, both within and across sectors. Second, some firms exit the market, while new ones enter. Young and innovative firms typically see rapid growth, build up their staff, and can thus reinforce future productivity growth. By contrast, firms that are no longer profitable dismiss their workers, who

Shifts in labour input among firms and sectors potentially enhance productivity



¹ See Anayi et al. (2021) and Barrero et al. (2021a).

² See Decker et al. (2017), Bartelsman et al. (2013) and Modery et al. (2021) for studies on the role of job reallocation for productivity irrespective of the economic cycle. In principle, job reallocation among firms also occurs in non-crisis times. However, employment reallocation and its impact on productivity may vary depending on the economic cycle (see, for example, Foster et al. (2016)).

are then free to engage in more efficient activities with other firms.³

Cleansing effect of coronavirus shock

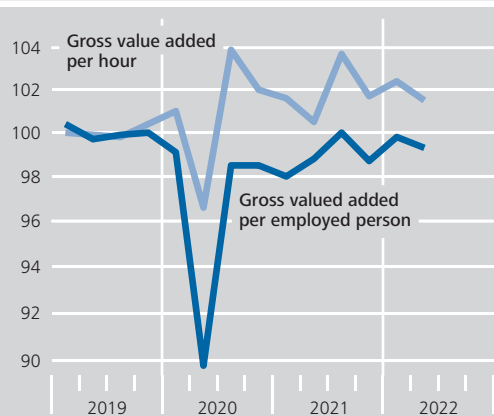
Recessions are usually associated with losses of jobs and income. However, in the sense of Schumpeterian “creative destruction”, the COVID-19 crisis could have been a time of increased productivity-enhancing job reallocation.⁴ In the literature, this is referred to as a “cleansing effect” triggered by recessions. However, a priori, it is unclear whether economic crises actually reinforce the productivity-enhancing reallocation process.⁵ This is because, especially during recessions, reallocation can be disrupted by other factors, such as financial market friction or government intervention.⁶ In addition, even productive firms may reduce job creation during economic crises, for instance if they take on a “wait-and-see” attitude.⁷ This article analyses the role of job reallocation for labour productivity growth in the German corporate sector since the coronavirus pandemic.⁸ Productivity effects resulting from the reallocation of capital are not investigated here.

Shifts in labour input measured in hours worked due to short-time working temporary in some cases

Labour productivity is calculated as the ratio of gross value added to labour input. Depending on how labour input is measured, labour productivity has developed very differently over the past two years. In terms of hours worked, it grew by just under 1% in each of these years. If the number of employed persons is instead used to measure labour input, it decreased by around 3% in 2020 and increased by 2.5% in 2021. The different results produced by these two measures are due to the extensive use of short-time working, which allowed firms to drastically cut back their working hours without reducing their numbers of staff. Hourly productivity is considered to be the more accurate measure for analysing productivity growth since it also factors in changes in average working hours. Nevertheless, in the following, labour productivity refers to the number of employed persons. First, this ensures consistency with the firm-level data used for analytical purposes, as these data typically contain infor-

Labour productivity*

2019 = 100, seasonally and calendar-adjusted data, log scale



Sources: Federal Statistical Office and Bundesbank calculations.
 * Gross value added chain-linked to previous-year prices.
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mation on employees and not hours worked. Second, changes in the number of employed persons are a better indicator of more persistent adjustments in labour input.

3 Furthermore, the pandemic affected innovation in certain business areas, for example in the medical and pharmaceuticals sector. This means that the productivity of incumbents may have also changed as a result of shifting profit opportunities.

4 See Schumpeter (1934).

5 For studies that find evidence of the cleansing effect of recessions, see, inter alia, Caballero and Hammour (1994), Foster et al. (2016) and Osotimehin and Pappadà (2017). Cleansing effects are not necessarily optimal for welfare, as they are usually accompanied by (temporary) unemployment and fluctuations in consumption.

6 See, inter alia, Barlevy (2003), Boeri and Bruecker (2011), Foster et al. (2016) and Kozeniasukas et al. (2022). This does not mean that support measures are fundamentally inefficient. For example, in a frictional market, measures such as short-time working can also enhance efficiency (see Giupponi and Landais (2019)). In this context, frictions in the labour market may be due to political factors (for example, employment protection) or result from the structure of the market (for example, search frictions).

7 Recessions may therefore also have a dampening effect on productivity (see, inter alia, Caballero and Hammour (2005), Kehrig (2015) and Haltiwanger et al. (2021)). Furthermore, recessions can have a lasting negative impact on productivity growth, for example if innovation activities are weakened during the recession (see, for example, Anzoategui et al. (2019)).

8 Here, reallocation is determined by the changes in the number of employed persons in sectors, industries or firms. The reallocation of jobs therefore only accounts for filled positions and not vacant positions.

Indicators of employment reallocation*



Sources: Federal Statistical Office and Federal Employment Agency. **1** Closures of corporate head offices with greater economic significance. **2** Weighted standard deviation of the annual growth rate in the number of employed persons or employees at a quarterly frequency. Weights based on the number of employed persons or employees in the previous year. **3** Dispersion of annual growth rates across 17 sectors calculated on the basis of national accounts data. **4** 205 four-digit industries. **5** 35 four-digit industries.
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Indicators of the reallocation of jobs

Fluctuations in corporate sector in 2020 only small on the whole ...

