DISCUSSION PAPER SERIES

DP15156

COVID-19 AND FIRMS: PRODUCTIVITY AND GOVERNMENT POLICIES

Nicholas Kozeniauskas, Pedro Moreira and Cezar Santos

MACROECONOMICS AND GROWTH

ISSN 0265-8003

COVID-19 AND FIRMS: PRODUCTIVITY AND GOVERNMENT POLICIES

Nicholas Kozeniauskas, Pedro Moreira and Cezar Santos

Discussion Paper DP15156
Published 11 August 2020
Submitted 09 August 2020

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

COVID-19 AND FIRMS: PRODUCTIVITY AND GOVERNMENT POLICIES

Abstract

This paper investigates how the Covid-19 pandemic has affected firms and which firms have benefited from government support. Using a panel survey of Portuguese firms conducted during the pandemic matched with pre-Covid administrative data, the results show that the shock was large, but heterogeneous across firms. Though most firms experienced declines in sales, high productivity firms were more likely to remain open, less likely to cut employment and made less use of government support.

JEL Classification: N/A

Keywords: N/A

Nicholas Kozeniauskas - nic.j.koz@gmail.com
Bank of Portugal

Pedro Moreira - pmoreira@bportugal.pt
Banco de Portugal

Cezar Santos - cezarsantos.econ@gmail.com
Bank of Portugal, FGV EPGE and CEPR

Covid-19 and Firms: Productivity and Government Policies*

Nicholas Kozeniauskas Pedro Moreira Cezar Santos

August 9, 2020

Abstract

This paper investigates how the Covid-19 pandemic has affected firms and which firms have benefited from government support. Using a panel survey of Portuguese firms conducted during the pandemic matched with pre-Covid administrative data, the results show that the shock was large, but heterogeneous across firms. Though most firms experienced declines in sales, high productivity firms were more likely to remain open, less likely to cut employment and made less use of government support.

Keywords: Covid-19, firms, productivity, policies
JEL codes: E24, D22, H81

*Financial support from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES)—Finance Code 001 and Faperj is gratefully acknowledged. An Online Appendix is available at https://sites.google.com/site/czrsantos/research. The views expressed in this article are those of the authors and do not necessarily represent those of Banco de Portugal or the Eurosystem. Kozeniauskas: Banco de Portugal & Católica-Lisbon (email: nicjkoz@gmail.com), Moreira: Banco de Portugal (email: pmoreira@bportugal.pt), Santos: Banco de Portugal, FGV EPGE & CEPR (email: cezarsantos.econ@gmail.com)

1 Introduction

The Covid-19 pandemic has caused a massive shock to firms around the world. Many have been forced to close temporarily in the interest of public health, while others have had to make significant changes to their operations in response to this new state of the world. Governments have responded with a wide range of policies designed to support businesses through this period.

In this context, this paper addresses two questions: how has the pandemic affected firms, and which firms have benefited from government policies? Addressing these questions is crucial for a better understanding of the current state of the economy and its trajectory in the coming months and years. Moreover, it is an essential input for improving public policy and to better prepare society for future public health shocks.

To tackle these issues, we use data from a survey of Portuguese firms conducted from April through July 2020. This survey provides information on operations, sales and employment of firms, as well as their use of government policies. We match this survey with pre-pandemic administrative data, which enables us to study differences across the distribution of firms. In particular, we focus on firm heterogeneity with respect to productivity. For policies, the focus is on the four main measures adopted for supporting firms during the pandemic: a moratorium on debt payments, government-provided credit lines, deferred tax obligations and a subsidized paid furlough scheme.

Our analysis shows that the shocks to sales and employment were remarkably large on average, but also quite heterogeneous. Taking sales as an example, 31% of firms had a maximum decline in sales during the survey period in excess of 75%, while for 14% of firms, sales were flat or increasing. Looking at the relationship between this and productivity within sectors, we find that firms across the productivity distribution were equally likely to have had a decline in sales. Where higher productivity firms did do better was with a lower incidence of large sales declines. Higher productivity firms were also more likely to stay open during the pandemic, and were less likely to reduce their employment. To quantify these effects, firms in the top productivity quartile of their sector were 5.5 percentage points less likely to reduce their employment and 1.3 percentage

points more likely to remain open compared to firms in the bottom quartile.

The stronger performance of higher productivity firms carries over to their use of government support. Across the board, the probability of having used government policies is declining in productivity and the differences are substantial. Firms in the top productivity quartile are 7 to 18 percentage points less likely to have used each of the support policies.

Recently, there has been a great effort among economists to study different aspects of the Covid-19 pandemic. Some papers have investigated the effects of the pandemic and mitigation policies on the behavior of individuals, for example Brotherhood et al. (2020) and Eichenbaum, Rebelo, and Trabandt (2020). We contribute to this literature by focusing on firms. On this, Bartik et al. (2020) and Fairlie (2020) study the impact of the pandemic shock on small businesses. We add by exploring the effects over the entire firm size distribution and gauging how heterogeneous those effects were conditional on firm level productivity. Granja et al. (2020) and Neilson, Humphries, and Ulyssea (2020) study the Paycheck Protection Program in the US, a policy that focused on small businesses. We also investigate a policy aimed at keeping workers employed (paid furlough) and also examine policies related to credit and tax obligations.

More generally, our results that high productivity firms are less affected by the pandemic shock is reminiscent of the literature on the cleansing effects of recessions (e.g. Caballero and Hammour 1994) and the importance of heterogeneous firms for business cycles (e.g. Ottaviano 2012; Clementi and Palazzo 2016). These findings can be important for understanding the allocation of resources across firms in the economy, the relevance of which has been emphasized by Guner, Ventura, and Xu (2008) and Hsieh and Klenow (2009), among others. We contribute by empirically analyzing the effects of a public health-induced recession on heterogeneous firms.

The remainder of this paper is organized as follows. The next section describes the data and summarizes the context of the Covid-19 pandemic in Portugal. Section 3 gives an overview of the impact of the pandemic on firms and their use of government policies. Section 4 studies how impacts and policy use differed across the productivity distribution.. Section 5 concludes.

2 Data and context

This section gives an overview of the pandemic in Portugal and introduces the datasets that will be used. The timing of events during the pandemic was similar to other European countries. Portugal's first official case of Covid-19 was reported on March 2. On Thursday, March 12, the government announced that all schools would close at the end of the next day, and from then on there was a significant decline in movement in the country.[1] An official state of emergency commenced on March 18 under which all non-essential businesses with interactions with the public closed and teleworking was required wherever possible (i.e. the "lockdown"). Six and a half weeks later, on May 4, the government allowed some businesses to start reopening and the scope of reopening gradually expanded throughout May. The opening followed a typical path starting with small shops and personal services, and gradually expanded to larger stores and restaurants. On the epidemiological side, the first death was on March 16, daily deaths increased until early April and then declined until mid-June.[2]

The first dataset that we use is a survey of firms that was conducted weekly during April and every fortnight from the start of May to the middle of July.[3] The surveys asked firms a range of questions about the impact of the pandemic on their activities and the mitigation actions they were taking, including the use of government support policies. In the interest of increasing the speed and response rate, firms were asked to quantify changes to their business in ranges, rather than exact numbers (e.g. a change in sales of 26–50% rather than 37%). The analysis therefore focuses on the distributions of changes and relative effects between firms, rather than providing precise quantitative differences. Each round of the survey was sent to the same 8,883 non-farm, non-financial firms and the average response rate was 60.3%.[4]

[1] Google mobility data report that there was an increase of 30% in time spent at home in April in Portugal. See www.google.com/covid19/mobility/.

