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## The effects of COVID-19 on businesses: Key versus non-key firms

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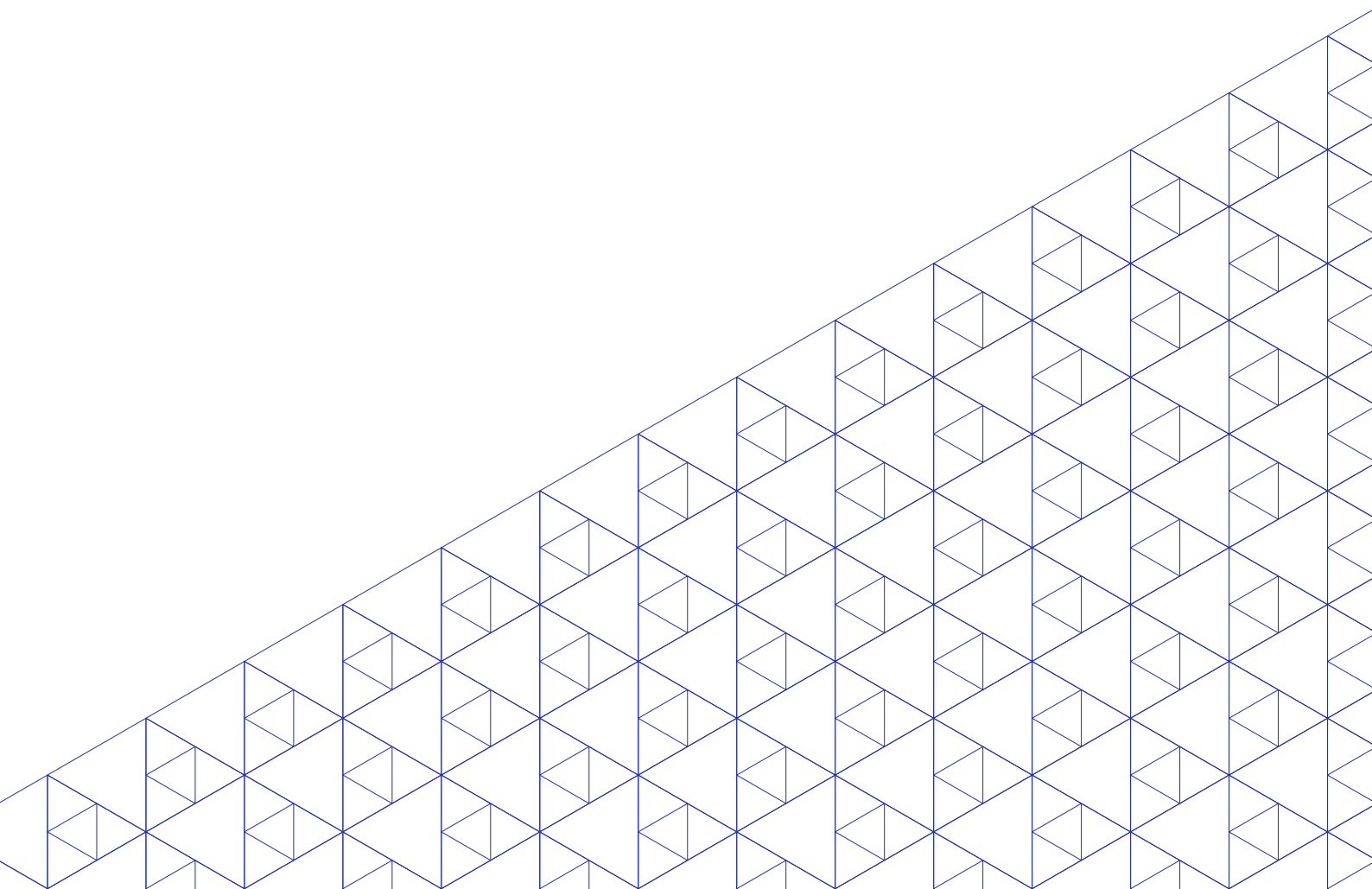
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# ► The effects of COVID-19 on businesses: key versus non-key firms

Author / Henry Stemmler





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## Abstract

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This paper analyzes how a specific differentiation by governments throughout the world – whether a sector was deemed “essential” or “key” – affected firm performance. During the COVID-19 pandemic, governments designated specific services as “essential,” which allowed firms operating in those sectors to remain (partially) open as well as being granted other preferential treatment. This paper analyses the effects of the key-status, by mapping the countries’ lists to the sectoral level, and matching these sectors with firm-level Covid-19 survey data from 27 countries. The findings reveal that, controlling for a rich set of firm-level and sectoral characteristics, firms deemed key less often reported declining sales and demand for their goods or services, and had a smaller number of furloughed workers. Nonetheless, non-key firms were more likely to employ online business activities and to change the main product or service they offered, reflecting the necessity to otherwise adjust to the economic downturn and changes in demand.

## About the author

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**Henry Stemmler** is a postdoctoral researcher at the Chair of Food Systems Economics and Policy at ETH Zurich with a PhD in Economics from the University of Göttingen. In 2017, he graduated with a Master in Economics from the University of Copenhagen. His research lies at the intersection of technological change, international trade and economic development. He has worked as an Economist at the International Labor Organization and as a Consultant for the World Bank.

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## ► Introduction<sup>1</sup>

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The Covid-19 pandemic began as a public health crisis that quickly turned into an economic crisis. While the objective of most governments since the start of the pandemic has been to minimize infection and hospitalization rates through the use of lockdowns, curfews and other restrictions on in-person gatherings, such restrictions have had severe economic consequences on the operation of businesses and the sustainability of individual livelihoods. During the COVID-19 pandemic, many governments throughout the world tried to support enterprises and businesses in an effort to mitigate economic hardship, but the private sector nonetheless faced multiple challenges, such as lower demand, disrupted supply chains, declines in investment and dampened expectations.

While lockdown and physical distancing measures forced many firms to close at least partially, parts of the economy that were deemed “essential” or “key” to the functioning of society were allowed or required to continue operating. Such firms ranged from food producers to toilet paper manufacturers to gas stations. Across the world, governments drew distinctions between those firms allowed to operate, both with and without customer contact, and firms that had to temporarily close their operations. This paper examines the economic effects of the pandemic on businesses and their responses, distinguishing between key and non-key firms. In general, government support and physical distancing measures, as well as their stringency, varied starkly between countries. In response to the pandemic, almost 90 per cent of countries have provided liquidity for firms and supported entrepreneurs (Gentilini et al. 2020) and 80 per cent of countries have provided some form of financial assistance to small businesses, in an aim to dampen the economic turmoil for firms (International Monetary Fund 2021).<sup>2</sup> Notwithstanding the widespread support, the amount of assistance has varied widely across countries and has been piecemeal or absent in some middle and lower-income countries.

This paper investigates government regulations beyond fiscal and monetary support measures. Based on data of about 10,000 firms from 27 countries of different income levels and regions of the world, it empirically tests whether the pandemic differentially affected key firms and non-key firms, the channels through which these firms were affected and the measures that firms have implemented to combat the economic downturn. As there is no global consensus as to which jobs are “essential” (Fana, Torrejón Pérez, and Fernández-Macías 2020), country-level lists of key sectors were coded into a comparable industry-level classification. After the start of the pandemic, governments emitted lists of key sectors or firms for their respective economy. Such lists define sectors in the economy, which were, depending on the respective country, (partially) allowed to operate in-person under lockdown and curfew measures, had access to services such as child-care, received personal protective equipment (PPE) or obtained preferential access to COVID-19 vaccinations. While some basic services sectors are included in all countries’ lists, there is substantial variation in their coverage, particularly with respect to the classification of key manufacturing sectors. Further details on the countries in the sample and their respective list of key sectors are provided below.

A priori, one would expect that being allowed to remain fully operational or having access to basic services would improve firms’ capacity to deal with the pandemic. No rigorous empirical evidence however exists which disentangles how, and through which channels the pandemic differentially affected key and non-key firms and the adjustments that these firms have undertaken to combat the economic downturn. Have demand shocks, shortages of inputs and curfew measures hit primarily less key firms? Were key firms able to retain their workers and uphold their businesses, granting them an advantage over other firms also beyond the pandemic? Have non-key firms adapted their businesses to make them more resilient in the light of changing demand?

<sup>1</sup> This study was prepared as background material for the WESO 2023: Valuing the essential for a more resilient world of work.

<sup>2</sup> The extent of policies enacted to stimulate the economy was highly correlated with the country’s GDP per capita, COVID-19 infections and median age of the population (Elgin, Basbug, and Yalaman 2020).



The empirical analysis shows that firms deemed key indeed exhibited fewer hardships throughout the pandemic. These firms less often experienced declining sales and had a smaller number of furloughed workers. With respect to channels, they did not face as strong of a decline in demand for their goods and services or supply of inputs as non-key firms did. While being exempt from nationally ordered closure measures naturally affected demand, declines in input was likely driven by other firms in the supply chain also being essential. In contrast, non-key firms were more likely to employ online business activities and to change the main product or service they offered. The necessity to adjust one's business model in light of the pandemic therefore appears to have driven digital uptake, innovation and adaptation. The findings are robust to controlling for underlying firm characteristics, the firm's sector and country of operation, as well as other empirical specifications. This indicates that the results are not driven by selection effects into the essential list, for instance through the sector of operation.

The paper adds to a growing literature on the effects of Covid-19 on firms. Existing research has shown that the pandemic has led to substantial declines in sales and a drop in stock returns (Al-Awadhi et al. 2020; Apedo-Amah et al. 2020; Ding 2020). Less productive firms have been more likely to have to cease operations, while the opposite is true for firms with strong innovative capacity and digital operations (Janzen and Radulescu 2021; Kozeniauskas, Moreira, and Santos 2020; Muzi et al. 2021). As fear of the novel virus triggered stockpiling behavior, especially at the start of the pandemic, both classical retail stores and e-commerce businesses experienced a surge of customers, while at the same time closures of businesses and fear of contagion lead to a jump in online purchases (Addo et al. 2020). Evidence about the effectiveness of government support and its allocation has been mixed in aggregate terms. Emergency aid for the self-employed in Germany was effective for their survival probability, but this effect faded out quickly after distribution (Block et al. 2021). In the UK, government mitigation schemes have reduced the number of SMEs with negative earnings and extended the length that they could survive, however, the most affected sectors were not the ones which benefited most (Belghitar, Moro, and Radić 2021). Cross-country evidence from EU countries shows that government subsidies were allocated efficiently but could not substantially defer the pandemic's negative impact on aggregate productivity (Bighelli and Lalinsky 2021), while wage subsidies and deferral of payments helped to retain employment (Janzen and Radulescu 2021).