One fundamental question that arises here is whether the COVID-19 crisis was a reallocation shock in Germany, too. One reason to believe that this is not the case is that some indicators used to measure fluctuations in the corporate sector fell sharply, especially in the first year of the pandemic. This applies primarily to the number of corporate insolvencies and business closures.⁹ The number of start-ups initially dropped, too. Moreover, not only the number of jobs subject to social security contributions

that started, but also those that had been terminated, fell considerably. The reallocation of workers was therefore not particularly pronounced in the first year of the pandemic.¹⁰ Nevertheless, productivity-enhancing reallocation effects arise when comparatively productive industries or firms add jobs or less productive industries or firms destroy jobs more sharply, thereby shifting employment weightings towards more productive activities. It is therefore particularly important to know whether firms, industries or sectors have added or destroyed jobs to varying degrees.

According to indicators on the dispersion of employment growth, the reallocation of jobs has increased significantly over the past two years, at least compared with previous years.¹¹ This applies both to the intersectoral dispersion of employment growth in Germany as a whole and to interindustry employment growth within individual sectors. Owing to the sharp decline in closures and the initially only moderate change in the number of start-ups, shifts between incumbents were the main reason for this. In this respect, the COVID-19 crisis did not trigger a comprehensive reallocation shock in the corporate sector in Germany, unlike else-

... but intersectoral and intra-sectoral employment shifts increased

⁹ Data on start-ups and closures are based on the Federal Statistical Office's business registration statistics. Corporate head offices with greater economic significance are considered here. These encompass undertakings managed or established by a legal person, partnership or natural person. In the case of a natural person, this is predicated on them being (or having been) entered in the commercial register, having (had) an entry in a skilled trades register, or employing (or having employed) at least one person.

¹⁰ See also Schmidt (2021). The reallocation of workers also includes employees changing firms without jobs being either created or destroyed. These transfers can, in principle, also be productivity-enhancing even without employment weightings being shifted because, for instance, the employees' skill sets are a better fit to the new firms' needs.

¹¹ A comprehensive analysis of job reallocation requires extensive corporate data covering job creation and destruction by firms in all sectors; see, for example, Foster et al. (2016) and Bachmann et al. (2021). For reasons of data availability, this is not possible here.

where.¹² Nevertheless, the increase in the dispersion of employment growth across sectors and industries shows the potential for productivity-enhancing reallocation effects during the pandemic.

Impact of the reallocation of jobs between sectors

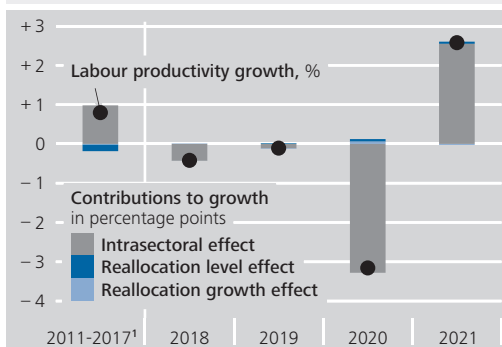
Sector shifts in the workforce during the pandemic hardly productivity-enhancing ...

Sector 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 would result absent shifts in jobs across sectors. The first two components can therefore be used to identify the productivity effect resulting from reallocation between 20 sectors which are distinguished in the national accounts.¹³ The reallocation level effect is positive if employment shifts from less productive to more productive sectors. However, this effect was basically zero in 2020 and 2021. Moreover, hardly any changes can be seen in this component of productivity growth compared with the pre-crisis years of 2018 and 2019.¹⁴ The reallocation growth effect, which measures the contribution to growth of shifts in employees between sectors with different productivity dynamics, likewise did not contribute to productivity growth during the pandemic. Overall, productivity growth has thus hardly increased in the past two years owing to job shifts towards more productive or dynamic sectors.

... because sectors with above-average productivity destroyed jobs and sectors with below-average productivity created jobs as well

This finding may be surprising given the increased employment shifts between sectors. It results from the fact that, during the pandemic, jobs were destroyed not only in sectors with below-average productivity, such as the accommodation and food service activities sector, but also in highly productive sectors, such as manufacturing. The percentage decline in employment in 2020 was significantly smaller in manufacturing than in the accommodation and food

Components of aggregate labour productivity growth*



Sources: Federal Statistical Office and Bundesbank calculations.
 * Annual growth rates of real gross value added per person employed. Decomposition based on data for 20 sectors. ¹ Average annual change.
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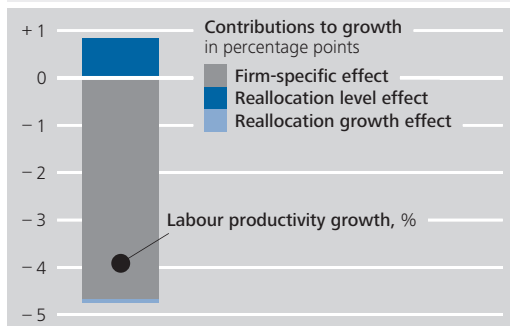
service activities sector. However, employment was reduced more strongly here in terms of the number of persons. At the same time, in addition to the highly productive information and communication sector, less productive sectors in arithmetical terms, such as human health and social work activities, also saw sharp rises in employment.

¹² In Germany, the fluctuations in the dispersion measures were not exceptionally high by historical standards. The dispersion of sector employment growth was more pronounced in the early 1990s. The dispersion of intrasectoral employment growth was likewise higher in the past. For studies that link a reallocation shock to the pandemic in the United States and the United Kingdom, see Anayi et al. (2021) and Barrero et al. (2021a).

¹³ The decomposition of growth follows the OECD's standardised approach; see OECD (2018). In the literature, there are different methods of performing this type of decomposition. The OECD approach corresponds to a firm-level growth decomposition. However, it can lead to distortions caused by adding chained volume data. For an alternative approach, see, for example, Deutsche Bundesbank (2021a). This delivers overall similar results for the reallocation effect over the past two years.