[2] In terms of levels, the highest toll was 37 deaths on April 2 and this had declined to an average of 2 per day in the week of June 15–21. More information is available on the Portuguese Ministry of Health's website: https://covid19.min-saude.pt.

[3] The name of the survey is the *Inquérito Rápido e Excecional às Empresas—COVID-19*. It was administered to firms by the Portuguese National Statistics Institute, the main body responsible for collecting firm level statistics in Portugal.

[4] The response rate was fairly stable over time, ranging from 54% to 66%.

To measure the characteristics of firms, we use an annual administrative dataset that provides information on the balance sheet of firms as well as some other operational variables.[5]

After merging and cleaning the datasets, the sample contains 6,952 firms. The main cleaning criteria are that we omit firms that did not respond to the survey during April since we want at least one observation per firm during the lockdown period, and we omit the mining and utilities sectors because they have too few observations for the within-sector variation that our analysis relies on. Fifty percent of firms responded to at least eight out of nine surveys, 76% of firms responded to at least five surveys and observations are very evenly spaced over the survey period. In terms of the size of firms, the sample has relatively large and old firms. The median total income and employment of firms are €3.6m and 28, respectively, compared to €122k and two for the population of firms. The industry composition approximately matches that of the firm population.[6]

Government policy during the pandemic is also important for understanding and interpreting the analysis, with four main policies being relevant.[7] On March 16 the government commenced a policy of subsidizing employee salaries at firms severely affected by the pandemic to try to prevent layoffs. Employees at eligible companies were entitled to two-thirds of their salary, subject to a cap of €1905 per month. The government paid 70% of this and the employer the remainder. Firms were not allowed to fire any of their employees while receiving this benefit, or for 60 days afterwards. This resulted in many people being employed and paid during the pandemic, but not actually working. We will call this employment state *paid furlough*.[8]

[5]This dataset is called the *Informação Empresarial Simplificada* (IES).

[6]Other filters applied to the data are that we drop: firms with annual total income less than the minimum wage because they are unlikely to be businesses operating at any scale; and firms cannot be matched to the administrative firm data because they are too young (did not exist in 2018) or their data is otherwise missing. The Online Appendix provides additional details of the sample construction, details on the number of of surveys that each firm in the sample responded to, and the total number of responses to each survey by firms in our sample, and details on the industry composition between the survey and the population for firms.

[7]We provide brief descriptions of these policies in this section. Additional details are available in the Online Appendix.

[8]Unlike the other policies considered in the paper, firms were only asked whether they had used the government's paid furlough scheme in the final survey in the first half of July. Therefore analysis of the use of this policy is restricted to the sample of 4,340 firms who answered

A moratorium on loan repayments was adopted on March 27 under which all firms in Portugal were effectively entitled to suspend their loan repayments until the end of September if they wished. During the course of this policy, interest was capitalized on loans and banks were prohibited from revoking credit lines. In June this measure was extended until the end of March 2021.

To further support firm financing, the government also provided credit lines. On March 12, several lines of credit were implemented focusing particularly on small and medium enterprises of the most affected sectors: restaurants, tourism and manufacturing. Loans had a maturity of up to 4 years and low interest rate spreads. In early April, the program was expanded to all sectors and the volume of funds was increased in partnership with the European Commission.

Finally, the government allowed firms to defer the payment of income, value-added and social security taxes for three months without any interest accrual. Alternatively, firms could opt for a longer time limit of six months, with interest accruing for the last three months.

3 Impact of pandemic on firms

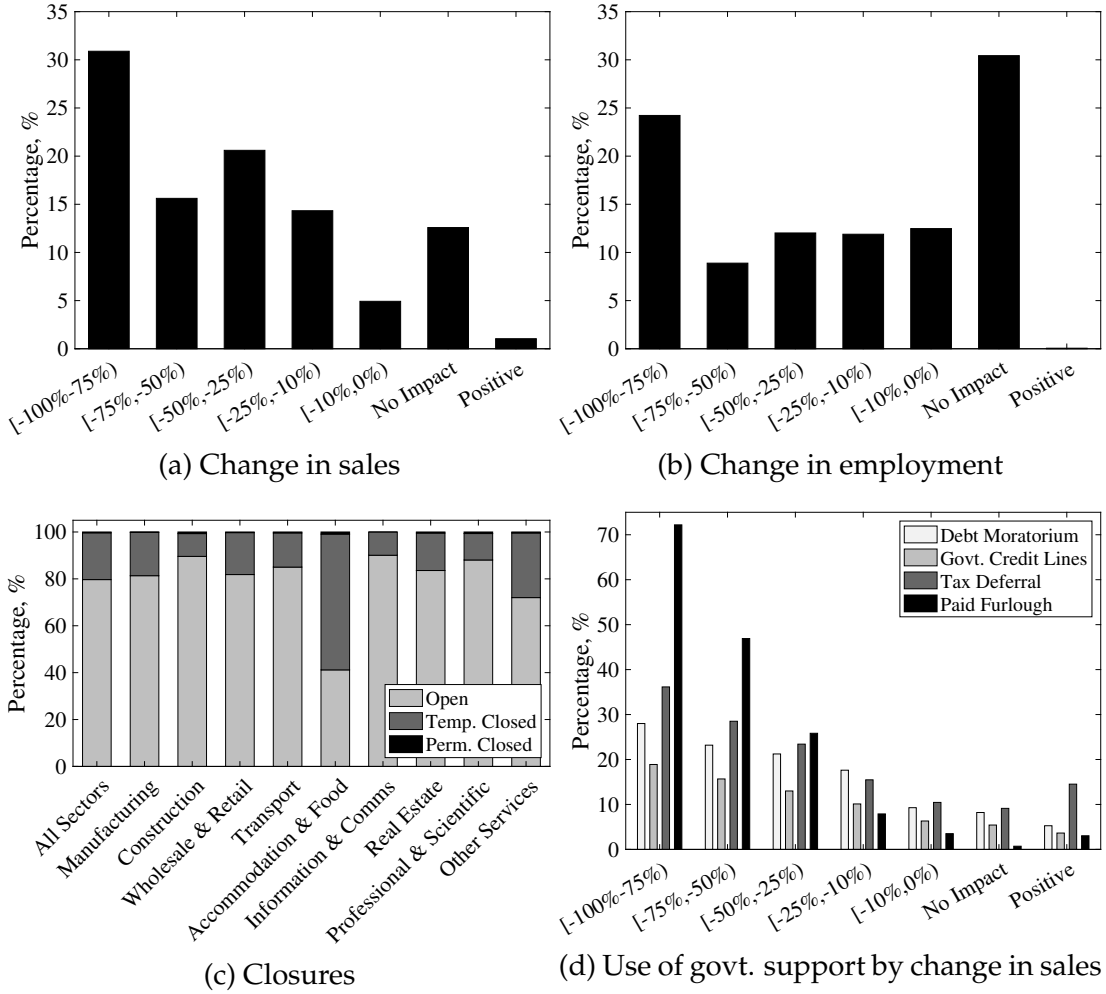
To provide an overview of the impact of the pandemic, this section summarizes changes in the operations of firms and their use of government policies. To start, consider the impact of the pandemic on sales and employment for firms that did not close permanently. Since we are interested in measures of economic activity, we use the number of people working as the measure of employment, omitting people on furlough. This will be the measure of employment throughout the paper. To assess the cross-sectional distribution of the shock, we look at its maximum negative impact on the sales and employment of firms during the survey period.[9]

Figures 1(a) and 1(b) show that the shock was large and heterogeneous. 31% of firms experienced a decline in sales of more than 75% while 14% had flat

this round of the survey.

[9]In each survey firms are asked what the level of their sales and employment are during the survey period relative to what they would have expected them to be in the absence of Covid-19. We measure the size of the shock with the biggest negative impact recorded for each firm.