While digitalization was well underway prior to the pandemic, uptake dramatically increased when business as usual was no longer viable. Curfews, lockdowns and a general worry of close physical proximity favored business transformations towards online platforms. Successful changing business models, especially of non-key firms, included tailoring products and services to new customers and making offers more accessible, such as by offering online platforms or hosting web-based services targeted at other businesses (Manolova et al. 2020).<sup>3</sup> Some firms started producing protective face masks instead or on top of other garments (Manolova et al. 2020). Paint or beverage producers started to produce hand sanitizer and disinfectants (Laato et al. 2020). Such innovative activities and experimenting with existing or new products may well have long-term beneficial effects, through action-based learning and knowledge and skill creation (Björklund et al. 2020). Having been pushed to make changes to the business model may therefore well benefit an enterprise even after the end of the pandemic. Firms which were not allowed or able to operate the way they did prior to the pandemic, could have had a stronger incentive to adopt e-commerce or adapt the product or service they offer. This notion is confirmed by the findings of the paper; firms which are not defined as essential were more likely to adjust their *modus operandi*. Smaller and self-employed firms have been disproportionally affected through supply-chain disruptions and financial shocks and at the same time have not been able to respond to the pandemic through operational changes (Adian et al. 2020; James Hurley et al. 2021; Kalenkoski and Pabilonia 2021; Pereira and Patel 2021). Furthermore, the pandemic has hit formalized firms in Africa more than in other regions, in terms of closures and declines of sales (Aga and Maemir 2021). Firms with better access to finance have been less likely to experience declining sales (Amin and Viganola 2021).

<sup>3</sup> Besides innovation, adaption and government assistance, customer ties have been shown to be vital for the resilience of businesses. For example, customer loyalty has been shown to lead to higher stock returns during the crisis (Albuquerque et al. 2020). Female entrepreneurs in Saudi-Arabia contended that the pandemic has not impacted on customers' behaviour, in contrast to the majority of male entrepreneurs doing so (Alessa et al. 2021).

In terms of employment, cost-cutting measures have hit primarily temporary workers, low-wage female workers and younger workers, with the effects being the strongest at the beginning of the pandemic (Donthu and Gustafsson 2020; John Hurley et al. 2021). Women, who generally still shoulder the majority of care work within households, were adversely affected from the closure of child- or elderly care services and schools (Alekseev et al. 2020; OECD 2020b). In Europe and some middle-income countries, government policies to maintain employment did not result in a steep increase in unemployment, but rather in the share of employees not working. Furloughing practices lead to a large decline in hours worked. The drop in working hours was largest in sectors characterized by face-to-face interaction, but it also included sectors identified as essential in the EU (John Hurley et al. 2021). More digitalized sectors in turn experienced increasing hours worked.

The pandemic has initiated a discussion about working conditions of essential workers. At the forefront of the combat against the pandemic, health sector workers have been in the spotlight of any political discussion. Public attention has also comprised other lines of work, including social and care workers, workers in agriculture and food production, retail workers who are exposed to many people every day, and transport workers (Bochtis et al. 2020; Hawkins 2020; Kaptan and Kaptan 2021; Roberts et al. 2020; Topriceanu et al. 2021; Ramos et al. 2021; Waltenburg et al. 2020). The social value of the jobs that these workers carry out has become more evident, fuelling a debate about their working conditions, especially in terms of remuneration, working hours and psychological strain (Hummel et al. 2021; McConnell and Wilkinson 2020; Mojtahedzadeh et al. 2021; Sorensen et al. 2021). At the heart of the public discourse has been a re-evaluation of which workers are key to the functioning of the society and their working conditions beyond the pandemic (Farquharson, Rasul, and Sibieta 2020). This paper takes a different perspective, focusing on the economic effects of Covid-19 on such key firms. While the contribution and social value of essential workers is indisputable, less attention has been paid to the enterprises providing essential services during the pandemic. As many key workers work for these enterprises, understanding how the businesses fared is important for future policy work.

The remainder of the paper is structured as follows. Chapter 1 presents the data sources, the methodology to define key sectors, and descriptive evidence about key and non-key firms. In chapter 3, the estimation strategy is defined, and the empirical results are reported. Chapter 4 concludes.

## ► 1 Data and descriptive evidence

---

### 1.1 Data sources

The main data sources of this paper are the World Bank Group's Enterprise Surveys (ES) and Covid-19 follow-up surveys (COV-ES). The ES is a nationally representative dataset of registered firms in the private sector with five or more employees. The ES excludes firms in the agricultural, mining and several service sectors such as health and social work, real estate or research and development.<sup>4</sup> As the agricultural sector is excluded, the data is naturally not representative of all key sectors within the countries. Even though agriculture employs more than 60% of the workforce in many developing countries, the dataset allows the most comprehensive analysis of firms in key sectors across countries of different income levels. Within each country, the sample of firms is stratified by industry, size and location. The data includes sampling weights to correct for selection probability. The COV-ES is a rapid phone survey in response to the pandemic (Apedo-Amah et al. 2020). The sample of the COV-ES consists of enterprises in a baseline ES between 2016 and 2020, which were re-interviewed in up to three waves (at the time of writing) since May 2020. This study focuses on the first wave of the COV-ES data, which has the largest coverage and is best comparable between countries. Besides Armenia, Azerbaijan, Bosnia-Herzegovina, Montenegro and Serbia, for which the first wave of data was collected in early 2021, the data stems from 2020. The questionnaire consists of items about the impact of the pandemic on a firm's operating status, its sales or employment levels, any operational adjustments and government assistance. The COV-ES data furthermore includes adjusted sampling weights. To ensure equal weights across countries, within country survey weights are re-scaled to sum to 1 (Muzi et al. 2021). This ensures that firms in one country are not over-proportionally represented in the cross-country sample.

At the heart of this paper is the classification of firms into key and non-key sectors by each country. The sources of these lists vary from official government gazettes with essential sectors defined by sector-level codes to newspaper articles. For each country, these lists were translated into the ES data's ISIC Rev. 3.1. sectoral coding, either through crosswalks or by matching sectoral descriptions with the ISIC rev. 3.1. sector definitions. Manual adjustments were implemented in cases when the lists were not directly translatable to the sectoral classification.<sup>5</sup> For instance, certain keywords, such as "hygiene products" or "pharmaceuticals", were cross-referenced with a variable in the ES data containing a description of the main product or main service of the firm. Responding business owners or managers wrote down a sentence or several keywords to describe the main operation of the firm. Based on the list of key sectors, a variable was then created which indicates whether the firm operates in a key sector of the respective country, or if it produces a good/ offers a service which is defined to be key. An exception here is Lebanon, where the survey data includes a variable indicating whether the enterprise is key or not.

Nevertheless, the quality of some of the countries' lists does not allow a meaningful classification into key and non-key sectors. Of a total of 46 countries with COV-ES data<sup>6</sup>, for 12 countries no list could be found, for 6 countries the quality of the list was too poor for classification or the share of firms in key sectors would have been larger than 95%, and one country had no available baseline ES data (see Table A.1 in the Appendix). Countries for which there is no meaningful list of key sectors are relatively evenly spread geographically. The final sample consist of 27 countries.

<sup>4</sup> The sectoral classification is based on ISIC Rev. 3.1. Included sectors are manufacturing (section D), construction (section F), wholesale and retail (section G), hotels and restaurants (section H), transport, storage, and communications (section I) and information technology (division 72).

<sup>5</sup> One special case is the construction sector, which rarely was defined as essential, but firms oftentimes remained open. For some countries, it is therefore likely to be subsumed under "basic services".

<sup>6</sup> As of October 2021.

## 1.2 Descriptives

To get an overview over how the pandemic affected firms in key and in non-key sectors, this section provides descriptive evidence before turning to the empirical analysis in the subsequent section. Table 1 contains summary statistics of the sample of 27 countries, which consist of countries in Africa, Latin America, Central and East Asia, Western and Eastern Europe and the Middle East. The share of firms in the respective country's key sectors differs substantially between countries from 20 per cent up to 90 per cent. Regional patterns are only evident up to a certain extent. For instance, while Latin American countries all exhibit a low share of firms in key sectors, the share differs strongly between Eastern European countries. Similarly, across-countries there is substantial variation with regard to which sectors are defined as key. Table 2 displays the share of key firms in each aggregated sector. In most sectors, the share of key firms lies between 35 and 55 per cent. Thus, within-sector variation comes from different definitions of key sectors between countries. Not surprisingly, the food and beverages as well as the coke and chemicals (which includes pharmaceuticals) sectors exhibit the largest share of key firms, in contrast to the accommodation and restaurant sector which has the smallest share.