¹⁴ By contrast, calculations of hourly productivity indicate a significant, positive contribution of the reallocation level effect for 2020. This is likely to be due, amongst other things, to the fact that some sectors that were severely affected by the pandemic and display a relatively low level of productivity saw an extremely sharp decline in hours worked. In the accommodation and food service activities sector, for example, the number of hours worked fell by around 23%, while the number of persons employed in the sector fell by 8%. In 2021, the reallocation level effect calculated on an hourly basis roughly corresponds to the effect obtained for productivity measured in persons.

Components of sector labour productivity growth in 2020*



Sources: Bundesbank Online Panel Firms (BOP-F, Wave 5) and Bundesbank calculations. * 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.

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Intrasectoral effects key to productivity growth during the pandemic

According to the decomposition, labour productivity growth in Germany during the pandemic was shaped by the contribution of the intrasectoral effect (the third component of the decomposition). Sector-specific developments are key to this component.¹⁵ These include changes in total factor productivity (TFP) or capital intensity in a given sector. In addition, job reallocation – namely between firms in the same sector – can also matter for this component. This is plausible inasmuch as the fluctuation of employees within sectors is associated with comparatively low frictions owing to industry-specific human capital, whilst at the same time the dispersion of productivity levels of firms even within narrowly defined industries is extremely high.¹⁶

Effects of the reallocation of jobs within sectors

Intrasectoral reallocation strengthened productivity in 2020 ...

The relationship between job reallocation and labour productivity between incumbent firms within sectors can be analysed using German firm-level data. To this end, the Bundesbank online survey of firms (Bundesbank Online Panel – Firms, BOP-F) was used.¹⁷ The fifth wave of the survey in May 2021 contains data on changes in turnover, sales price, employees and average production costs in 2020 com-

pared with 2019. From this, the change in firms' labour productivity in 2020 can be approximated and sector productivity growth can be broken down into the contributions of a firm-specific effect and a reallocation effect.¹⁸ The firm-specific effect measures the sector productivity growth that, given the composition of employment, would result from changes in the average productivity of firms in the sector, for example due to changes in TFP or capital intensity. The reallocation effect is, in turn, again the sum of the level effect and growth effect. These effects are caused by within-sector changes in the employment shares of firms with different productivity levels or different productivity dynamics. The growth decomposition shows that the firm-specific effect in 2020 was strongly negative, at -4.7 percentage points. This means that average productivity (in terms of number of employees) across firms fell sharply during the pandemic. This is due, in particular, to the use of short-time working, which enabled firms to retain employees despite high turnover losses. However, this was somewhat counteracted by the shift in the employment weights of individual firms. The positive reallocation level effect shows that more productive firms gained in importance, while producers with less-than-

¹⁵ The intrasectoral effect measures productivity growth within sectors on the assumption of no changes in the employment structure in the economy. The effect is calculated as the weighted sum of productivity growth in the sectors under review.

¹⁶ See Syverson (2011). An analysis based on large firm-level datasets for nine European countries concludes that intrasectoral job reallocation between incumbents was a key factor in sector productivity growth between 2007 and 2016; see Modery et al. (2021).

¹⁷ The BOP-F is a firm-level survey dataset. Since June 2020, the Bundesbank's Research Centre and Research Data and Service Centre have been conducting the survey in cooperation with forsa, an external market research company. The survey consists of recurring key questions on firms' economic situation and their expectations as well as special modules that vary from quarter to quarter and often address topical issues.

¹⁸ The analysis is based on a sample size of around 2,000 firms. For these firms, weighting factors were applied in order to measure aggregate developments. The calculation of labour productivity follows the analyses for the United Kingdom published in Bloom et al. (2020). The growth decomposition chosen corresponds to that for sector data. See Foster et al. (2008) for such a decomposition using firm-level data.

average productivity lost out. By contrast, the reallocation growth effect was virtually irrelevant. The overall reallocation effect therefore dampened the decline in labour productivity by just under 1 percentage point. Aggregate labour productivity, however, still fell by almost 4%.

... yet only partially offset the firm-specific decline in productivity

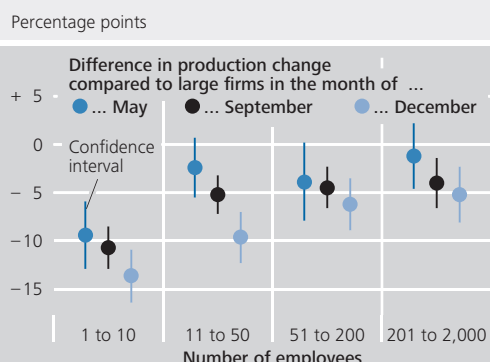
Given the small sample size of just over 2,000 firms, these results based on the BOP-F are somewhat uncertain. Nevertheless, in terms of the magnitude of the decline in productivity, they are roughly in line with those of the national accounts. The results suggest that in 2020 reallocation effects among firms in the same sector increased labour productivity growth (measured in terms of number of employees) in Germany. However, this failed to offset the larger firm-specific losses in efficiency.

Heterogeneous output developments among firms in the same sector

Large firms came through pandemic much better than small firms in the same sector

The COVID-19 crisis had an uneven impact on firms of different sizes within sectors, too. This is shown by further estimations based on Waves 1, 3 and 4 of the BOP-F survey data for 2020.¹⁹ According to these estimations, even if, in particular, industry-specific effects are taken into account, output developments of smaller firms were significantly weaker than those of large enterprises because of the COVID-19 crisis. Conversely, larger firms weathered the 2020 recession significantly better than smaller firms in the same sector. If, in addition, one takes into account that larger firms are more productive on average, the results are consistent with the positive intrasectoral reallocation effects shown above.²⁰ Larger firms tend to be more highly digitalised and were therefore able to implement remote working, for instance, more quickly and more efficiently, thereby minimising turnover losses (see the box on pp. 54 f.).²¹ In addition, they usually have greater financial means to cushion periods of slumping

Production changes in 2020 due to the coronavirus crisis*



Sources: Bundesbank Online Panel Firms (BOP-F, Waves 1, 3 and 4) and Bundesbank calculations. * Weighted regressions controlling for sector fixed effects. Robust standard errors. Regressions are based on data for more than 10,000 (May), more than 12,000 (September) or more than 15,000 (December) firms.