Figure 1: Impact on sales, employment, closures, and policy use



(a) Change in sales

(b) Change in employment

(c) Closures

(d) Use of govt. support by change in sales

Notes: Panel (a) presents the distribution with respect to their percentage change in sales. Panel (b) present the distribution for the percentage change in employment (defined as people actively working). Panel (c) is the share of firms who remained open at all times during the survey period, closed temporarily or closed permanently. One bar is for the aggregate (*All Sectors*) and the remainder are for each sector. In panel (d) we divide the sample according to the percentage change in sales of each firm (horizontal axis) and present the share of firms in each category using each of the four government policies.

or increasing sales. The effects on employment were not as severe, but still large. 24% of firms reduced their workforce by more than 75% while 30% had no change. There is a lot of heterogeneity across sectors, but all sectors suffered significant shocks. The accommodation and food services sector was hit the hardest with the sales of 86% of firms decreasing by more than half, but this was even true for 27% of firms in construction, which was the sector which declined the least.[10]

For the extensive margin of operations, 20% of firms closed temporarily at some point (Figure 1(c)). The rate of actual exits is low, at 0.4%, but we treat this number with caution because firms that exit may have been less likely to respond to the survey. This figure also illustrates the degree of sectoral heterogeneity of the shock in more detail. The accommodation and food services sector contracted the most with 59% of firms closing temporarily or permanently. Other sectors were more similar to each other with the temporary closure rates ranging from 10% to 28%.

As might be expected in the context of such a large shock, the support policies of the government were widely used. Overall, 36% of firms benefited from at least one of the debt moratorium, government credit lines or tax deferral, and the same share made use of the subsidized paid furlough policy. In Figure 1(d), we break down the use of the four policies conditional on the size of the decline in sales that firms experienced. Even amongst firms whose sales did not change, the policies were used by up to 9% of firms. Firms with worse shocks had much higher rates of policy use. For firms with shocks of more than 75% to sales, the take-up rates of the policies varied between 19% and 72% of firms. Regarding the role of eligibility in these results, virtually all firms reported being eligible for the debt moratorium, government credit lines and tax deferral policies.[11] Eligibility is more important for use of the paid furlough policy, since firms needed to have a decline in sales of more than 40% relative to the previous two months, or have been forced to shut down, to use this policy.[12]

[10]The full picture of sectoral heterogeneity is presented in the Online Appendix, where Figures 1(a) and 1(b) are replicated for each sector.

[11]The ineligibility rates of firms in our sample for these policies were 2.1%, 1.6% and 1.8% respectively.

[12]See the Online Appendix for a detailed discussion of the eligibility criteria for this policy.

4 The importance of firms' productivity

We now turn to assessing the effects of the pandemic and the use of support policies across the firm productivity distribution. The objective is to investigate how a firm's productivity is correlated with the impact on its sales or employment. Moreover, we can gauge whether high or low productivity firms were more likely to take advantage of the different policies implemented by the government.

To perform this analysis, Ordinary Least Square (OLS) regressions of the following form are used:[13]

$$y_i = \beta_0 + \boldsymbol{\beta}_1' \mathbf{TFP}_i + \boldsymbol{\beta}_2' \mathbf{Sector}_i + \boldsymbol{\beta}_3 \mathbf{X}_i + \varepsilon_i. \tag{1}$$

y_i is a binary variable related to the outcome of interest. This could based on the change in sales or employment, or government policy use of firm i. $\mathbf{TFP}_i$ is a vector of controls for productivity, which can take one of two forms discussed shortly. $\mathbf{Sector}_i$ is a vector of sector dummies.[14] $\mathbf{X}_i$ is a vector of additional control variables containing age, total income and a dummy for whether the firm was in Lisbon. We include the control for Lisbon since it is the largest city in the country, where 29% of firms are located, and has a disproportionate share of high productivity firms.

All right hand side variables are measured using the most recent available administrative data, from 2018. In the Online Appendix we show that, for the firms in the sample, these variables were quite stable from 2016–18, so the 2018 data is a good measure of firms characteristics at the start of the pandemic.

All regressors in (1) are straightforward except for Total Factor Productivity (TFP). To measure this, we follow the approach of Foster, Haltiwanger, and Krizan (2001) by assuming a Cobb-Douglas production function with labor,

[13] We have also estimated logit regressions using the same specification and the results are robust to this. These results are available upon request.

[14] The sectors are: manufacturing; construction; wholesale and retail trade; transport; accommodation and food services; information and communication; real estate; professional, scientific and technical activities; and other services.

capital and materials as inputs and measure the TFP of firm i in sector s as:

$$\ln TFP_i = \ln Y_i - \alpha_K^s K_i - \alpha_L^s L_i - \alpha_M^s M_i. \tag{2}$$

Y_i is the value of output, L_i is hours of paid employees and M_i is consumption of intermediates (i.e. materials). To measure the capital stock, we follow Hsieh and Klenow (2009) and use the average book value of capital from the start and end of 2018.

The weights on the inputs in equation (2) are measured for the nine sectors covered by our sample. Given the assumption of a Cobb-Douglas production function, the weights are equal to the share of revenue spent on each input. Specifically, α_L^s is the total wage bill as a share of output, α_M^s is the total cost of intermediates as a share of output and, assuming constant returns to scale, $\alpha_K^s = 1 - \alpha_L^s - \alpha_M^s$. We estimate these using industry cost shares.[15] According to our estimates, sectors have the expected characteristics. The most materials intensive sectors are manufacturing and construction, while the services sectors and wholesale and retail trade are the most labor intensive. Real estate—which encompasses firms in the business of renting, trading and managing real estate—is the most capital intensive. The average labor share across sectors is 61%.[16]

In regression (1), we control for productivity using the $\mathbf{TFP}_i$ term and have two alternative specifications for this. For the first, we normalize the productivity of each firm in the following way:

$$\widehat{TFP}_i = \frac{1}{\sigma^s}\Big(TFP_i - \frac{1}{N_s}\sum_{j\in\mathcal{S}} TFP_j\Big) \tag{3}$$

where s is the sector of firm i, $\mathcal{S}$ is the set of firms in sector s, N_s is the number of such firms and σ^s is the standard deviation of TFP for these firms. Thus $\widehat{TFP}_i$ is the deviation of firms i's productivity from its sector's mean, in units

[15]The estimated values of these parameters are presented in the Online Appendix. We estimate productivity for all firms in the population and then, to prevent outliers significantly impacting the results, drop firms in our sample that are in the top or bottom 1% of the population productivity distribution. Due to missing data for some firms and the omission of outliers, for the productivity analysis the sample reduces from 6,952 to 6,626.

[16]For the production function being used, the labor share for sector s is $\alpha_L^s/(\alpha_L^s + \alpha_K^s)$.

of that sector's TFP standard deviation. We do this normalization since the level of TFP can differ across sectors. For the second specification, we allow for a more flexible relationship between productivity and the outcomes of interest by computing the productivity quartile of each firm *within* its sector, and specifying $\mathbf{TFP}_i$ to be a vector of dummy variables for the 2^{nd}, 3^{rd} and 4^{th} quartiles. Note that both specifications use productivity variation within sectors. Sector-specific effects on outcomes are additionally controlled for with sector fixed effects.

To investigate differences in the impact of the pandemic across the productivity distribution, we start by assessing the relationship between productivity and changes in sales, changes in employment and whether firms remained open.[17] For changes in sales and employment, since the survey provides categorical information, we use binary variables. For both outcomes, we study whether there was a contraction or not, and whether there was a contraction of more than 50% or not.[18] This allows us to consider the propensity of firms to contract, and also their exposure to large contractions. For whether firms remained open, y_i is a dummy variable equal to one if a firm remained open throughout the survey period (April to mid-July).