► Table 1: Sample composition

Country	Sample size	Baseline year	Number of COV-ES waves	Share of firms in key sectors
Albania	344	2019	1	79%
Armenia	460	2020	1	33%
Azerbaijan	101	2019	1	35%
Bosnia and Herzegovina	234	2019	1	79%
Croatia	342	2019	3	84%
Cyprus	167	2019	2	36%
Czech Republic	398	2019	3	90%
El Salvador	391	2016	2	25%
Estonia	272	2019	3	83%
Georgia	501	2019	2	42%
Greece	530	2019	3	80%
Guatemala	199	2018	2	23%
Honduras	163	2017	2	22%
Hungary	619	2019	3	44%
Italy	419	2019	3	48%
Jordan	498	2019	3	24%
Lebanon	364	2019	2	40%
Moldova	283	2019	3	40%
Mongolia	284	2019	2	40%
Montenegro	136	2019	1	51%
Mozambique	222	2018	1	58%
Romania	514	2019	3	52%
Russian Federation	1145	2019	1	26%
Serbia	313	2019	1	83%
Slovenia	249	2019	3	52%
South Africa	193	2019	1	38%
Zimbabwe	536	2016	2	33%

► Table 2: Share of Key firms by sector

Sector	Share of key firms	Number of firms
Food/Beverages	90%	1312
Textiles/Apparel/Leather	20%	640
Paper/Printing	48%	302
Coke/Chemicals	86%	191
Rubber/Plastic/Minerals	40%	510
Metals	36%	797
Vehicles/Other Transport	39%	77
Other Manufacturing	31%	1129
Construction	45%	777
Wholesale	54%	1151
Retail	48%	1816
Accommodation/Restaurants	5%	646
Transport	77%	346
Computer Activities	72%	138
Other services	60%	45

The choice of governments on which sectors and firms to define as key is by nature not random. Governments needed to consider whether a sector is vital for the functioning of the society, but also if it is of paramount importance for the country's economy. Table 3 displays average firm characteristics by key and non-key firms, and t-statistics of the difference between the two.<sup>7</sup> As could be expected, the characteristics of key firms differ from non-key firms. Key firms are larger, both in terms of baseline sales and employment, and older. Furthermore, key firms are more likely to export. These differences show the necessity to control for baseline firm characteristics in the empirical estimation. In Table 4, the summary statistics of all dependent variables are presented. Seventy per cent of firms reported a decline in sales, while slightly less than half had to close at some point after the start of the pandemic. On average, firms reported fewer employees than before the pandemic, with male employment responding stronger than female employment. The number of furloughed workers is larger than that of workers whose wage was cut and the number of workers that took leave. A quarter of firms started or increased online activities and deliveries, while a third started or increased remote working arrangements. In terms of channels through which the pandemic affected firms, two-thirds experienced a decline in demand and slightly more than half a decline in input supplies or working hours. Lastly, a third of firms have received government support during the pandemic.

<sup>7</sup> The estimations underlying the t-statistics control for country, 1-digit sector and baseline year fixed effects.

► **Table 3: Mean differences between key and non-key firms**

	Key firms	Non-key firms	T-Statistic
Baseline sales (log)	16.71 (2.85)	16.26 (3.15)	3.64
Baseline employment (log)	3.48 (1.31)	3.21 (1.25)	2.58
Firm age (log)	2.94 (0.68)	2.82 (0.71)	2.45
Manager is female	0.17 (0.38)	0.18 (0.38)	-1.27
Multi-establishment	0.17 (0.38)	0.14 (0.35)	0.88
Any state ownership	0.01 (0.08)	0.01 (0.09)	-1.16
Any foreign ownership	0.11 (0.32)	0.09 (0.29)	1.24
Any exports	0.39 (0.49)	0.27 (0.44)	2.66
Electricity outage	0.43 (0.49)	0.37 (0.48)	1.21
Loan or credit	0.45 (0.50)	0.37 (0.48)	1.65
Website	0.70 (0.46)	0.65 (0.48)	-1.41
Spent time on regulations	0.60 (0.49)	0.51 (0.50)	1.21

Estimations are weighted with the re-scaled sampling weights and include country fixed-effects, 1-digit sector fixed-effects and baseline year fixed-effects.

► **Table 4: Descriptive statistics of all dependent variables**

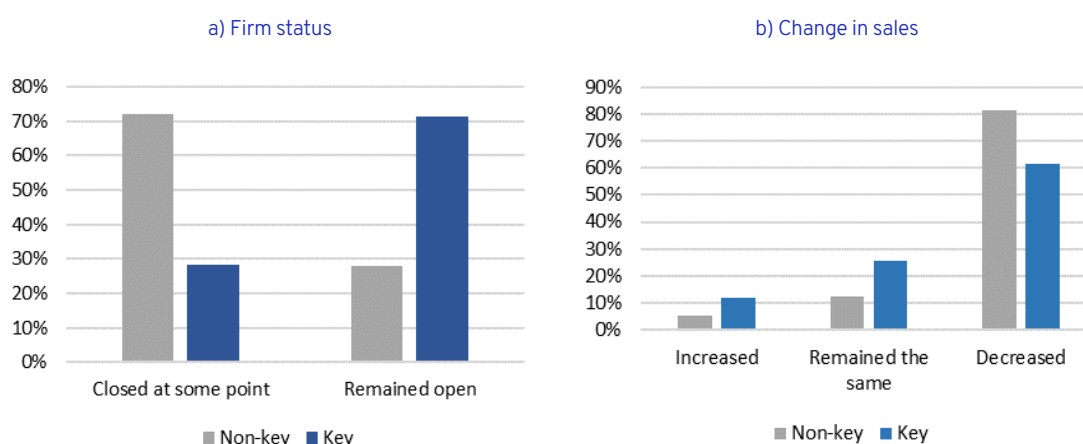
	Median	Mean	Standard-deviation	Min.	Max.	Obs.
Decline in sales	1,00	0,71	0,46	0,00	1,00	9871
Closed at some point	0,00	0,46	0,50	0,00	1,00	9167
Change in employment (asinh)	0,00	-0,59	1,71	-8,29	8,13	7254
Change in fem. employment (asinh)	0,00	-0,32	1,20	-7,50	5,70	7108
Change in male employment (asinh)	0,00	-0,41	1,51	-8,29	8,13	7094
Furloughed workers (log)	0,00	0,89	1,40	0,00	7,17	6702
Workers with wage cuts (log)	0,00	0,46	1,15	0,00	7,17	6054
Decrease in temp. workers	0,00	0,24	0,43	0,00	1,00	9418
Workers who took leave (log)	0,00	0,41	0,96	0,00	7,12	4572
Started/increased online activity	0,00	0,27	0,45	0,00	1,00	9507
Started/increased delivery	0,00	0,24	0,42	0,00	1,00	9871

	Median	Mean	Standard-deviation	Min.	Max.	Obs.
Started/increased remote work	0,00	0,34	0,47	0,00	1,00	9871
Decline in inputs	1,00	0,55	0,50	0,00	1,00	9507
Decline in demand	1,00	0,65	0,48	0,00	1,00	9289
Decline in hours	1,00	0,51	0,50	0,00	1,00	9507
Received government support	0,00	0,34	0,47	0,00	1,00	9507

Descriptive statistics of all dependent variables.

Figure 1 displays how the pandemic affected the operational status and sales of firms. Panel a) shows that 72 per cent of firms in key sectors remained open throughout the pandemic, which is true for only 28 per cent of non-key firms. While this draws a stark contrast between key and non-key firms, it also shows that there is not a one-to-one correlation between the operational status and being in a key sector. Panel b) of the same figure shows that the majority of firms, regardless of being deemed key, experienced declining sales during the pandemic. Nevertheless, key firms less often reported declining sales (62 per cent vs. 82 per cent) and more often reported unchanged (25 per cent vs. 12 per cent) or even increasing sales (11 per cent vs. 5 per cent), as compared to non-key firms. Whether this relationship holds in an empirical model and controlling for a number of characteristics along different dimensions will be investigated in the next section. This shows that there are also winners in the pandemic, albeit the share being small. Figure A.1 in the Appendix shows the same trends but with respect to sectors instead of key firms.<sup>8</sup> Interestingly, most sectors have a relatively equal share of firms that closed at some point and those that remained open throughout. This again shows that it is not necessarily only sectors across countries which are decisive for how firms are affected by the pandemic, but that being deemed key marks a starker contrast. The accommodation and restaurant sector exhibits the largest decline in sales and the largest proportion of firms that closed at some point (Aga and Maemir 2021). Firms in the coke, petroleum and chemicals sector as well as the vehicles and other transport sector were most often able to increase their sales.

► Figure 1: Impact of the Covid-19 pandemic on firms



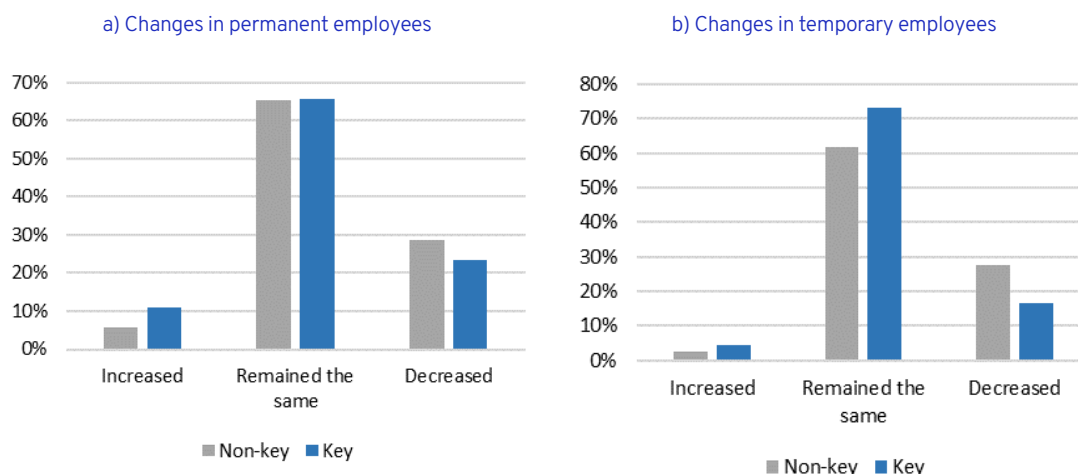
Notes: The sample consists of 9169 firms in Panel A and 9873 firms in Panel B. COV-ES sampling weights are applied

While declines in sales have been substantial, fewer firms have decreased their number of employees (Figure 2). Furthermore, the difference between key and non-key firms here is smaller than for sales. Two-thirds of both types of firms reported that the number of permanent employees remained the same, 29%

<sup>8</sup> Sectors are here aggregated from the 4-digit level to 14 sectors, to ensure visibility and to retain a significant number of firms per sector.

of non-keys and 23% of keys reported decreases (panel a)). The share of firms that stated an increasing number of employees is similar to those who reported increasing sales (11% vs. 6%). With respect to temporary employment, key firms more often reported that the number of employees remained the same and fewer firms overall increased the number of employees (a larger share of firms reported “Don’t know”).