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turnover growth.²² This is also likely to have had an impact on firms' decisions to create and destroy jobs.

The effects of job reallocation between incumbent firms in the same sector over time

In addition, intrasectoral reallocation effects between incumbents can be analysed using an alternative dataset, the Bundesbank's JANIS dataset, which is available for several years up to 2020. Based on this dataset, the relationship between employment growth and firms' labour productivity during the pandemic can be contrasted with that prior to the crisis. For

Evaluations of an alternative firm-level dataset show a positive intrasectoral reallocation effect for 2020, too ...

¹⁹ The regressions are based on the following question about changes in production due to the unexpected COVID-19 crisis: "Your production/business activity has decreased (increased) as a result of the coronavirus pandemic. How large was the decrease (increase) in your production/business activity as a result of the coronavirus pandemic in the month of May (Wave 1), September (Wave 3) or December (Wave 4) compared with a "normal" situation, e.g. in May (September or December) 2019?"

²⁰ See OECD (2014).

²¹ See European Investment Bank (2022), Kaus et al. (2020) and Comin et al. (2022).

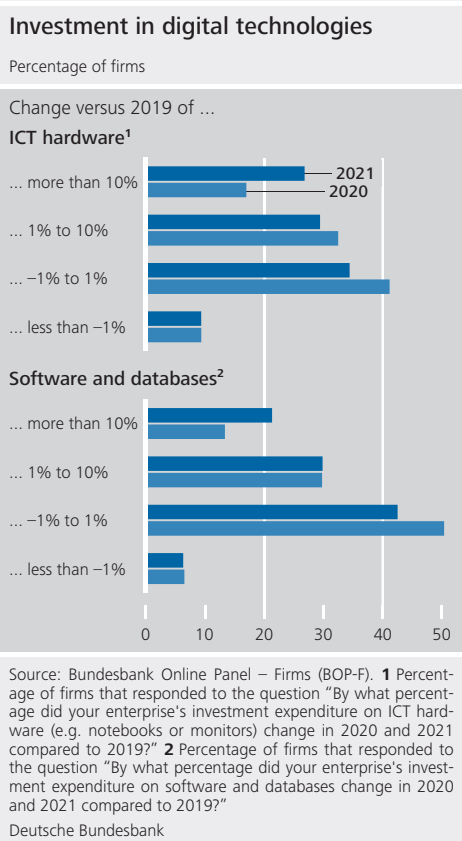
²² See, for example, Chodorow-Reich et al. (2022). Dettmann et al. (2021) also find that firms in Germany with a better profitability in pre-crisis years were less affected by the pandemic.

Digitalisation in the German corporate sector since the onset of the coronavirus pandemic

One possible positive consequence of the coronavirus pandemic is often said to be a digitalisation boost in the corporate sector.¹ Faced with the measures taken to contain the pandemic and mandatory business closures, many firms made greater use of remote work and online distribution channels.² This may also have necessitated additional investment in the required digital technologies. However, the national accounts indicators available for the corporate sector as a whole do not, to date, suggest that digitalisation in Germany has accelerated. National accounts data show gross fixed capital formation in software and databases as well as in information and communication technology (ICT) in 2020 to have been below the average of the previous five years.³ Some other macroeconomic

indicators which focus on the use of information technology (IT) goods or the internal generation of proprietary digital solutions through the increased use of IT human capital provide a more optimistic assessment.⁴ Nonetheless, in a European comparison, Germany currently only occupies a mid-table position in terms of digitalisation according to the broad-based DESI index.

The latest Bundesbank Online Panel – Firms (BOP-F) provides data on digitalisation, broken down by category of firm, for the period from April to June 2022. These data suggest that digitalisation has accelerated in some areas of the corporate sector since the pandemic,⁵ with roughly half of firms investing significantly more in ICT and hardware as well as software and databases in 2020 than in the year preceding the crisis. One-sixth and one-seventh of firms reported increasing their investment in, respectively, hardware and software by more than 10%. Investment growth was particularly pronounced in some services sectors, such as the financial and insurance sector, as well as in education, health and social services. In 2021, the share of firms with higher invest-



1 See, for example, D'Adamo et al. (2021) and OECD (2020).

2 See Deutsche Bundesbank (2021c) and German Economic Institute (2021).

3 The figure for investment in software and databases was below average in 2021, too. Data on investment in ICT are not yet available for 2021.

4 According to the European Commission's Digital Economy and Society Index (DESI), the percentage of ICT specialists in the German workforce rose from 4% in 2019 to 4.7% in 2020.

5 Other survey results among German enterprises yield similar results overall. See, for example, European Investment Bank (2022) and Bellmann et al. (2021). According to the results of the European Investment Bank's Investment Survey, the push for digitalisation may even have been somewhat greater in Germany than the EU average.

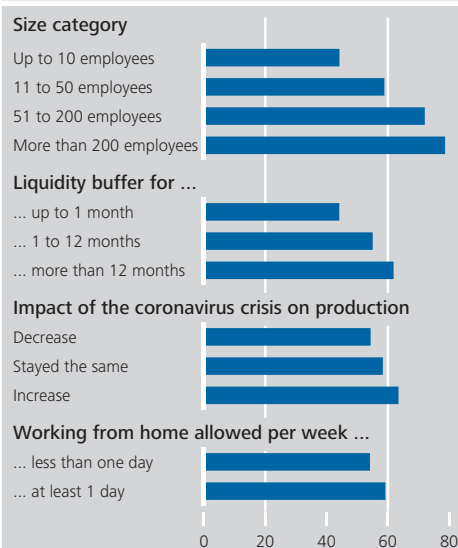
ment in hardware and software continued to grow, and investment volumes also increased. At the firm level, investment in the two years is closely correlated. This could therefore be more than just a temporary digitalisation boost in these firms.

However, the results of the BOP-F suggest that digital technologies did not spread at the same pace in all firms. A breakdown of the survey results by size category shows that large firms, in particular, ramped up their investment in digital technologies. Around four-fifths of large firms (with more than 200 employees) reported increasing investment in hardware and software. By contrast, this was the case for only around two-fifths of micro-firms (with up to ten employees). In addition, firms with liquidity bottlenecks and those experiencing a decline in production during the coronavirus pandemic reported significantly weaker growth in investment in digital technologies. In 2021, those firms that had made greater use of remote working arrangements since the onset of the coronavirus pandemic, in particular, upped their investment in digital goods. All in all, the recent surge in digitalisation increased the digital advantage of large firms, which tend to be more highly digitalised.

The results of the Bundesbank's BOP-F paint a mixed picture in terms of productivity effects. On the one hand, they corroborate the optimistic assessment that the surge in digitalisation witnessed by the corporate sector since the onset of the coronavirus pandemic, which is at least somewhat more than just short term, could, on balance, strengthen future productivity growth. It is unclear in all this how persistent the increase in digital uptake and the associated changes in firms' working processes will prove.⁶ On the other hand, large, productive firms, in particular, reported higher in-

Firms with more investment in digital technologies in 2021 than in 2019*

Percentage of firms



Source: Bundesbank Online Panel – Firms (BOP-F). * Increase in investment defined as growth in investment of more than 1%. Mean of responses for ICT hardware, and software and databases. The information on working from home (wave 4), the impact of the coronavirus pandemic (wave 4) and firms' liquidity buffer (waves 9-11) are available only for a subset of the sample of waves 15-17 (investment in digital technologies).
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vestment in digital technologies, while digitalisation in smaller, less productive firms barely accelerated.⁷ The uneven progress in digitalisation thus deepened the digital divide in the German corporate sector. Owing to the slowdown in technology diffusion in recent years suggested by studies, aggregate productivity gains could therefore be somewhat smaller than would have been expected were additional investment in digital technologies distributed more evenly.⁸

⁶ See Barrero et al. (2021b) and Bick et al. (2022).

⁷ See Rückert et al. (2021).

⁸ See Akcigit and Ates (forthcoming) and Andrews et al. (2016).

Relationship between employment growth and previous year's labour productivity in manufacturing and the retail trade*

Item	2008-09	2011-2019	2020
Previous year's labour productivity ¹	3.58 ^a (0.64)	6.13 ^a (0.62)	3.55 ^a (1.21)
Number of observations	12,614	54,324	4,863
Number of firms	7,131	9,620	4,863
R ²	0.04	0.06	0.07

Sources: JANIS and Bundesbank calculations. * Table shows estimation coefficients for the relationship between employment growth (%) and the labour productivity of corporations in manufacturing and the retail trade lagged by one year. The estimation equation controls for industry and year fixed effects and for firm age and size. Estimates weighted on the basis of extrapolation factors. ^a Significant at the 1% level. ¹ Deviation of log labour productivity from the industry-specific mean.

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2020, the JANIS dataset shows a positive relationship between the level of firms' labour productivity in the pre-crisis year of 2019 and employment growth in the crisis year of 2020, taking industry-specific effects into account.²³ This implies that those firms that were among the more productive before the crisis added more jobs (or reduced fewer jobs) in 2020 than those that were already less efficient before the crisis. The results are consistent with those of the BOP-F, as they indicate a positive intrasectoral reallocation level effect.

... which, compared with pre-crisis years ...

For a comparison over time, the above estimation is carried out for different time periods. Specifically, the relationship between employment growth and the previous year's level of labour productivity at the firm level is estimated, taking into account other factors.²⁴ Changes in the estimated relationship over time indicate changes in the magnitude of productivity-enhancing reallocation, as they show the extent to which more productive firms add more jobs than less productive firms. As the dataset best covers manufacturing and retail trade corporations, the analysis is confined to these areas.

A comparison of the relationship estimated for 2020 with that for the years of the economic and financial crisis shows that the effects were

roughly the same in both economic downturns. In particular, firms with a high level of productivity in the previous year added jobs at an accelerated pace during the two crises. The gap to the change in employment of low-productivity firms was, in each case, nearly 4 percentage points.²⁵ However, the estimated effect over the 2011 to 2019 period, i.e. between the crises, was on average markedly

... was not particularly pronounced, however, and therefore does not indicate a strong cleansing effect

²³ The JANIS dataset contains annual financial statements of German non-financial corporations which are sent to the Bundesbank for credit assessment purposes, as well as financial statements from public sources (see Becker et al. (2022)). This is a non-representative sample of firms in which the coverage of individual sectors in part varies considerably. In addition, the number of employees is not necessarily part of the annual financial statements submitted to the Bundesbank and is therefore reported only by some of the firms. In manufacturing and retail trade, the firm-level data needed for the analysis are available for a larger number of corporations. In order to approximate as closely as possible the aggregated effects for the sectors under review, the regressions are weighted using weighting factors for turnover size classes and industries.

²⁴ The regression model contains industry-specific effects; the variation across firms within industries is therefore used to identify the effect of interest. Labour productivity is defined as value added per employee and enters the model as a deviation from the annual industry-specific mean. Value added is price adjusted using sector deflators. In addition, the regressions take into account firm size (total assets) in the previous year, firm age and year fixed effects. The estimated model follows Foster et al. (2016) and Andrews et al. (2021).

²⁵ For this calculation, firms whose productivity level was one standard deviation above the industry-specific mean in the year prior to the crisis were compared with firms whose productivity level was one standard deviation below the mean.

larger. Over that period, the mean difference in growth rates between high-productivity and low-productivity firms amounted to 6.5 percentage points. Although estimation uncertainty is quite high, especially for the effect calculated for 2020, the results do suggest that productivity-enhancing employment reallocation in the COVID-19 crisis did not increase compared with non-crisis years.²⁶ A cleansing effect is therefore not apparent on the basis of this analysis. The extensive government support measures may have been a contributing factor here. These may have protected some less productive firms from having had to reduce the workforce by more.²⁷ By contrast, financial market frictions are unlikely to have significantly impaired job reallocation during the pandemic.

Reallocation through firm entry

Number of start-ups rose exceptionally sharply in 2021 ...

According to the German Council of Economic Experts, around 20% to 25% of job creation and job destruction in Germany is attributable to business start-ups and closures.²⁸ Newly established, innovative firms make an important contribution to productivity growth, job creation and economic structural change in the medium term. Following the recession-induced decline in business registrations in 2020, a strong countermovement was seen last year, with the number of start-ups rising by 9.7% on the year. On an average of 2020 and 2021, the number of business start-ups exceeded the average pre-crisis level of 2018 and 2019 by 1.7%. Start-ups therefore not only withstood the headwinds of the pandemic, but even increased markedly. Even so, on account of the typically low initial number of people employed at such firms, fluctuations in the number of start-ups during the pandemic are likely to have had little impact on productivity, on balance. In the medium term, though, the increased number of start-ups could strengthen productivity (see the box on pp. 58 ff.).

The sector structure of business start-ups over the past two years also improved the outlook for productivity growth. It reflects the accelerated structural shift towards knowledge-based services triggered by the pandemic. For example, there was a sharp increase in the number of start-ups in the information and communication sector, primarily on the back of the growth seen in information technology services in 2021, which was more than 20% up on the pre-crisis year 2019. In addition, the number of start-ups in the field of scientific and technical activities (particularly consultancy firms) as well as in financial and insurance activities climbed steeply. These, too, are comparatively productive sectors.²⁹ At the same time, however, start-up figures in some less productive sectors in arithmetical terms also rose considerably as a result of the pandemic, with higher numbers being registered in sectors including retail trade, transporting (partly due to the sharp increase in express services) as well as human health and social work activities. By contrast, business registrations in other less knowledge-intensive, less productive sectors, such as construction and accommodation and food service activities, decreased significantly compared with the year before the onset of the crisis.

... on account of more start-ups in the knowledge-based services sector, amongst other things

Reallocation through corporate insolvencies or closures

Corporate insolvencies declined sharply in both 2020 and 2021, falling by -15.5% and -11.7%,

²⁶ Regressions for the United States and a panel of European countries also show that the reallocation effects in the economic and financial crisis were positive but not particularly pronounced (see Foster et al. (2016) and Bartelsman et al. (2019)).

²⁷ See Boeri and Bruecker (2011). Additional data are needed to evaluate the possible effects of the support measures on allocative efficiency in Germany. Analyses for other European countries conclude that firms with lower productivity tended to take greater recourse to government support measures. See Kozeniauskas et al. (2022) and Bighelli et al. (2022).

²⁸ See German Council of Economic Experts (2019).

²⁹ The number of start-ups in the likewise relatively productive industrial sector declined, just as it had in the pre-crisis years.

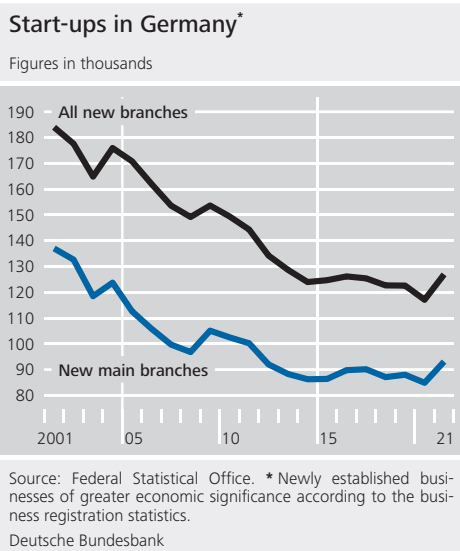
The role of start-ups during the COVID-19 crisis for economic activity in Germany

Start-ups play an important role in the growth dynamics of the corporate sector. Young firms do more than just create new jobs.¹ They can also make important contributions to productivity growth by bringing innovative products to market, strengthening competition and boosting the productivity-enhancing reallocation process in the corporate sector.² These effects usually materialise only after a certain period of time, as newly established enterprises tend to initially employ a fairly small number of employees and cease operations again relatively often. However, those start-ups that succeed in surviving in the market sometimes grow quickly and can thereby exert relevant macroeconomic effects.³

The number of start-ups established annually in Germany has declined sharply over the past two decades. More than 132,000 head offices were registered as businesses in 2002, compared with just over 86,000 in 2014. This corresponds to a decline of 35%. Even though registrations stabilised in subsequent years, on an average of the period

from 2015 to 2019, the number of enterprises founded – around 88,000 head offices per year – was still relatively small. The 2020 recession pushed firm births down to just under 85,000 (a decline of 3.5% on the year). In the following year, however, they rose sharply, increasing by almost 10% to more than 93,000. On an average of the period from 2020 to 2021, then, the number of start-ups exceeded pre-pandemic levels.

But this does not yet constitute a trend reversal. Countermovements in the number of start-ups have already previously been observed in individual years without business registrations then remaining at a higher level in the long run. In addition, there are structural reasons for declining firm births – reasons on which the pandemic is unlikely to have had much of an impact. They have also led to declines in other countries in recent years. One of these reasons is demographic change, something that is also affecting Germany.⁴ In ageing populations, the generally lower level of creativity, higher average risk aversion, a shrinking labour force and usually more unfavourable growth prospects serve as barriers to establishing a start-up. Another reason could be the slower diffusion of knowledge from frontier firms to other firms in an industry that has been observed over the past two decades.⁵ A decline in knowledge diffusion tends to be as-



1 See, for example, Haltiwanger et al. (2013).
 2 See, for example, Aghion et al. (2004), Acemoglu et al. (2018) and Haltiwanger et al. (2016).
 3 See Haltiwanger et al. (2016).
 4 See Quimet and Zarutskie (2014), Liang et al. (2018), Emes et al. (2018), Röhe and Stähler (2020), Peters and Walsh (2021) and Hopenhayn et al. (2022).
 5 See Akcigit and Ates (forthcoming); Andrews et al. (2016); Calvino et al. (2020).

sociated with shifts in the structure of markets and digital technologies. It makes it more difficult for young firms to catch up with market leaders, thereby reducing incentives to start a business.

The resilience of start-ups in Germany during the pandemic may have prevented worse losses in value added, and it could support labour productivity in the medium term.⁶ That is because, had the short-term drop in firm entry at the start of the pandemic not been rapidly counterbalanced, labour productivity would probably have been lower over the next few years. Following a study by Gourio et al. (2016) for the United States, the role of firm births for economic activity in Germany can be roughly estimated. Data from the Federal Statistical Office and State Statistical Offices on start-ups, gross domestic product (GDP) and em-

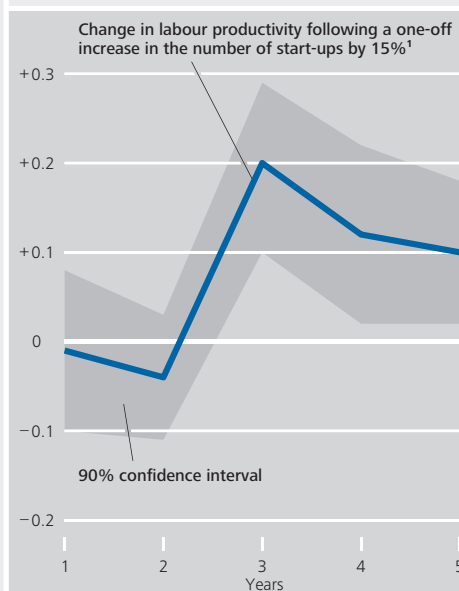
⁶ A sharp decline in firm births can amplify losses in value added during crises and also slow the economic recovery. See Clementi and Palazzo (2016).

⁷ See Jordà (2005) and Gourio et al. (2016). The estimation equation is as follows: $y_{l,t+k} = \gamma^k g_{l,t} + \delta^k x_{l,t} + \alpha_l^k + \alpha_r^k + \varepsilon_{l,t}^k$, where l denotes a NUTS 3 region (or district), r a NUTS 2 region (usually a government region) and t a year. $y_{l,t+k}$ is the dependent variable (GDP, employment or labour productivity) at time $t+k$, and $g_{l,t}$ represents the log change in the number of start-ups. $x_{l,t}$ contains control variables for the years t and $t-1$; these comprise the dependent variable as well as the population, GDP, participation rate, building land prices and the value added share of the manufacturing sector in district l . With the exception of the local participation rate obtained from the OECD, all data are from the Federal Statistical Office and State Statistical Offices. α_l^k and α_r^k are fixed district and government region-year effects. Fixed district effects take account of time-constant, unobserved differences between districts. Fixed government region-year effects take account of unobserved annual shocks at the NUTS 2 level. They reflect regional demand or supply shocks, for example. As only nominal GDP information is available at the district level, they also control for unobserved price developments at the government region level. One assumption on which the analysis is based is that price developments of districts within government regions are similar and any differences are largely captured by the other control variables. The estimates are calculated using data from 2010 to 2019. The first and last percentile of the growth in the number of start-ups are winsorised.

⁸ See also German Council of Economic Experts (2019) for an analysis with regional data on this issue.

Estimated relationship between start-ups and labour productivity*

Percentage deviation from baseline



Sources: Federal Statistical Office and State Statistical Offices, OECD and Bundesbank calculations. * Impulse response estimated using local projections (Jorda, 2005). Standard errors clustered at the district level. ¹ This corresponds to one standard deviation of the change in the number of start-ups.
 Deutsche Bundesbank

ployed persons at the district level are used for this purpose. In addition to the establishment of main branches of enterprises, the establishment of dependent and independent branches is also taken into account, as they can also be important for the local economy. An estimation model based on local projections shows how local GDP and local labour productivity change after an increase in the number of local start-ups.⁷ Various other determinants are also taken into account in the estimation framework.⁸

The estimated effect of an increase in the number of start-ups on GDP in the first two years is close to zero and statistically insignificant. Only thereafter is there a significant positive relationship. This finding reflects the lagged, but distinct, effect of firm entry on economic activity. By contrast, the estimated impact of the increase in the number of start-ups on local employment is

consistently small and statistically insignificant. This could be related to the fact that start-ups tend to recruit employees from other firms or to hire displaced employees before they register as unemployed or leave the labour market. This supports the hypothesis that start-ups promote the reallocation process in the corporate sector. The picture for labour productivity thus resembles the one for GDP. A significant positive effect is observed from the third year and ranges from 0.1% to 0.2%. Taken in isolation, the decline in firm births in 2020 would therefore lead to one-off losses in labour productivity growth of less than 0.1 percentage point three years later. While this effect is manageable, it is also not negligible when compared with the average growth in real gross value added per employed person in Germany of around 0.6% between 2011 and 2019. That said, the results suggest that the subsequent strong rebound in the

number of start-ups in 2021 more or less offsets this effect with a one-year lag.⁹

⁹ These back-of-an-envelope calculations do not take into account the sectoral structure of the start-ups.

*Insolvencies
down sharply
in 2020 and
2021 ...*

respectively, on the year.³⁰ Government support measures and the temporary suspension of the obligation to file for insolvency contributed substantially to this.³¹ The subsequent implications for productivity growth depend on the types of firms that were protected from insolvency. Overall, preserving generally profitable firms which became distressed through external shocks as a result of the pandemic is likely to have a positive impact on aggregate productivity, as this shields productive jobs and productive capital. In particular, intangible knowledge capital pertaining to, for example, production and demand, corporate culture or relationships with customers and financial institutions would otherwise be lost, for the most part.³² If, on the other hand, it was mostly firms with low levels of productivity that benefited from the support measures – firms that would otherwise have closed were it not for the outbreak of the pandemic – the impact on aggregate productivity would be unambiguously negative.

Evaluations show that insolvencies, particularly among micro firms, fell sharply during the pandemic.³³ These tended to be firms with below-average productivity. There is evidence that these firms benefited in part from free-rider effects.³⁴ This means that some of these firms that benefited from support measures had already been experiencing financing problems before the pandemic and might have filed for insolvency in 2020 in the absence of these measures. However, owing to the small size of

*... particularly
among micro
firms*

³⁰ Since the financial and economic crisis, insolvency figures had been continually declining (on an annual average of almost 6% between 2011 and 2019). During the crisis year of 2009, by contrast, they rose by 11.6%.

³¹ See Deutsche Bundesbank (2021b).

³² Guerrieri et al. (2022) show, furthermore, in a theoretical framework, that an increase in firm exits resulting from an asymmetric negative shock such as the coronavirus pandemic can amplify a recession.

³³ See Deutsche Bundesbank (2021b) and Creditreform (2019, 2020 and 2021).

³⁴ See Dörr et al. (2022).

these firms, the impact on aggregate productivity growth is likely to be modest.³⁵

Steep decline in closures in accommodation and food service activities sector and retail trade

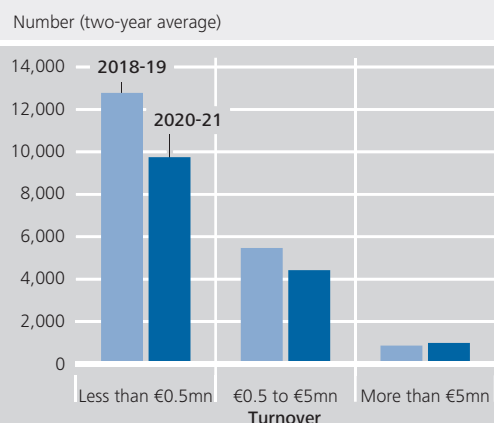
Many firms that close down are not involved in insolvency proceedings. Furthermore, such proceedings do not necessarily mean that a firm will exit the market. With regard to reallocation effects, then, closures are of particular significance. But in business deregistrations, too, a sharp decline, of -13.6%, was seen in 2020, and in 2021, the number of business closures remained at the low level of the previous year. Business closures decreased in almost all sectors. However, accommodation and food service activities and trade alone accounted for half of the decline in business deregistrations, in numerical terms. Firms in these sectors were heavily affected by the measures taken to contain the coronavirus pandemic, and therefore also benefited disproportionately from support measures. In this regard, these sectors in particular might see further firms exit the market with a lag once government support has been fully phased out, which means that certain productivity-enhancing effects might still materialise.

■ Conclusion

Intrasectoral reallocation counteracted productivity decline

The coronavirus pandemic had a highly heterogeneous impact on the different parts of Germany's corporate sector, as evidenced by the large dispersion in the growth of value added and turnover over the past two years. The dispersion of employment growth was not quite as pronounced, but still increased on the years prior to the pandemic. However, the intersectoral shifts in employment shares did not produce any noteworthy productivity effects. Analyses based on firm-level microdata, on the other hand, suggest that the intrasectoral reallocation of jobs between firms bolstered productivity growth during the pandemic. Even so, labour productivity per person employed declined overall.

Corporate insolvencies by turnover size class*



Source: Creditreform. * Figures partially based on estimated turnover figures (see Creditreform (2019, 2020, 2021)).
 Deutsche Bundesbank

Compared with the pre-crisis period, these productivity-enhancing reallocation effects were not particularly pronounced. 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, 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 have low levels of productivity. Viewed overall, then, the pandemic did not trigger a pronounced cleansing effect in Germany.

No cleansing effect from the recession

Government support measures are likely to have played an important role in this regard. Whilst a conclusive assessment of the productivity effects produced by these measures is still pending, it can be said that this assistance for firms was granted according to how they had been affected by the pandemic and their financing requirements, whilst aspects such as the firms' profitability were of secondary import-

Government assistance counteracted productivity-enhancing reallocation effects

³⁵ Studies for France and Italy find no evidence to suggest that the coronavirus pandemic led to a broad-based increase in the number of zombie firms or a disproportionate take-up of support measures by zombie firms. See Cros et al. (2021) and Pelosi et al. (2021).

ance.³⁶ The aim of the measures was to support those firms that had run into difficulties through external shocks as a result of the pandemic – an aim which seems to have largely been achieved. As a result, productive capital is likely to have been preserved and systemic risk

averted. That said, the government assistance measures may have partially hampered stronger productivity-enhancing reallocation effects.

³⁶ See Dörr et al. (2022).

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