Table 1 reports the results for sales and employment. The table includes results for both specifications of $\mathbf{TFP}_i$, and with and without the control variables in $\mathbf{X}_i$. Starting with sales, the message is that there were no clear differences in whether sales declined or not across the productivity distribution (panel (a), columns (1)–(4)). For the specification in which normalized TFP enters linearly, the TFP coefficient is insignificant. For the alternative specification using quartiles of TFP, only one coefficient in one specification is significant at 5%. Looking at large contractions ($> 50\%$), the picture is different. Higher productivity firms were less likely to experiences these, with this result driven by firms in the top quartile of the productivity distribution. Quantitatively, firms in the top productivity quartile of their sector's productivity distribution were 3.4 percentage points less likely to suffer a large contraction in sales.

[17] We do not look at the survival of firms since the exit rate is extremely low, so there is little variation to use.

[18] For the first case, $y_i = 1$ if sales contracted and otherwise equals zero, and for the second case, $y_i = 1$ if sales contracted by more than 50%. For employment y_i is defined analogously.

Table 1: Sales and employment changes by productivity

(a) *Sales*

	Contracted				Contracted $> 50\%$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFP	0.004	0.006			-0.018***	-0.019***		
	(0.004)	(0.004)			(0.006)	(0.006)		
TFP Q2			0.020*	0.021*			-0.010	-0.010
			(0.012)	(0.012)			(0.017)	(0.017)
TFP Q3			0.021*	0.024**			-0.013	-0.014
			(0.012)	(0.012)			(0.017)	(0.017)
TFP Q4			0.015	0.019			-0.033*	-0.034**
			(0.012)	(0.012)			(0.017)	(0.017)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	6396	6395	6396	6395	6396	6395	6396	6395
R^2	0.022	0.024	0.023	0.024	0.063	0.064	0.062	0.063

(b) *Employment*

	Contracted				Contracted $> 50\%$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFP	-0.024***	-0.021***			-0.019***	-0.018***		
	(0.006)	(0.006)			(0.006)	(0.006)		
TFP Q2			0.028*	0.031**			-0.007	-0.006
			(0.016)	(0.016)			(0.016)	(0.016)
TFP Q3			0.031**	0.036**			-0.013	-0.012
			(0.016)	(0.016)			(0.016)	(0.016)
TFP Q4			-0.064***	-0.055***			-0.052***	-0.051***
			(0.016)	(0.016)			(0.016)	(0.016)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	6516	6515	6516	6515	6516	6515	6516	6515
R^2	0.046	0.049	0.051	0.053	0.076	0.076	0.076	0.076

Notes: All regressions take the form specified in equation (1). In panel (a) the dependent variable y_i for columns (1)–(4) is an indicator variable for whether a firm's sales contracted, and for columns (5)–(8) is as an indicator for whether sales contracted by more than 50%. In panel (b) the dependent variable is the same, except that it is for changes in employment instead of sales. Sector FE are sector fixed effect. The Controls are age, total income and an indicator for whether a firm is located in the Lisbon region. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

There are greater differences across the productivity distribution when we look at employment (Table 1b). The regressions consistently show that higher pro-

ductivity firms were less likely to reduce their employment, or reduce their employment by more than 50%. Firms with one standard deviation higher productivity in their sector were 2.1 percentage points less likely cut employees, and 1.8 percentage points less likely to do so by more than 50% (columns 2 and 6). The results for the alternative specification of the TFP control show that, like for sales, this effect was particularly driven by firms in the top productivity quartile. These firms were around 5 percentage points less likely to reduce their employment, or reduce it by more than 50%, compared to firms in the first quartile (columns 4 and 8).

One concern with the results for employment may be that higher productivity firms could have been less likely to be eligible for the government's paid furlough scheme, which could explain their lower propensity to decrease employment. The main eligibility criteria for this policy was that a firm's sales declined by more than 40% relative to the previous two months or that it was forced to closed by the pandemic (in which case its sales would have likely fallen by much more than 40%). Therefore, to address this concern, we have performed the analysis for the contraction in employment again, restricting the sample to firms whose sales declined by more than 50% (full results in the Online Appendix). The results are very similar. Firms with one standard deviation higher productivity in their sector are still 1.3 percentage points less likely to have cut their employment, and firms in the top productivity quartile of their sector's productivity distribution were 4.6 percentage points less likely to cut employment than firms in the bottom quartile.

The results for whether firms remained open show a similar pattern to those for employment (Table 2). The main result is that firms with higher productivity were more likely to remain open. The magnitude of this from column (2) is that a firm that was one standard deviation higher in its sector's productivity distribution was 1.3 percentage points more likely to stay open. The results for the alternative specification of the TFP control (columns 3 and 4) indicate that most of this effect is coming from a difference between the first quartile of the productivity distribution and the higher quartiles. Firms in the 2^{nd}, 3^{rd} and 4^{th} quartiles were all 2.7–2.9 percentage points more likely to remain open than firms in the first quartile.

Table 2: Operating decisions by productivity

	Operating			
	(1)	(2)	(3)	(4)
TFP	0.014***	0.013***		
	(0.005)	(0.005)		
TFP Q2			0.030**	0.029**
			(0.013)	(0.013)
TFP Q3			0.030**	0.028**
			(0.013)	(0.014)
TFP Q4			0.031**	0.027**
			(0.013)	(0.014)
Sector FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes
Obs.	6626	6625	6626	6625
R^2	0.079	0.081	0.079	0.081

Notes: All regressions take the form specified in equation (1). The dependent variable y_i is an indicator variable for whether a firm remained open throughout the survey period. Sector FE are sector fixed effect. The Controls are age, total income and an indicator for whether a firm is located in the Lisbon region. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Overall the message from the data is that firms across the productivity distribution were equally likely to suffer a decline in sales. However, higher productivity firms were able to avoid large declines in their sales, were better able to retain their employees and were less likely to shut down. Note that we are controlling for the size (pre-pandemic total income) and age of firms in the regressions, so this result is not explained by higher productivity firms being larger or being more mature and thereby having a more stable business.

Now consider the use of government policies. Table 3 presents the results for the use of the four government policies, one in each panel. For all of these regressions the dependent variable equals one if a firm used the relevant policy and zero otherwise. For all policies, the result is that more productive firms were less likely to use them. Firms one standard deviation higher in their industry's productivity distribution were 6.4, 2.5, 3.5 and 4.1 percentage points less likely to make use of the debt moratorium, government credit lines, tax deferral and government subsidized paid furlough, respectively (column 2 of

Table 3: Government support by productivity

	(a) *Debt Moratorium*				(b) *Govt. credit lines*			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
TFP	-0.067***	-0.064***			-0.028***	-0.025***		
	(0.005)	(0.006)			(0.005)	(0.005)		
TFP Q2			-0.037**	-0.034**			0.017	0.020
			(0.015)	(0.015)			(0.013)	(0.013)
TFP Q3			-0.125***	-0.119***			-0.034***	-0.030**
			(0.015)	(0.015)			(0.013)	(0.013)
TFP Q4			-0.186***	-0.178***			-0.077***	-0.070***
			(0.015)	(0.015)			(0.013)	(0.013)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	5567	5566	5567	5566	5496	5495	5496	5495
R^2	0.041	0.043	0.047	0.049	0.025	0.027	0.029	0.032
	(c) *Tax Deferral*				(d) *Paid Furlough*			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
TFP	-0.035***	-0.035***			-0.042***	-0.041***		
	(0.006)	(0.006)			(0.007)	(0.007)		
TFP Q2			-0.016	-0.017			-0.027	-0.026
			(0.016)	(0.016)			(0.020)	(0.020)
TFP Q3			-0.069***	-0.069***			-0.011	-0.008
			(0.016)	(0.016)			(0.020)	(0.020)
TFP Q4			-0.090***	-0.092***			-0.112***	-0.108***
			(0.016)	(0.016)			(0.020)	(0.021)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	5730	5730	5730	5730	4105	4104	4105	4104
R^2	0.022	0.023	0.023	0.023	0.092	0.092	0.093	0.093

Notes: All regressions take the form specified in equation (1). In panels (a), (b), (c) and (d), the dependent variable y_i is an indicator for whether a firm used the government's debt moratorium, credit line, tax deferral and paid furlough policies, respectively. Sector FE are sector fixed effect. The Controls are age, total income and an indicator for whether a firm is located in the Lisbon region. Analysis of use of the paid furlough policy has a smaller sample because firms were only asked about this in one survey. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

each panel). To put these numbers in perspective the unconditional usage rates of these policies were 20.5%, 13.2%, 24.4% and 35.5%, respectively. For the alternative specification using quartiles of TFP, we see that the probability of us-

ing each policy is almost perfectly monotonically decreasing in productivity.[19] Firms in the 4^{th} quartile of productivity were 7.0–17.8 percentage points less likely to make use of the government policies than firms in the first quartile (column 4 of each panel).

One question that these results raise is to what extent they are driven by eligibility criteria. Is it the case that more productive firms are less likely to be eligible for the policies? To investigate this for the debt moratorium, government credit lines and tax deferral, we can condition the sample on firms who were eligible.[20] As discussed in relation to Figure 1, very few firms were ineligible for these policies, so excluding them barely changes the results. For the paid furlough policy, we address this question by restricting the sample to firms whose sales declined by more than 50%, as we did for the employment regressions earlier. Just as for the other policies, the results hold. Firms one standard deviation higher in their sector's productivity distribution are still 4.8 percentage points less likely to have used the paid furlough policy and firms in the top productivity quartile of their sector are 14.1 percentage points less likely to have used it than those in the bottom quartile. Full results for all of these exercises are in the Online Appendix.

While it is beyond the scope of this paper to provide a robust explanation for the differences in outcomes by productivity, the data provides some suggestive evidence. For the greater retention of employees by higher productivity firms, one theory is that they have higher productivity workers who are more costly to lose; that is, there is positive assortative matching between workers and firms (see e.g., Eeckhout and Kircher 2011). This higher cost could come from greater output losses while their position is empty or greater recruitment and training costs.[21] Consistent with this theory, within sectors, higher productivity firms pay higher wages. Across sectors, the average hourly wage is 106% higher at firms in the top productivity quartile than at firms in the bottom quartile.[22]

[19] The one exception is that the point estimate for TFP Q3 is lower than the point estimate for TFP Q2 for the paid furlough policy—but both coefficients are insignificantly different from zero.

[20] Firms were asked directly about their eligibility for using these policies.

[21] Bradley, Ruggieri, and Spencer (2020) build a theory in which, upon the Covid-19 pandemic shock, firms can hoard labor in order to save on future hiring costs.

[22] See the Online Appendix for the distribution of wages by productivity and sector.

5 Conclusion

Firms around the world have been affected by the Covid-19 pandemic and governments have implemented a variety of policies to support them. Using panel data on Portuguese firms during this period matched with pre-pandemic administrative data, we show that the impact on sales and employment was large and heterogeneous. Though most firms experienced declines in sales, high productivity firms were more likely to remain open, less likely to cut employment and made less use of government support.

These results are valuable for improving our understanding of the the economic impact of Covid-19. In particular, they shed light on the distributive impact of this shock, and the subsequent government policies, on firms. In this way, they can contribute to the design of future policy. As better data becomes available, new facets of heterogeneity (such as narrower industries) can be explored in future research.

References

Bartik, Alexander W., Marianne Bertrand, Zoe Cullen, Edward L. Glaeser, Michael Luca, and Christopher Stanton. 2020. "The impact of COVID-19 on small business outcomes and expectations." *Proceedings of the National Academy of Sciences* 117 (30): 17656–17666.

Bradley, Jake, Alessandro Ruggieri, and Adam Spencer. 2020. "Twin Peaks: Covid-19 and the Labor Market." Working paper.

Brotherhood, Luiz, Philipp Kircher, Cezar Santos, and Michèle Tertilt. 2020. "An economic model of the Covid-19 epidemic: The importance of testing and age-specific policies." Technical Report DP14695, CEPR.

Caballero, Ricardo J., and Mohamad L. Hammour. 1994. "The Cleansing Effect of Recessions." *The American Economic Review* 84 (5): 1350–1368.

Clementi, Gian Luca, and Berardino Palazzo. 2016. "Entry, exit, firm dynamics, and aggregate fluctuations." *American Economic Journal: Macroeconomics* 8 (3): 1–41.

Eeckhout, Jan, and Philipp Kircher. 2011. "Identifying Sorting—In Theory." *The Review of Economic Studies* 78 (3): 872–906 (03).

Eichenbaum, Martin S, Sergio Rebelo, and Mathias Trabandt. 2020. "The

Macroeconomics of Epidemics." Working paper 26882, National Bureau of Economic Research.

Fairlie, Robert. 2020. "The Impact of COVID-19 on Small Business Owners: The First Three Months after Social-Distancing Restrictions." Working paper.

Foster, Lucia, John Haltiwanger, and C. J. Krizan. 2001. "Aggregate productivity growth: lessons from microeconomic evidence." In *New developments in productivity analysis*, edited by Charles Hulten, Edwin Dean, and Michael Harper, 303–372. University of Chicago Press.

Granja, João, Christos Makridis, Constantine Yannelis, and Eric Zwick. 2020. "Did the Paycheck Protection Program Hit the Target?" Working paper 27095, National Bureau of Economic Research.

Guner, Nezih, Gustavo Ventura, and Yi Xu. 2008. "Macroeconomic implications of size-dependent policies." *Review of Economic Dynamics* 11 (4): 721 – 744.

Hsieh, Chang-Tai, and Peter Klenow. 2009. "Misallocation and manufacturing TFP in China and India." *Quarterly Journal of Economics* 124 (4): 1403–1448.

Neilson, Christopher, John Eric Humphries, and Gabriel Ulyssea. 2020. "Information Frictions and Access to the Paycheck Protection Program." Working paper 27624, National Bureau of Economic Research.

Ottaviano, Gianmarco I. P. 2012. "Firm Heterogeneity, Endogenous Entry, and the Business Cycle." *NBER International Seminar on Macroeconomics* 8 (1): 57–86.

Online Appendix

A Covid-19 firm survey

To construct our sample we start with the dataset from the Covid-19 firm survey, which had at least one response from 7,816 firms. Firms that did not respond to at least one of the four surveys in April are dropped since this was the lockdown period and the analysis is focused on studying the negative shock to firms from the pandemic. For firms that did not respond in April the dataset is likely to be missing information for the period in which they were most severely affected. The second stage of sample construction is to match this data with administrative data on firms. Since the most recent year of this data is 2018 some young firms are lost in this step. A few firms are also lost because their data for 2018 is incomplete. Since our analysis exploits within sector variation, the third step is the drop two sectors with too few observations for this kind of analysis: mining and utilities. Finally for the construction of the main sample we drop firms with total income in 2018 that was less than the annual salary of a person earning the minimum wage, since such firms are unlikely to be fully functioning firms. The sample contains relatively large firms, so this is a minor concern and only three firms are dropped due to this criteria. The size of the sample at each of these steps is detailed in Table A1. In section 3 of the main text sample 4 is used for the analysis.

Since responses to the survey are voluntary, the dataset is an unbalanced panel. However, most firms in the sample responded to most of the surveys and, to the extent that this was not the case, responses were quite evenly spread over the survey period. The distribution of the number of surveys that each firm responded is presented in Table A2(b). 31% of firms responded to all nine surveys and 69% of firms responded to at least 6 surveys. The number of responses to each survey from firms in our sample is in Table A2(a). These numbers are quite even over the survey period, with slightly lower values at the beginning and end.

The composition of the sample by industry and firm size is presented in Figure A1. We present both the distributions of total income and of firms, and to put the sample in perspective include analogous distributions for the population of firms from the administrative data.[23] Panels (a) and (b) show that the distributions of total income and firms, respectively, by industry. In terms of total income, the distribution matches the population quite closely. In terms of firms, the manufacturing and wholesale and retail trade sectors are overrepresented.

[23]The administrative data is for 2018. To be consistent with the sample from the survey, firms with annual total income less than the minimum wage are dropped.

Table A1: Construction of sample

Sample construction step		*Sample size*
0	Full Covid survey sample	7,816
1	Delete firms not answered in April	7,425
2	Merge with administrative data	7,156
3	Drop mining and utilities sectors	6,955
4	Drop if total income $<$ minimum wage	6,952
5	Drop if data missing for productivity	6,745
6	Drop extreme productivity observations	6,626

Notes: Extreme productivity observations dropped in the final step are those in the bottom 1% and top 1% of the productivity distribution for the population of firms.

For the size distributions, size is measured with the number of paid employees at a firm. The survey is clearly tilted towards larger firms relative to the population. Additional cross-sectional moments of the sample and the population are in Table A3. Consistent with firms in the survey being larger than the population, they are also older. The geographic distribution of the sample closely matches the population.

In terms of the construction of variables, we define a firm as having closed permanently if it says that this is its state in the last survey that it answers. Firms who report being in this state are not asked about their sales, employment or use of government policies. Therefore these firms are only included in the analysis that does not use these variables. Specifically, this is the analysis of whether firms closed or remained open in Figure 1(c) and Table 2.

For the construction of the variables for the maximum declines in sales and employment, a few cases require special treatment. These variables are defined as the maximum declines in sales and employment reported by firms over the nine surveys. An issue arises when a firm reports closing permanently in one survey, but then reports being open or only closed temporarily in later surveys. We register such a firm as being closed temporarily in the period in which it reports being closed permanently and impute declines in sales and employment of more than 75% for this period. A second case arises where a firm reports being closed temporarily and fails to provide information about its sales and employment. In this situation we also impute declines in sales and employment of more than 75%.

For the analysis involving productivity in Section 4 we make use of the administrative data for 2018 to compute firm level productivity. The data required to do this is missing for 207 firms so the sample size reduces by this amount.

Table A2: Distribution of sample observations

(a) *Number of responses per survey*

April				May		June		July
6–12	13–19	20–26	27–3	4–17	18–31	1–14	15–28	29–12
4,681	5,573	5,555	5,215	5,159	4,946	5,232	4,462	4,340

(b) *Distribution of firms by number of survey responses*

1	2	3	4	5	6	7	8	9
6.3%	6.1%	5.7%	6.0%	6.9%	8.6%	10.6%	18.5%	31.3%

Notes: Panel (a) is the number of responses from firms in our sample to each wave of the Covid-19 firm survey. Panel (b) is the distribution of firms in our sample by the number of surveys that they responded to. E.g. 31.3% of firms responded to all 9 surveys that were conducted.

We also drop firms with productivity in the top and bottom 1% of the productivity distribution of the population to prevent outliers impacting the results. The sample used for all analysis involving productivity is therefore sample 6 in table A1. The final point regarding the sample is that, for most questions on the survey, firms have the option to not respond. Throughout the analysis, firms without a response to a question being used are dropped. This explains why, for example, the sample sizes in panels (a) and (b) in Table 1 are different, and why the sample sizes in (1) and (2) within these panels are also different. Similarly, firms were only asked about whether they used the government's paid furlough scheme in the final round of the survey, so the sample for the analysis of the use of this policy is restricted to firms answering that survey.

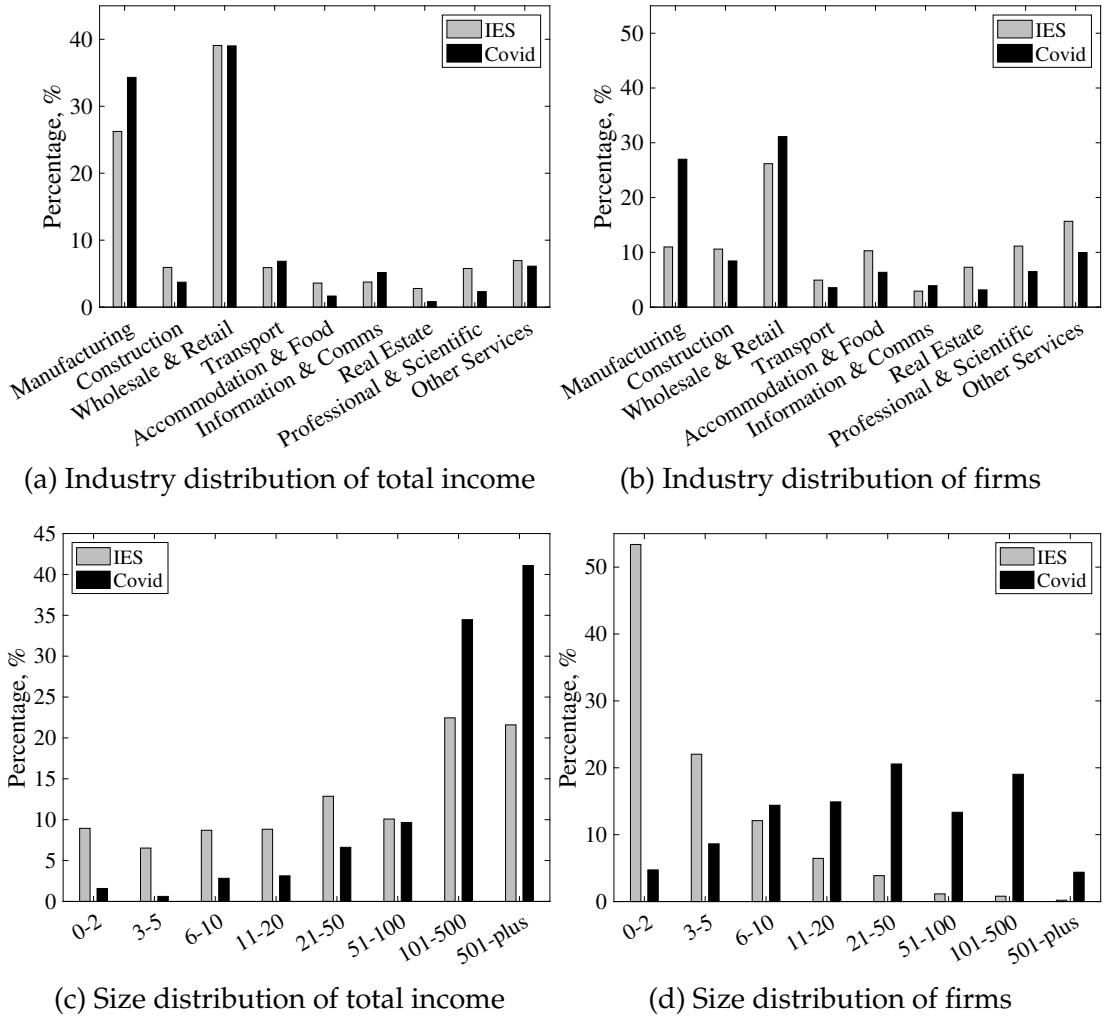
B Government policy details

Paid furlough

On March 26, 2020, the Portuguese government implemented a paid furlough scheme to help hard-hit firms to maintain and pay a fraction of the salaries of their employees. To be eligible for this policy, a firm had to satisfy at least one of the following three conditions: 1) the firm was forced to close (partially or completely) due to lockdown measures; 2) the firm was forced to close (partially or completely) due to problems in its supply chains; or 3) the firm suffered a drop of 40% or more of its sales compared to the previous two months.

The firm could use this paid furlough scheme for all of its employees or for a fraction of them. The employees under this scheme had 2/3 of their gross

Figure A1: Sample composition



(a) Industry distribution of total income

(b) Industry distribution of firms

(c) Size distribution of total income

(d) Size distribution of firms

Notes: This figure presents four distributions from the Covid-19 firm survey and the administrative data for the population of firms. Panel (a) and (b) are the distributions of total and firms, respectively, across industries. Panel (c) and (d) are the distributions of total income and firms, respectively, across firm size. The firm size categories are measured with the number of paid employees.

salary covered, subject to a floor equal to the minimum wage (€635) and a ceiling of €1905. The government paid 70% of this value whereas the firm was responsible for the remaining 30%. More details are available from the Portuguese Labor agency: https://www.dgert.gov.pt.

Debt moratorium

Starting on March 27, 2020, firms and individuals could request a debt moratorium. Firms were eligible to take advantage of this policy if they were not

Table A3: Additional moments of sample and population

	Covid-19 Survey	*Population*
Age		
Mean	26	14
Median	23	10
Std.	17	14
Geographic distribution		
Aveiro	8%	6%
Beja	1%	1%
Braga	8%	8%
Bragança	1%	1%
Castelo Branco	1%	1%
Coimbra	3%	3%
Évora	1%	1%
Faro	4%	5%
Guarda	1%	1%
Leiria	5%	5%
Lisbon	34%	29%
Portalegre	1%	1%
Porto	19%	19%
Santarém	4%	3%
Setúbal	4%	6%
Viana do Castelo	2%	2%
Vila Real	1%	1%
Viseu	2%	3%
Ponta Delgada	1%	1%
Funchal	1%	2%

Notes: For the geographic distribution the country is divided into regions around each of the major cities.

delinquent on their debt and had all their obligations with the Social Security agency met. The policy was originally supposed to last until September 2020, but, in June 2020, it was extended until March 2021.

A firm that opted for this policy could have all debt payments suspended for the duration of the policy. Interest would be capitalized at the contracted interest rate during the period. Alternatively, the firm could opt to pay only the interest. The maturity of the contract was also extended by the same length of time. More information is available from the Portuguese central bank.[24]

Government credit lines

[24]See https://www.bportugal.pt/page/o-banco-de-portugal-e-o-covid-19.

On March 12, the Portuguese government implemented different credit lines focusing on small and medium enterprises of the sectors most affected by the pandemic: restaurants, tourism and manufacturing. Each firm could borrow up to €1.5 million. The maturity was up to 4 years, with a 1-year grace period on interest and principal payments. The interest rate could be either fixed or variable and the spread varied up to 1.5 percentage points.

In early April, these special credit lines were expanded to all sectors in the economy and more resources were devoted to them according to an agreement with the European Commission.[25]

Tax deferral

On March 26, the Ministry of Finance in Portugal issued a decree allowing individuals and firms do delay payment of several taxes without any penalty. Firms could delay the payment of income and value added taxes owed in April, May and June, and start repayment afterward in either three interest-free installments or in six installments where interest only accrued on the last three payments. Social security contributions could also be partially delayed. Throughout March, April and May, firms only had to pay 1/3 of these contributions. The remaining 2/3 could be paid in three or six monthly installments without interest accrual. These payments were supposed to start in July. Finally, payments related to fiscal debt with the government were suspended until July.

Firms were eligible to use these policies if they had yearly sales of no more than €10 million, had been forced to close due to the pandemic, or had a decline in sales of at least 20%.[26]

C Industry level statistics

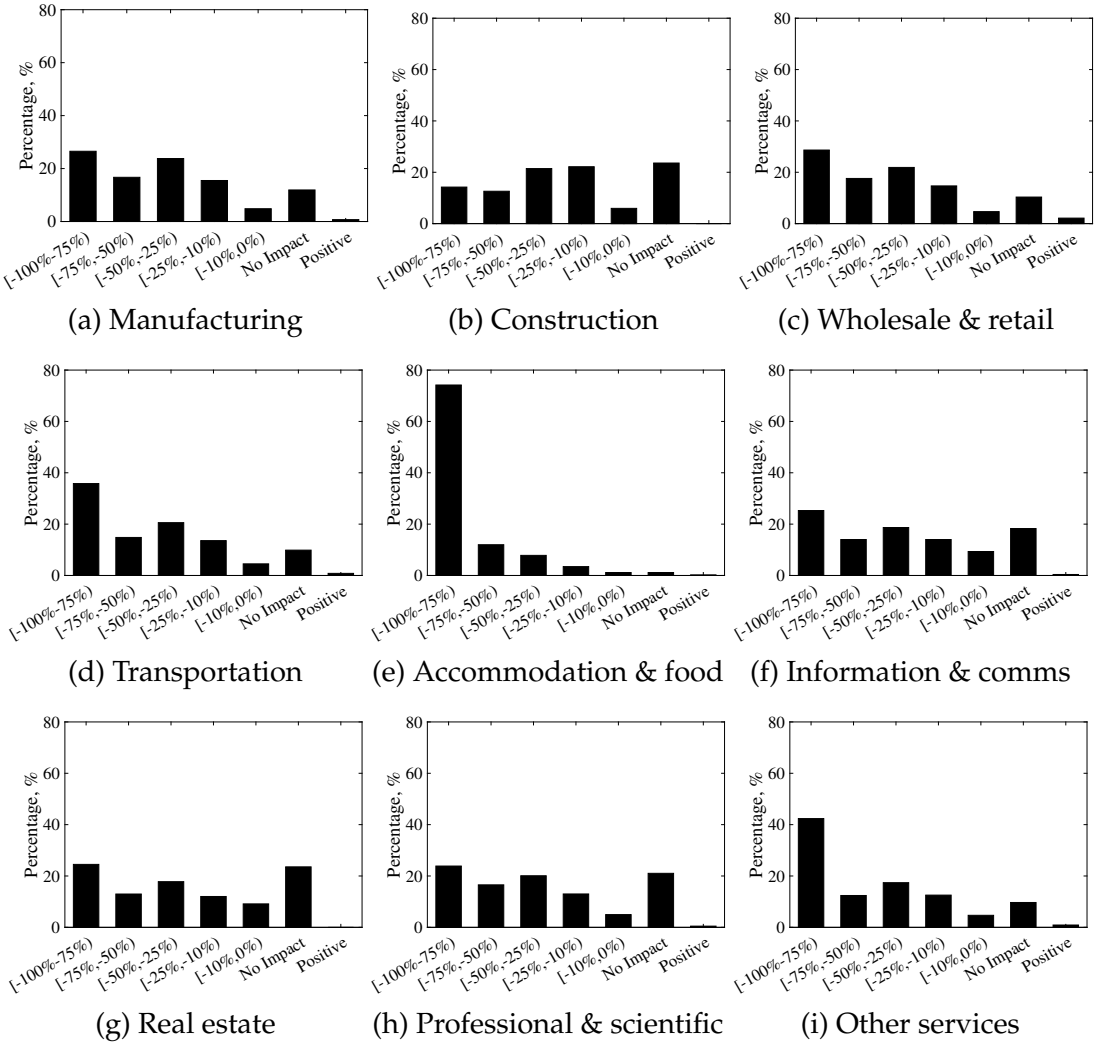
Figures C2 and C3 present the distribution of changes in sales and employment for firms by sector.

D Measurement of firm characteristics

In regressions throughout the paper, firm characteristics are being measured with data from 2018, because this is the most recent available. This raises the concern that firms could have changed between 2018 and March 2020 and, if this was the case, then we would not have good measures of firm characteris-

[25]See https://covid19estamoson.gov.pt/medidas-excecionais/empresas.
[26]See https://dre.pt/application/conteudo/130779505.

Figure C2: Impact on sales by sector



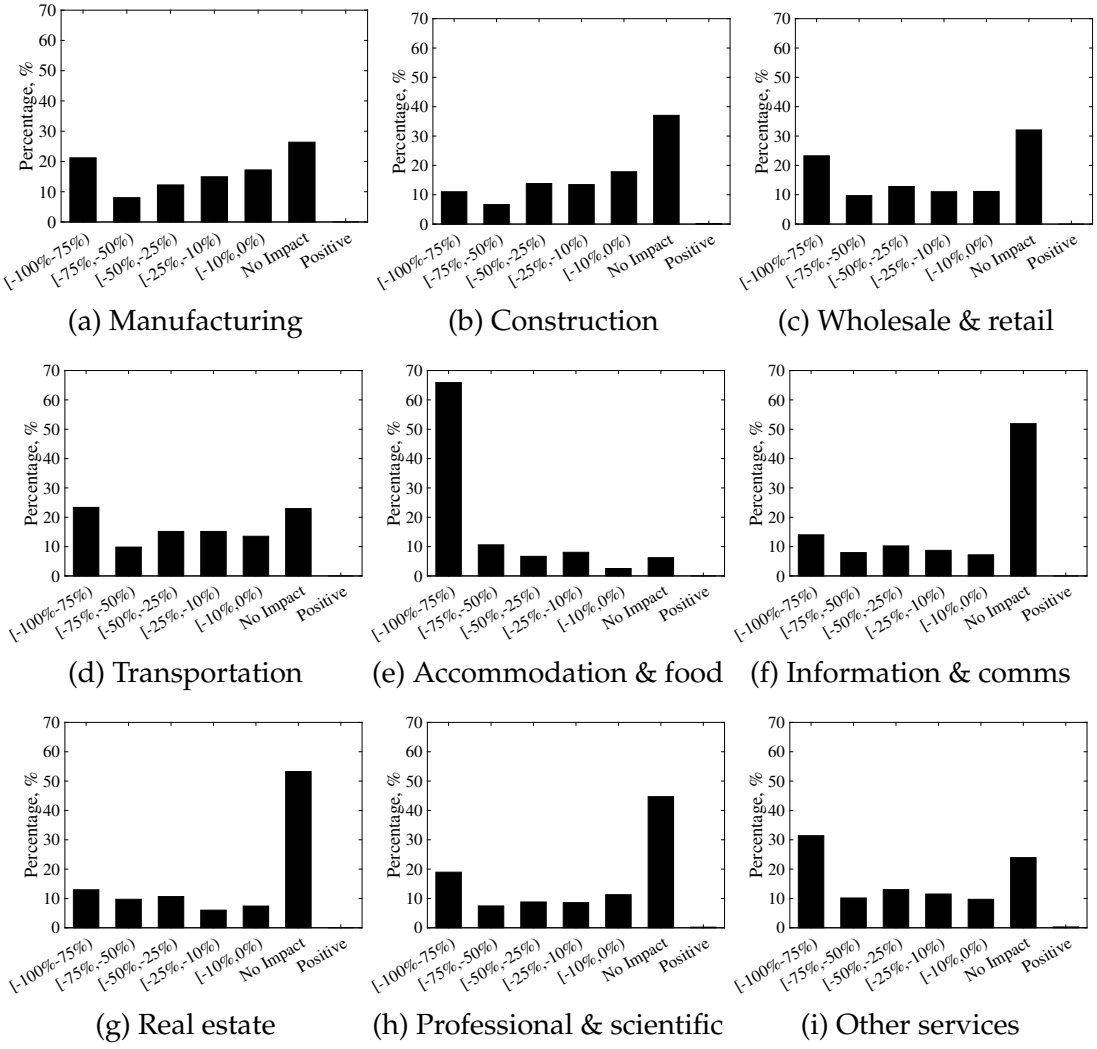
(a) Manufacturing (b) Construction (c) Wholesale & retail

(d) Transportation (e) Accommodation & food (f) Information & comms

(g) Real estate (h) Professional & scientific (i) Other services

Notes: This figure presents the distribution of the percentage change in sales for each sector. The horizontal axis is bins for the percentage change in sales and the vertical axis is the share of firms in each category. A firm's change in sales is measured as its minimum reported in the Covid-19 firm survey (i.e. the maximum decline it experienced).

Figure C3: Impact on employment by sector



(a) Manufacturing (b) Construction (c) Wholesale & retail

(d) Transportation (e) Accommodation & food (f) Information & comms

(g) Real estate (h) Professional & scientific (i) Other services

Notes: This figure presents the distribution of the percentage change in employment for each sector. The horizontal axis is bins for the percentage change in employment and the vertical axis is the share of firms in each category. Employment is measured as the number of employees actively working, which excludes employees on paid furlough. A firm's change in employment is measured as its minimum reported in the Covid-19 firm survey (i.e. the maximum decline it experienced).

Table D4: Total income and productivity correlations, 2016–18

	Total Income		*Productivity*	
	2017	2018	2017	2018
2016	0.976	0.954	0.914	0.875
2017	1.000	0.990	1.000	0.923

Table D5: Input weights for TFP estimation

Sector	α_L	α_M	α_K
Manufacturing	0.15	0.75	0.10
Construction	0.24	0.67	0.09
Wholesale and retail trade	0.32	0.49	0.19
Transportation	0.21	0.65	0.14
Accommodation and food services	0.29	0.56	0.15
Information and communication	0.26	0.52	0.22
Real estate	0.11	0.56	0.33
Professional, scientific and technical activities	0.31	0.55	0.14
Other services	0.36	0.51	0.13

tics at the start of the pandemic. The fact that firms in our sample are relatively large and mature (see Figure A1 and Table A3) somewhat ameliorates this concern. To further address this issue, however, we use earlier years of the administrative data to show that the characteristics of the firms in our sample were very stable from 2016–2018. Since there was no significant shock to the economy between 2018 and the start of the pandemic, this provides evidence that the 2018 results should be a good measure of pre-pandemic firm characteristics.

The firm characteristics that are used in the analysis are productivity, sector, age, total income and whether a firm is in the Lisbon region or not. Of these, sector, age and geographic location are very sticky characteristics so changes in them are not a large concern. Productivity and total income are more prone to change over time. To test their stability, we compute them for firms in our sample for 2016, 2017 and 2018 and present their correlations over time in Table D4. The three TFP correlations range from 0.88 to 0.91 and the total income correlations are all 0.95 and above. These correlations show that these characteristics have been very stable in recent years.

The inputs weights for each sector that are used to estimate TFP with equation 2 are presented in Table D5.

Table E6: Employment contraction for firms with sales decreasing $> 50\%$

	Employment contracted			
	(1)	(2)	(3)	(4)
TFP	-0.013**	-0.013**		
	(0.006)	(0.006)		
TFP Q2			0.023	0.022
			(0.016)	(0.016)
TFP Q3			0.043***	0.043***
			(0.016)	(0.016)
TFP Q4			-0.046***	-0.046***
			(0.016)	(0.016)
Sector FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes