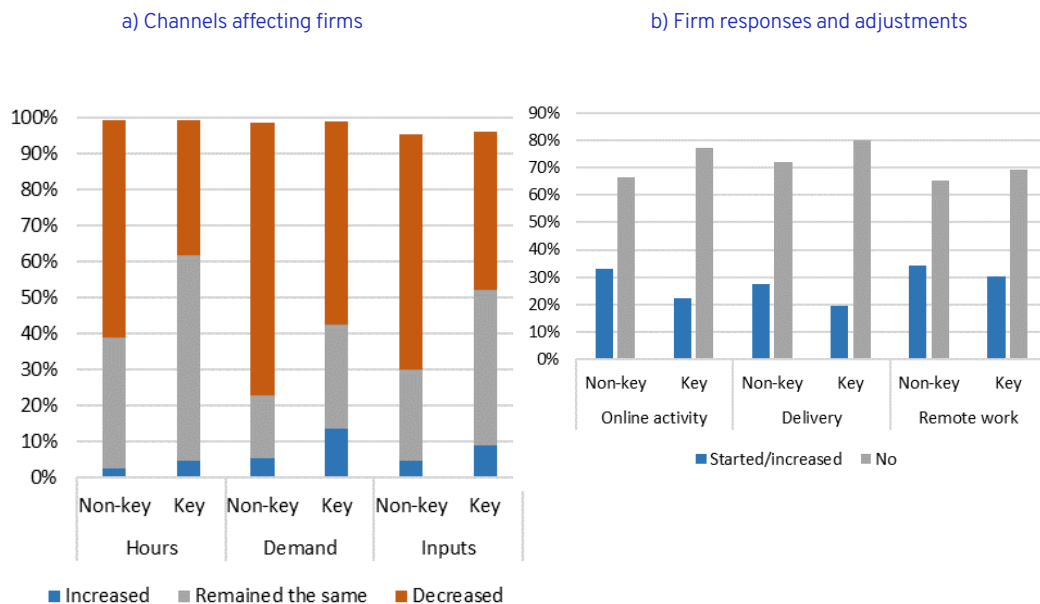
► **Figure 2: Impact of the Covid-19 pandemic on employment**



Notes: The sample consists of 9602 firms in Panel A and 9420 firms in Panel B. COV-ES sampling weights are applied.

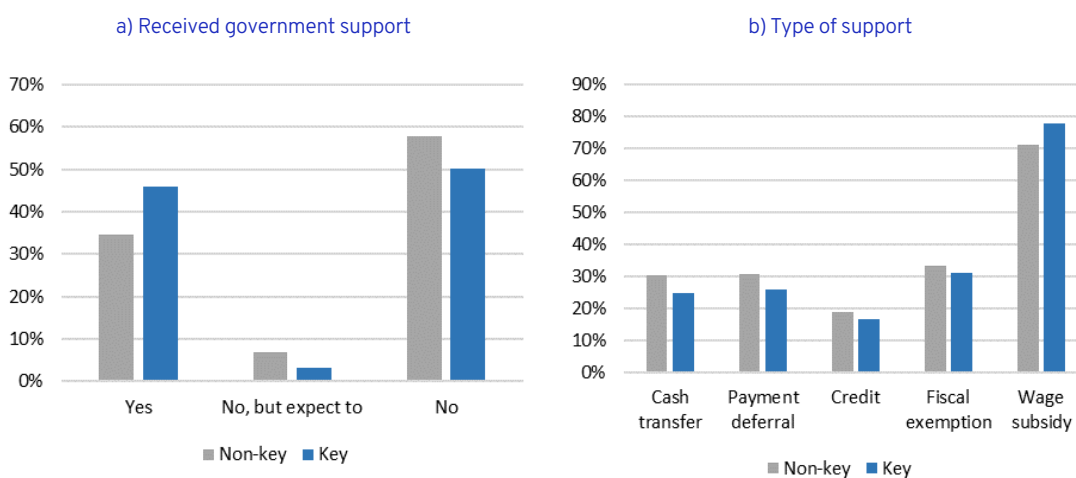
A similar picture arises with respect to channels through which the pandemic has affected firms the most, namely hours worked, demand and supply of inputs. Panel a) of Figure 3 shows that key firms less often report decreases in all three categories. While hours worked affected less than half of key firms, the fact that still almost 40% of key firms reported a decrease in the category indicates that worker supply was not only affected through government mandated closures. Declining demand is the strongest negative channel, both for key and non-key firms. However, 14 per cent of key firms reported increases in demand, which is in line with the share of firms reporting increasing sales. Roughly the same share of key firms reported that the supply of inputs decreased or remained the same, while two-thirds of non-key firms experienced declining supplies. Turning to firm-level adjustments in the aftermath of the pandemic, a different picture emerges (panel b)). Non-key firms actually more often adjusted their mode of operation as compared to key firms. The differences are starkest with respect to online activities. One in three non-key firms increased their online performance, in contrast to only one in five key firms. In fact, there is evidence that the crisis accelerated the expansion of e-commerce, which is likely to sustain in the long-term (OECD 2020a). Remote work was adopted by a similar share of both types of firms.



► **Figure 3: Channels and adjustments**

Notes: The sample consists of 9602 firms in Panel A and 9420 firms in Panel B. COV-ES sampling weights are applied.

Lastly, panel a) of Figure 4 indicates that key firms more often received government support than non-key firms. Interestingly, the type of support that key and non-key firms received differs (see panel b)). While key firms more often received cash transfers or wage subsidies, i.e. immediate liquidity boosts, non-key firms more often benefitted from more indirect measures, namely payment deferrals and better access to credit. Therefore, governments apparently differed between firms in key and non-key sectors with respect to the type of assistance issued.

► **Figure 4: Government support**

Notes: The sample consists of 9509 firms in Panel A and 4579 firms in Panel B. COV-ES sampling weights are applied.

## ► 2 Empirical analysis

This section develops an empirical framework and estimates how firms differentially coped with the pandemic.

### 2.1 Estimation strategy

While the COVID-19 pandemic can safely be viewed as an external and unexpected shock, firms are not randomly sorted into key and non-key sectors. Therefore, it is necessary to control for firm-level as well as sector-level characteristics, in order to properly identify the effects of being deemed key. The baseline linear probability model regression specification is as follows:

$$Y_{isc} = \alpha + \beta_1 \text{Key}_{isc} + \beta_2 C_{isc} + \theta_s + \delta_c + \tau_t + \varepsilon_{isc}, \quad (1)$$

where subscript  $i$  denotes the firm,  $s$  denotes the sector and  $c$  the country the respective firm operates in.  $Y_{isc}$  is the outcome of interest, such as the reported pandemic-induced change in sales or change in employment. The coefficient  $\beta_1$  measures the effect of the main explanatory variable, the firm being regarded as key.<sup>9</sup> Country fixed-effects are denoted by  $\delta_c$ , which account for differences in country-level conditions, how hard the pandemic hit the country of operation and responses to the pandemic (OECD 2021). The term  $\tau_t$  indicates a fixed-effect for the year in which the baseline ES survey was conducted. The latter variable accounts for differences in timing between the ES and COV-ES surveys. Further,  $\theta_s$  represents sector fixed-effects (either at the 2- or 4-digit level), which control for all sectoral characteristics. Therefore, the regression results will not be driven by the pandemic differentially affecting single sectors, e.g. benefitting the chemicals sector or damaging the accommodation and restaurant sector. Vector  $C_{isc}$  represents a set of control variables, which are based on literature using the ES data to study firm-level outcomes (Amin and Viganola 2021; Aga and Maemir 2021).

The control variables aim to capture underlying firm and economy characteristics, without which the estimation would suffer from omitted-variable-bias.<sup>10</sup> Firstly, larger, older and more productive firms may have a better capacity to cope with the negative consequences of the pandemic (Belitski et al. 2021; James Hurley et al. 2021; Amin and Viganola 2021; Kozeniauskas, Moreira, and Santos 2020; Liu et al. 2021). Firm level performance is controlled through the number of permanent employees, sales in the baseline year (both in logs) and the age of the firm. Furthermore, dummies indicating whether the firm belongs to a multi-establishment enterprise or whether the firm is to some part owned by the government or state are included. Subsidiary firms are likely to benefit from their parent company through transfers and shock-absorbing capacities (Liu et al. 2021; Amin and Viganola 2021). Similarly, it has been shown that firms with partial state-ownership have larger sales and employment rates during the pandemic, which is explained by soft-budget constraints (Liu et al. 2021; Megginson, Ullah, and Wei 2014). More ambiguous is the relationship between foreign-ownership or export orientation and the consequences of the COVID-19 pandemic. On the one hand, foreign-owned and exporting firms tend to be larger and more resilient (Aga and Maemir 2021). On the other hand, these firms are more reliant on global supply chains, which have undergone tremendous shocks during the pandemic (Guan et al. 2020; Janzen and Radulescu 2021; Liu et al. 2021). Furthermore, recent evidence suggests that the gender of business-owners or managers plays a role with regard to how a firm deals with the pandemic, both in terms of adjustments and responses (Liu, Wei, and Xu 2021). Therefore, a dummy for the manager or business owner being female is included. Lastly, with

<sup>9</sup> Note that variation of the variable Key predominantly comes from the sector within countries a firm operates in. Only in few cases, when the firm's description of its main operation indicated that it provided an essential good or service, there is within-country-sector variation.

<sup>10</sup> Table 3 shows the means of all control variables and differences between key and non-key firms.

respect to the business environment, variables indicating whether the establishment experienced any power outages and whether it has a line of credit or loan are added. Additional controls are added for robustness tests. The first is the management or business-owner experience, as the quality of management influences how it responds to the effects of the pandemic (Grover and Karplus 2021). Furthermore, baseline differences in e-commerce use are controlled for with a dummy of the firm having a website. In reference to the business and regulatory environment, a dummy for whether the management spends time on any regulations is added. Lastly, the COV-ES interview month captures the fact that interviews were held at different points in time after the start of the pandemic.

## 2.2 Estimation results

Table 5 provides baseline regression results, based on a linear probability model. The dependent variable is an indicator whether the firm experienced a decline in sales since the start of the pandemic. Throughout, country fixed-effects and the baseline year are controlled for. The first three columns include 1-digit sector fixed-effects and the last two columns 4-digit sector fixed-effects. Column 1 displays the coefficient of the Key firm dummy, without further controls. It is negative and statistically significant, indicating that firms deemed as essential to the economy and society were less likely to experience a decline in sales. Column 2 adds baseline firm-level characteristics, which account for endogeneity concerns with respect to firms being valued as key. Notably, firms with larger sales a priori are less likely to have decreasing sales through the pandemic. Thereafter, additional control variables are included, which characterize the firm's organizational structure, exporting-status and infrastructure and credit access. Multi-establishment firms appear to have been able to better deal with the pandemic than individual enterprises. Using 4-digit sector fixed-effects reduces the size of the main coefficient, however it remains statistically significant at the 1 per cent level. The fact that the coefficient remains highly significant is reassuring, as all industry-specific characteristics on a highly disaggregated level are controlled for. Therefore, variation in the Key variable does not appear to be driven by single industries, which are always deemed essential across countries, even when disaggregated at the 4-digit level. The country-level classification of key sectors appears to matter in terms of how strong the pandemic impacted single firms. However, one could argue that the Key variable simply reflects the fact that non-key firms were mandated to close during the pandemic, and thereby by construction showing a negative sales effect of these firms. Column 5 controls for the firm having had to close at some point since the start of the pandemic. While this further reduces the size of the coefficient, it does not change its statistical significance. The inclusion of this variable furthermore diminishes concerns that the definition of key sectors is an ad-hoc measure of the operational status of establishments during the pandemic. Overall, the table presents robust evidence that key firms were able to better deal with the consequences of the pandemic. It should be emphasized, however, that majority of key firms nonetheless experienced declines in sales. On a further note, firms with female managers as well as multi-establishment firms less often reported decreasing sales.

► Table 5: Estimation results - decline in sales

	Decline in sales				
	(1)	(2)	(3)	(4)	(5)
Key firm	-0.150*** (0.01)	-0.132*** (0.01)	-0.133*** (0.01)	-0.087*** (0.01)	-0.054*** (0.01)
Baseline sales (log)		-0.028*** (0.01)	-0.028*** (0.01)	-0.021** (0.01)	-0.019** (0.01)
Baseline employment (log)		0.005 (0.01)	0.006 (0.01)	-0.005 (0.01)	-0.003 (0.01)
Firm age (log)		0.008 (0.01)	0.009 (0.01)	0.010 (0.01)	0.019 (0.01)

	Decline in sales				
	(1)	(2)	(3)	(4)	(5)
Manager is female		-0.027 (0.02)	-0.026 (0.02)	-0.038** (0.01)	-0.045*** (0.02)
Multi-establishment			-0.058** (0.03)	-0.061* (0.03)	-0.064** (0.03)
Any state ownership			-0.119 (0.09)	-0.125 (0.08)	-0.139 (0.09)
Any foreign ownership			0.014 (0.03)	0.020 (0.03)	0.021 (0.03)
Any exports			0.010 (0.02)	-0.010 (0.02)	-0.012 (0.02)
Electricity outage			0.017 (0.01)	0.018 (0.02)	0.021 (0.02)
Loan or credit			0.009 (0.02)	0.016 (0.02)	0.014 (0.02)
Closed at some point					0.168*** (0.02)
Observations	9869	9001	8991	8986	8376
Country FEs	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes
1-digit sector FEs	Yes	Yes	Yes		
4-digit sector FEs				Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

In Table 6, the operational-status is used as the outcome variable in columns 1 and 2. The results indicate that key firms were less likely to close at some point, even with 4-digit sector fixed-effects. Columns 3-6 switch to changes in the number of employees (measured as the inverse hyperbolic sine to account for negative values) as outcome: In columns 3 and 4 total permanent employees, in column 5 female permanent employees and in column 6 male permanent employees. The Key variable is only significantly different from zero with 1-digit sector fixed-effects for total employment. This would indicate that non-key firms had a stronger decrease in overall employment, which however is not robust to 4-digit sector fixed effects. The Key coefficient is of larger magnitude in the estimation with female employment as the outcome as compared to male employment, but both are not statistically different from zero. Note however that due to missing values of either baseline employment in the ES data or missing values of employment in the COV-ES data, the sample size is starkly smaller for the employment outcomes than for the question on whether sales have declined.

► Table 6: Estimation results - firm status and employment change

	Closed at some point		Change in perm. em- ployees (asinh)		Female empl. change (asinh)	Male empl. change (asinh)
	(1)	(2)	(3)	(4)	(5)	(6)
Key firm	-0.334*** (0.03)	-0.207*** (0.03)	0.156*** (0.05)	-0.050 (0.09)	-0.036 (0.06)	-0.011 (0.07)
Baseline sales (log)	-0.030*** (0.00)	-0.019*** (0.01)	0.085*** (0.03)	0.030 (0.03)	0.008 (0.02)	0.009 (0.02)
Baseline employment (log)	0.022** (0.01)	0.008 (0.01)	-0.180** (0.07)	-0.090 (0.08)	-0.051 (0.06)	-0.077 (0.06)
Firm age (log)	-0.050*** (0.02)	-0.043*** (0.01)	0.042 (0.06)	0.010 (0.05)	0.033 (0.04)	0.033 (0.03)
Manager is female	0.029 (0.02)	0.016 (0.02)	-0.129*** (0.04)	-0.086** (0.04)	-0.004 (0.03)	-0.043 (0.04)
Multi-establishment	-0.029 (0.03)	-0.024 (0.03)	0.121 (0.08)	0.117 (0.08)	0.021 (0.08)	0.155** (0.06)
Any state ownership	-0.140 (0.09)	-0.140 (0.09)	0.505* (0.29)	0.398 (0.27)	0.190 (0.22)	0.165 (0.17)
Any foreign ownership	0.012 (0.03)	-0.002 (0.03)	0 (0.14)	-0.007 (0.13)	0.061 (0.08)	-0.067 (0.09)
Any exports	-0.013 (0.03)	-0.021 (0.02)	0.088 (0.06)	0.061 (0.07)	0.065 (0.04)	0.014 (0.06)
Electricity outage	-0.009 (0.02)	-0.013 (0.02)	0.009 (0.04)	0.020 (0.04)	0.043 (0.04)	0.012 (0.04)
Loan or credit	-0.015 (0.02)	-0.015 (0.02)	-0.031 (0.07)	-0.051 (0.06)	-0.029 (0.05)	-0.034 (0.04)
Observations	8382	8376	6619	6611	6481	6469
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes	Yes
1-digit sector FEs	Yes		Yes			
4-digit sector FEs		Yes		Yes	Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Table 7 in turn looks at different types of labour adjustments. The first two columns show a significant difference between the number of furloughed workers in key and non-key firms. To avoid large losses in permanent employees, non-key firms appear to have more often resorted to furloughing as compared to key firms, making use of government supported short-working time arrangements. Furthermore, firms deemed non-key appear to more often have reduced number of temporary workers (column 3), the effect however not holding with the inclusion of 4-digit sector fixed-effects<sup>11</sup>. Lastly, there is a significant difference between the two types of firms with respect to the number of workers that took leave or quit, with 4-digit sector fixed-effects. One can only hypothesize about why this is the case. The opposite effect could have been expected, as workers in key firms oftentimes faced large burdens and psychological stress (Béland,

<sup>11</sup> Unfortunately, the variable on workers with wage cuts only exists in the second wave of the COV-ES.

Brodeur, and Wright 2020). A possible explanation could be that key firms in some countries had better access to PPE and vaccination, as compared to non-key firms. The results should be treated with caution though, due to the large number of missing values.

► **Table 7: Estimation results - employment adjustments**

	Furloughed workers (log)		Decrease in temporary workers		Workers took leave (log)	
	(1)	(2)	(3)	(4)	(5)	(6)
Key firm	-0.257*** (0.06)	-0.139** (0.05)	-0.057*** (0.02)	-0.036 (0.02)	-0.021 (0.04)	-0.134** (0.06)
Baseline sales (log)	-0.052* (0.03)	-0.016 (0.03)	-0.017** (0.01)	-0.013 (0.01)	0.012 (0.01)	-0.003 (0.01)
Baseline employment (log)	0.298*** (0.05)	0.244*** (0.05)	0.030** (0.01)	0.019 (0.01)	0.177** (0.06)	0.203*** (0.07)
Firm age (log)	0.020 (0.03)	0.049 (0.03)	-0.004 (0.01)	0.003 (0.01)	-0.011 (0.02)	-0.017 (0.03)
Manager is female	0.067 (0.04)	0.063 (0.04)	0.001 (0.02)	0.003 (0.02)	-0.007 (0.04)	0.023 (0.04)
Multi-establishment	-0.055 (0.07)	-0.028 (0.07)	-0.004 (0.03)	-0 (0.03)	0.070 (0.06)	0.077 (0.05)
Any state ownership	-0.359* (0.20)	-0.319 (0.24)	-0.049 (0.06)	-0.088 (0.06)	-0.400*** (0.13)	-0.312** (0.12)
Any foreign ownership	0.013 (0.08)	0.008 (0.07)	0.003 (0.03)	0.007 (0.03)	-0.051 (0.13)	-0.067 (0.14)
Any exports	-0.010 (0.04)	-0.031 (0.04)	0.003 (0.02)	0.013 (0.02)	0.064 (0.07)	0.050 (0.06)
Electricity outage	0.008 (0.04)	0.019 (0.04)	0.005 (0.01)	-0.003 (0.01)	0.092** (0.04)	0.088** (0.04)
Loan or credit	-0.049 (0.05)	-0.052 (0.05)	0.002 (0.02)	0.010 (0.02)	0.041 (0.07)	0.032 (0.07)
Observations	6230	6224	8553	8549	4082	4069
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes	Yes
1-digit sector FEs	Yes		Yes		Yes	
4-digit sector FEs		Yes		Yes		Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

The pandemic has induced firms to adjust their modus operandi. With stores and firms having to close, many companies both in developing and developed countries have moved their operations online, digitalized their working process, resorted to deliveries and initiated remote working possibilities (OECD 2020a). Table 8 shows that the difference in uptake of these modes of operation is relatively small between key and non-key firms. Even though non-key firms had to close more often, they do not appear to more often have resorted to deliveries (columns 3 and 4) or remote work (columns 5 and 6). However, there does seem to be a difference with respect to moving business activities online, though the Key coefficient is statistically significant only at the 10 per cent level (column 2). Increasing usage of online activities may well be driven

out of necessity for non-key firms. Similarly, these firms more often converted their production or service, as is displayed in Table 9. This is however only true for firms outside of retail and wholesale trade. Only when these firms are excluded in columns 3 and 4, the Key coefficient becomes statistically significant. Therefore, what has been shown anecdotally for individual firms (Manolova et al. 2020; Laato et al. 2020), is here confirmed for non-key firms outside the retail and wholesale sectors. Non-key firms thus have in parts been innovative in their reaction to the pandemic. Some of these firms have started or increased the use of online platforms and have changed the main product or service that they offer.

► **Table 8: Estimation results - operational adjustments**

	Online activity		Delivery		Remote work	
	(1)	(2)	(3)	(4)	(5)	(6)
Key firm	-0.026 (0.02)	-0.038* (0.02)	-0.015 (0.02)	-0.018 (0.02)	0.001 (0.02)	-0.019 (0.02)
Baseline sales (log)	0.017** (0.01)	0.015** (0.01)	0.002 (0.01)	0.001 (0.01)	0.045*** (0.01)	0.039*** (0.01)
Baseline employment (log)	-0.002 (0.01)	0.016* (0.01)	0.002 (0.01)	0.017 (0.01)	0.019 (0.01)	0.043** (0.02)
Firm age (log)	-0.014 (0.01)	-0.022* (0.01)	-0.008 (0.01)	-0.008 (0.01)	0.001 (0.01)	-0.014 (0.01)
Manager is female	0.017 (0.02)	-0.004 (0.02)	0.032 (0.02)	0.017 (0.02)	-0.028 (0.03)	-0.031 (0.03)
Multi-establishment	0.045* (0.02)	0.029 (0.02)	0.018 (0.02)	0.003 (0.02)	0.031 (0.03)	0.031 (0.03)
Any state ownership	-0.124 (0.07)	-0.069 (0.08)	-0.075 (0.07)	-0.012 (0.08)	0.007 (0.14)	0.079 (0.14)
Any foreign ownership	0.057 (0.04)	0.024 (0.04)	0.010 (0.02)	0.004 (0.02)	0.114*** (0.03)	0.070** (0.03)
Any exports	0.018 (0.02)	-0 (0.02)	-0.022 (0.02)	-0.017* (0.01)	0.102*** (0.02)	0.054*** (0.02)
Electricity outage	-0.018 (0.02)	-0.033* (0.02)	0.004 (0.01)	-0.012 (0.02)	-0.009 (0.01)	-0.015 (0.01)
Loan or credit	0.013 (0.01)	0.025* (0.01)	0.023* (0.01)	0.029** (0.01)	-0.017 (0.02)	-0.006 (0.02)
Observations	8635	8630	8991	8986	8991	8986
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes	Yes
1-digit sector FEs	Yes		Yes		Yes	
4-digit sector FEs		Yes		Yes		Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

► **Table 9: Estimation results – change in products or services**

	Conversion of product/ service			
	All sectors		Excl. Wholesale/ Retail	
	(1)	(2)	(3)	(4)
Key firm	-0.015 (0.02)	-0.022 (0.02)	-0.046** (0.02)	-0.074** (0.03)
Baseline sales (log)	-0.011 (0.01)	-0.007 (0.01)	-0.016 (0.01)	-0.007 (0.01)
Baseline employment (log)	0.028** (0.01)	0.028* (0.01)	0.027* (0.01)	0.022 (0.01)
Firm age (log)	-0.040** (0.02)	-0.042** (0.02)	-0.026 (0.02)	-0.028 (0.02)
Manager is female	0.037* (0.02)	0.020 (0.02)	0.051 (0.03)	0.040 (0.03)
Multi-establishment	0.007 (0.03)	-0.001 (0.03)	0.022 (0.03)	0.015 (0.03)
Any state ownership	-0.109** (0.05)	-0.080 (0.07)	-0.048 (0.06)	-0.026 (0.07)
Any foreign ownership	0.029 (0.03)	0.021 (0.03)	-0.003 (0.04)	-0.021 (0.04)
Any exports	0.009 (0.02)	0.005 (0.03)	0.022 (0.02)	0.016 (0.03)
Electricity outage	0.034** (0.01)	0.017 (0.01)	0.058*** (0.02)	0.039* (0.02)
Loan or credit	0.019 (0.02)	0.032 (0.02)	0.018 (0.02)	0.033* (0.02)
Observations	8991	8986	6334	6328
Country FEs	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes
1-digit sector FEs	Yes		Yes	
4-digit sector FEs		Yes		Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Regarding channels affecting firms during the pandemic, a clear distinction between key and non-key firms arises across all categories. Table 10 displays regression results with the outcomes being indicator variables for having experienced declines in input supply (columns 1 and 2), declines in demand (columns 3 and 4) and declines in hours worked (columns 5 and 6). The Key dummy is negative and statistically significant in all columns, indicating that all channels had a stronger impact on non-key firms than on key firms. The largest difference between the two types of firms lies in the supply of inputs, closely followed by the demand for the firm's products or services. That non-key firms experienced stronger declines in demand is not surprising. On the one hand, these firms more often had to close their stores, especially affecting firms in retail. Moreover, the pandemic caused a shift in consumers' preferences and lower spending especially of high-income individuals on non-necessary goods (Chetty et al. 2020). That key firms had lesser



trouble acquiring inputs is most likely driven by the fact that firm's further upstream the value chain of key firms are also deemed as key. Non-key firms therefore faced a double penalty. Consumers spent less on the goods that they produce or services they provide, while at the same time they faced difficulties in the supply chain (Guan et al. 2020).

► **Table 10: Estimation results - impact channels**

Decline in	Input supply		Demand		Hours worked	
	(1)	(2)	(3)	(4)	(5)	(6)
Key firm	-0.136*** (0.02)	-0.075*** (0.02)	-0.132*** (0.02)	-0.074*** (0.02)	-0.131*** (0.02)	-0.048* (0.03)
Baseline sales (log)	-0.031*** (0.01)	-0.030*** (0.01)	-0.036*** (0.01)	-0.026*** (0.01)	-0.032*** (0.01)	-0.018*** (0.01)
Baseline employment (log)	0.013 (0.01)	0.004 (0.01)	0.018 (0.01)	0.002 (0.01)	0.030*** (0.01)	0.008 (0.01)
Firm age (log)	0.023 (0.01)	0.030** (0.01)	0.009 (0.01)	0.012 (0.01)	-0.013 (0.01)	-0.004 (0.01)
Manager is female	-0.013 (0.02)	-0.024 (0.02)	-0.027 (0.02)	-0.044*** (0.01)	0.001 (0.02)	-0.019 (0.02)
Multi-establishment	-0.026 (0.03)	-0.033 (0.03)	-0.028 (0.03)	-0.030 (0.03)	0.005 (0.03)	0.009 (0.02)
Any state ownership	-0.192* (0.11)	-0.210** (0.10)	-0.091 (0.10)	-0.108 (0.10)	0.092 (0.09)	0.073 (0.09)
Any foreign ownership	-0.008 (0.04)	0.003 (0.04)	0 (0.04)	0.006 (0.04)	0.031 (0.03)	0.039 (0.03)
Any exports	-0.003 (0.02)	0.007 (0.03)	-0.005 (0.02)	-0.023 (0.03)	-0.025 (0.02)	-0.028 (0.02)
Electricity outage	-0.019 (0.01)	-0.024* (0.01)	0 (0.02)	-0.002 (0.02)	-0.004 (0.02)	-0.003 (0.02)
Loan or credit	0.001 (0.02)	0.008 (0.02)	0.003 (0.02)	0.009 (0.02)	0.006 (0.02)	0.014 (0.02)
Observations	8635	8630	8417	8410	8635	8630
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes	Yes
1-digit sector FEs	Yes		Yes		Yes	
4-digit sector FEs		Yes		Yes		Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

## 2.3 Robustness tests and extensions

In this section, robustness tests and several extensions to the main results are presented.

Table A.2 in the Appendix adds additional controls to the model. Firstly, the manager's years of work experience in the sector control for the notion of more experienced managers can better deal with economic downturn. Secondly, a dummy for the firm having a website is included, as firms with experience in e-commerce may be better equipped to transform their business practices. Thirdly, a dummy whether the firm had to spend time on regulations controls for institutional differences and bureaucratic requirements. Lastly, the COV-ES interview month accounts for the interview being held at different points in time after the start of the pandemic. The outcomes in the table are those for which significant effects were previously found and which are most interesting for the analysis. The dummy for the firm being valued as key for the economy remains statistically significant for all outcomes even with the additional control variables. Firms which had a website before the start of the pandemic were more likely to start or increase online business activities. The inclusion of the variable however slightly increases the size of the Key variable's coefficient. Firms in a more regulated environment are also more likely to increase online business activities, as well as to furlough workers. Most likely, countries with regulated environments have better infrastructure, which therefore correlates with an increase in online activities. Government programs such as furloughing workers by nature requires bureaucratic steps.

While key firms have evidently faced fewer negative consequences of the pandemic, government support may differentially enable key or non-key firms to better cope with the economic downturn. Table A.3 in the Appendix tests these differential effects, by interacting the Key dummy with a dummy of having received government support. The interaction term is not statistically significantly different from zero for any of the outcomes though. This indicates that government support did not benefit key firms more than non-key firms, or vice versa. Furthermore, the coefficient of the government support dummy is positively related to the decline in sales and to the decline in demand. This could indicate that governments targeted firms which faced a larger shock in terms of sales and demand. Recent evidence suggests that, in the case of European countries, government subsidies were relatively efficiently distributed and not over proportionally targeted firms which were unproductive already before the pandemic (Kozeniauskas, Moreira, and Santos 2020; Bighelli and Lalinsky 2021).

Several studies have highlighted that firm size matters with respect to how firms cope with the pandemic. Smaller firms were disproportionately affected by lower demand and disrupted supply chains. Table A.4 tests whether there are any differential effects by firm size between key and non-key firms. The firm size at the time of sampling is used, such that there is no endogeneity effect between the pandemic and firm size. The results exhibit some interesting patterns. For instance, larger key firms are less likely to have experienced a decline in sales, while there is no difference between non-key firms of different sizes. There is also no differential effect with respect to the number of furloughed workers. The previous results showed that non-key firms are more likely to increase online activities, which appears to be driven by larger firms. This may especially be true for less developed countries, where barriers are larger especially for smaller firms. Surprisingly, larger non-key firms more often faced input supply shortages, while the opposite is true for key firms. In contrast to declining sales, declines in demand were more often reported by larger than smaller non-key firms.

Next, we investigate whether the difference between key and non-key firms varies between regions. The countries in the sample are split into four regions:<sup>12</sup> Africa and the Middle East, Central and East Asia, Europe and Latin America. As above, the Key dummy is interacted with the regional indicator in Table A.5 in the Appendix. The baseline category, omitted in the table, is the region Africa and the Middle East. The interaction coefficients are negative and statistically significant in most cases, besides for the online business activity outcome. These findings suggest that the categorization of key and non-key firms in Africa and the

<sup>12</sup> The number of countries within regions does not allow for a finer disaggregation.

Middle East is less distinctive relative to other regions of the world. This could mean that firms deemed key in the region had fewer advantages in terms of government support over non-key firms or that government regulations towards non-key firms were less stringent. For instance, much fewer firms in Sub-Saharan Africa received government support during the pandemic as compared to other regions in the world (Aga and Maemir 2021). Therefore, it can be expected that governments in general mandated fewer policies related to the business environment and regulations for firms in the region.

Lastly, Table A.6 tests whether the number of workers which took leave, possibly due to home-care responsibilities or fear of or actual infection, is correlated with any of the other observed factors and a firm being key. For example, key firms which did not offer the possibility of remote work may have had more employees taking leave. Frontline workers saw themselves confronted with large levels of psychological and physical stress especially at the start of the pandemic, leading to exhaustion and burnout symptoms (Béland, Brodeur, and Wright 2020). The results of the table however do not provide evidence for any such effects. Each column interacts the Key dummy variable with an observed adjustment or government support. The only statistically significant interaction is government support, which suggests that firms receiving support had fewer workers taking leave. This could potentially mean that these firms were able to provide better conditions for workers.

## ► Conclusion

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This paper analyzes how the Covid-19 pandemic affected key and non-key firms in 27 countries. The sample ranges from less developed to industrialized countries. To identify key firms, government emitted lists about industries and goods defined as essential were coded into 4-digit ISIC-Rev. 3 sectors. In addition, a keyword search in the description of a firm's main product or service determines if its main activity resonates with the respective national government's essential list. The effect of being deemed key is identified by controlling for observed and unobserved characteristics, which capture both the selection into the key-status and characteristics which itself affect how the firm is able to deal with the economic consequences of the pandemic.

The estimation results show that key firms less often had experienced declining sales and had to close. Demand for their goods and supply of input declined less than for non-key firms. In terms of employment, non-key firms furloughed more workers and more of their workers took leave. Government support did not assist one type of firm more than the other. Heterogeneity is however apparent in terms of firm size and regions. Larger key firms were least likely to experience declining sales and input supply shortages, while larger non-key firms more often faced supply shortages. Moreover, the categorization of key and non-key firms in Africa and the Middle East is less distinctive relative to other regions of the world. However, non-key firms exhibit a stronger response to the economic downturn. They are more likely to have started using or increased their usage of online business activities and to have changed the main product or service that they offer. Some non-key firms therefore have been innovative in their response to the pandemic.

While these innovations may well benefit them in the long-run, the empirical results clearly show that most non-key firms had a harder time dealing with the economic downturn of the pandemic. To foster rapid and fair recovery, governments should consider assisting these firms once the pandemic no longer necessitates the limitation of firm operations to minimize infection rates. These findings warrant future research on the subject. Will firms deemed key have a long-run advantage over non-key firms, as they have been less affected by the negative consequences of the pandemic? Or will being innovative and adaptive make non-key firms more resilient and productive once the pandemic has ceased?

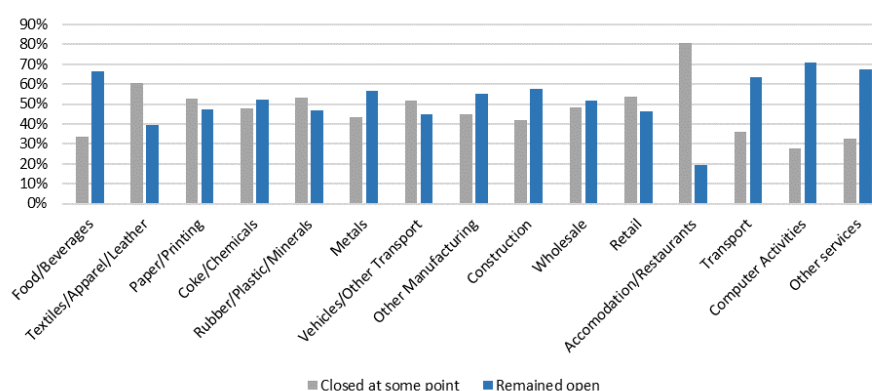
## Annex

► **Table A.1: Sample overview and excluded countries**

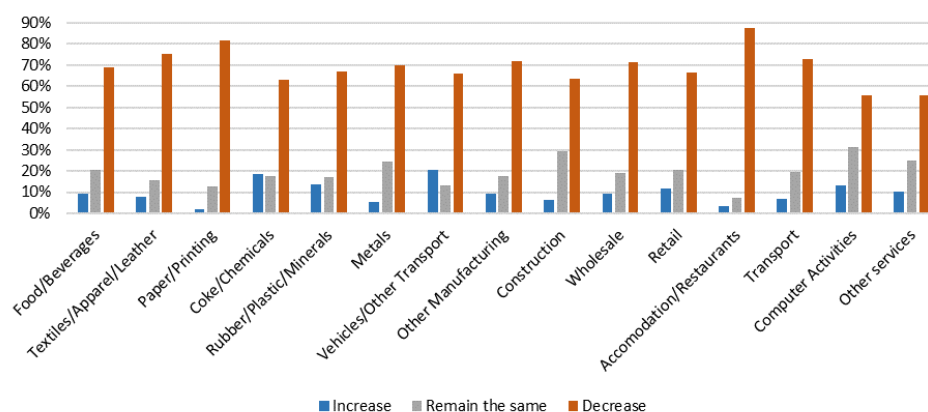
COV-ES Countries included in the sample:	
Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Cyprus, Czech Republic, El Salvador, Estonia, Georgia, Greece, Guatemala, Honduras, Hungary, Italy, Jordan, Lebanon, Moldova, Mongolia, Montenegro, Mozambique, Romania, Russian Federation, Serbia, Slovenia, South Africa, Zimbabwe	
COV-ES Countries excluded from the sample:	
No baseline year	Panama
No essential list	Belarus, Chad, Guinea, Kazakhstan, Latvia, Lithuania, Nicaragua, Niger, North Macedonia, Somalia, Togo, Zambia
No variation in list	Bulgaria, Malta, Morocco, Poland, Portugal, Slovak Republic

► **Figure A.1: Impact of the Covid-19 pandemic on firms by sector**

### a) Firm status



### b) Change in sales



Notes: The sample consists of 9169 firms in Panel A and 9873 firms in Panel B. COV-ES sampling weights are applied.

► Table A.2: Estimation results - Additional controls

	Decline in sales	Furloughed workers (log)	Online activity	Input supply	Declining demand
	(1)	(2)	(3)	(4)	(5)
Key firm	-0.088*** (0.02)	-0.147*** (0.05)	-0.040* (0.02)	-0.075*** (0.02)	-0.071*** (0.02)
Baseline sales (log)	-0.022** (0.01)	-0.018 (0.03)	0.011* (0.01)	-0.030*** (0.01)	-0.025*** (0.01)
Baseline employment (log)	-0.003 (0.01)	0.239*** (0.05)	0.009 (0.01)	0.003 (0.01)	0.005 (0.01)
Firm age (log)	0.003 (0.02)	0.020 (0.03)	-0.025* (0.01)	0.029** (0.01)	0.022 (0.01)
Manager is female	-0.038** (0.01)	0.070* (0.04)	-0.004 (0.02)	-0.023 (0.02)	-0.045*** (0.01)
Multi-establishment	-0.065** (0.03)	-0.026 (0.07)	0.021 (0.02)	-0.033 (0.03)	-0.029 (0.03)
Any state ownership	-0.111 (0.08)	-0.308 (0.24)	-0.055 (0.08)	-0.217** (0.10)	-0.123 (0.11)
Any foreign ownership	0.023 (0.03)	0.013 (0.07)	0.026 (0.04)	0.002 (0.04)	0.001 (0.03)
Any exports	-0.013 (0.02)	-0.037 (0.04)	-0.010 (0.02)	0.006 (0.03)	-0.021 (0.03)
Electricity outage	0.018 (0.02)	0.003 (0.04)	-0.042** (0.02)	-0.026* (0.01)	0.002 (0.02)
Loan or credit	0.014 (0.02)	-0.061 (0.05)	0.018 (0.01)	0.007 (0.02)	0.008 (0.02)
Manager experience (log)	0.016 (0.02)	0.058* (0.03)	-0.003 (0.01)	0.002 (0.01)	-0.019 (0.01)
Website	0.015 (0.02)	0.060 (0.04)	0.114*** (0.02)	0.002 (0.02)	-0.026 (0.02)
Spent time on regulations	-0.011 (0.01)	0.091*** (0.03)	0.052*** (0.02)	0.011 (0.01)	-0.006 (0.02)
Observations	8980	6223	8624	8624	8404
Country FEs	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes
Interview month	Yes	Yes	Yes	Yes	Yes
4-digit sector FEs	Yes	Yes	Yes	Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

► Table A.3: Estimation results - Effects of government support

	Decline in sales	Furloughed workers (log)	Online activity	Input supply	Declining demand
	(1)	(2)	(3)	(4)	(5)
Key firm	-0.100*** (0.02)	-0.237*** (0.07)	-0.023 (0.03)	-0.096*** (0.02)	-0.095*** (0.02)
Received gov. support	0.070** (0.03)	0.193 (0.12)	0.045 (0.03)	0.026 (0.03)	0.063** (0.03)
Key x Received gov. support	0.032 (0.04)	0.187 (0.12)	-0.041 (0.03)	0.050 (0.04)	0.054 (0.03)
Baseline sales (log)	-0.022** (0.01)	-0.015 (0.03)	0.011* (0.01)	-0.030*** (0.01)	-0.025*** (0.01)
Baseline employment (log)	-0.004 (0.01)	0.234*** (0.05)	0.008 (0.01)	0.003 (0.01)	0.003 (0.01)
Firm age (log)	0.005 (0.02)	0.025 (0.03)	-0.025* (0.01)	0.030** (0.01)	0.024* (0.01)
Manager is female	-0.038** (0.01)	0.070 (0.04)	-0.004 (0.02)	-0.023 (0.02)	-0.045*** (0.01)
Multi-establishment	-0.067** (0.03)	-0.035 (0.08)	0.020 (0.02)	-0.033 (0.03)	-0.031 (0.03)
Any state ownership	-0.111 (0.08)	-0.304 (0.24)	-0.058 (0.08)	-0.215** (0.10)	-0.123 (0.10)
Any foreign ownership	0.027 (0.03)	0.021 (0.07)	0.026 (0.04)	0.005 (0.04)	0.007 (0.03)
Any exports	-0.012 (0.02)	-0.037 (0.05)	-0.010 (0.02)	0.007 (0.03)	-0.020 (0.03)
Electricity outage	0.016 (0.02)	-0.010 (0.04)	-0.043** (0.02)	-0.028* (0.01)	-0.001 (0.02)
Loan or credit	0.012 (0.02)	-0.067 (0.05)	0.019 (0.01)	0.006 (0.02)	0.006 (0.02)
Manager experience (log)	0.014 (0.02)	0.051* (0.03)	-0.003 (0.01)	0 (0.01)	-0.021 (0.01)
Website	0.011 (0.02)	0.052 (0.04)	0.113*** (0.02)	0 (0.02)	-0.029 (0.02)
Spent time on regulations	-0.014 (0.01)	0.086** (0.03)	0.052*** (0.02)	0.009 (0.01)	-0.009 (0.02)
Observations	8624	6223	8624	8624	8404
Country FEs	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes
Interview month	Yes	Yes	Yes	Yes	Yes
4-digit sector FEs	Yes	Yes	Yes	Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

► Table A.4: Estimation results – Sampling firm size effects

	Decline in sales	Furloughed workers (log)	Online activity	Input supply	Declining demand
	(1)	(2)	(3)	(4)	(5)
Key firm	-0.080*** (0.02)	-0.112* (0.06)	-0.028 (0.03)	-0.049 (0.05)	-0.032 (0.03)
Medium (20-99)	-0.006 (0.02)	0.112 (0.15)	0.040* (0.02)	0.208* (0.11)	0.065** (0.03)
Large (100 or more)	0.029 (0.03)	-0.258 (0.38)	0.082* (0.04)	0.299* (0.15)	0.076** (0.03)
Key x Medium (20-99)	-0.010 (0.03)	-0.137 (0.14)	-0.028 (0.02)	-0.292** (0.11)	-0.018 (0.04)
Key x Large (100 or more)	-0.095** (0.04)	0.175 (0.17)	-0.007 (0.03)	-0.552*** (0.16)	-0.004 (0.04)
Baseline sales (log)	-0.021** (0.01)	-0.002 (0.01)	-0.014 (0.01)	-0.018 (0.03)	0.014** (0.01)
Baseline employment (log)	0 (0.01)	0.213* (0.11)	0.007 (0.02)	0.247*** (0.07)	0 (0.01)
Firm age (log)	0.011 (0.01)	-0.019 (0.03)	0.002 (0.01)	0.051 (0.03)	-0.022* (0.01)
Manager is female	-0.038** (0.01)	0.021 (0.04)	0.003 (0.02)	0.062 (0.04)	-0.005 (0.02)
Multi-establishment	-0.061** (0.03)	0.074 (0.05)	-0.001 (0.03)	-0.034 (0.07)	0.028 (0.02)
Any state ownership	-0.126 (0.08)	-0.346*** (0.11)	-0.098 (0.06)	-0.343 (0.23)	-0.080 (0.08)
Any foreign ownership	0.022 (0.03)	-0.054 (0.14)	0.004 (0.03)	0.020 (0.07)	0.022 (0.04)
Any exports	-0.010 (0.02)	0.053 (0.06)	0.013 (0.02)	-0.027 (0.04)	-0.001 (0.02)
Electricity outage	0.017 (0.02)	0.086** (0.04)	-0.002 (0.01)	0.019 (0.04)	-0.032* (0.02)
Loan or credit	0.015 (0.02)	0.031 (0.07)	0.011 (0.02)	-0.053 (0.05)	0.025* (0.01)
Observations	8986	4069	8549	6224	8630
Country FEs	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes
Interview month	Yes	Yes	Yes	Yes	Yes
4-digit sector FEs	Yes	Yes	Yes	Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01



► Table A.5: Estimation results - Differential effects by region

	Decline in sales	Furloughed workers (log)	Online activity	Input supply	Declining demand
	(1)	(2)	(3)	(4)	(5)
Key firm	0.054 (0.04)	0.181* (0.09)	0.038 (0.08)	-0.017 (0.03)	0.055 (0.04)
Key x Central and East Asia	-0.188*** (0.05)	-0.157 (0.11)	-0.090 (0.09)	-0.125*** (0.02)	-0.160*** (0.04)
Key x Europe	-0.153*** (0.04)	-0.360*** (0.10)	-0.071 (0.08)	-0.055* (0.03)	-0.107** (0.04)
Key x Latin America	-0.188** (0.08)	-0.800*** (0.09)	0.110 (0.09)	-0.199*** (0.06)	-0.219** (0.08)
Baseline sales (log)	-0.026** (0.01)	0.007 (0.03)	0.012 (0.01)	-0.027** (0.01)	-0.028** (0.01)
Baseline employment (log)	0 (0.01)	0.214*** (0.05)	0.007 (0.01)	0.005 (0.02)	0.007 (0.01)
Firm age (log)	0.002 (0.02)	0.001 (0.03)	-0.027* (0.01)	0.037** (0.01)	0.021 (0.02)
Manager is female	-0.039** (0.02)	0.054 (0.04)	-0.017 (0.02)	-0.026 (0.02)	-0.047*** (0.01)
Multi-establishment	-0.058 (0.03)	-0.019 (0.07)	0.032 (0.03)	-0.036 (0.03)	-0.026 (0.04)
Any state ownership	-0.101 (0.11)	-0.287 (0.24)	-0.027 (0.11)	-0.235* (0.13)	-0.119 (0.14)
Any foreign ownership	0.030 (0.03)	0.025 (0.08)	0.003 (0.04)	0.007 (0.05)	0.011 (0.04)
Any exports	-0.032 (0.02)	-0.070* (0.04)	-0.005 (0.02)	-0.008 (0.03)	-0.039 (0.03)
Electricity outage	0.024 (0.02)	0.009 (0.04)	-0.047** (0.02)	-0.021 (0.02)	0.006 (0.02)
Loan or credit	0.016 (0.02)	-0.044 (0.06)	0.009 (0.01)	0.008 (0.03)	0.011 (0.02)
Manager experience (log)	0.023 (0.02)	0.049 (0.03)	0.004 (0.01)	0.002 (0.01)	-0.013 (0.01)
Website	0.012 (0.02)	0.053 (0.05)	0.108*** (0.02)	-0.003 (0.03)	-0.046* (0.02)
Spent time on regulations	-0.019 (0.01)	0.100*** (0.03)	0.049** (0.02)	0.015 (0.01)	-0.012 (0.02)
Observations	7679	5756	7323	7323	7323
Country FEs	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes
Interview month	Yes	Yes	Yes	Yes	Yes
4-digit sector FEs	Yes	Yes	Yes	Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

► Table A.6: Estimation results – Number of workers who took leave: interactions

Outcome Interaction	Number of workers who took leave (log)					
	Online ac- tivity	Remote working	Delivery	Gov. Support	Reduced hours	Declining demand
	(1)	(2)	(3)	(4)	(5)	(6)
Key	-0.137** (0.07)	-0.141** (0.07)	-0.134** (0.06)	-0.098 (0.06)	-0.109 (0.07)	-0.040 (0.15)
Interaction variable	0.088 (0.08)	0.049 (0.06)	0.107 (0.10)	0.034 (0.04)	0.009 (0.06)	-0.017 (0.10)
Key x Interaction variable	-0.027 (0.11)	0.023 (0.08)	-0.002 (0.13)	-0.096* (0.05)	-0.069 (0.06)	-0.137 (0.14)
Baseline sales (log)	-0.003 (0.01)	-0.005 (0.01)	-0.002 (0.01)	-0.003 (0.01)	-0.002 (0.01)	-0.008 (0.02)
Baseline employment (log)	0.206*** (0.07)	0.200*** (0.07)	0.202*** (0.06)	0.208*** (0.07)	0.208*** (0.07)	0.216*** (0.07)
Firm age (log)	-0.019 (0.03)	-0.016 (0.03)	-0.016 (0.03)	-0.020 (0.03)	-0.020 (0.03)	-0.016 (0.03)
Manager is female	0.025 (0.04)	0.024 (0.04)	0.021 (0.04)	0.025 (0.04)	0.026 (0.04)	0.019 (0.04)
Multi-establishment	0.075 (0.06)	0.077 (0.05)	0.075 (0.05)	0.077 (0.06)	0.080 (0.06)	0.085 (0.06)
Any state ownership	-0.297** (0.12)	-0.292** (0.12)	-0.302** (0.12)	-0.327*** (0.11)	-0.305** (0.11)	-0.340** (0.15)
Any foreign ownership	-0.073 (0.14)	-0.073 (0.14)	-0.073 (0.14)	-0.073 (0.14)	-0.070 (0.13)	-0.077 (0.14)
Any exports	0.054 (0.06)	0.047 (0.06)	0.053 (0.06)	0.053 (0.06)	0.051 (0.06)	0.041 (0.07)
Electricity outage	0.089** (0.04)	0.089** (0.04)	0.090** (0.04)	0.086** (0.04)	0.086** (0.04)	0.085** (0.04)
Loan or credit	0.033 (0.07)	0.032 (0.07)	0.028 (0.07)	0.035 (0.07)	0.034 (0.07)	0.031 (0.07)
Observations	3885	4069	4069	3885	3885	3758
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Baseline year	Yes	Yes	Yes	Yes	Yes	Yes
Interview month	Yes	Yes	Yes	Yes	Yes	Yes
4-digit sector FEs	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors, in parentheses, are clustered on the country level. Estimations are weighted with the re-scaled sampling weights.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

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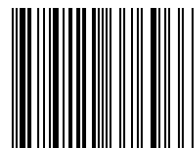
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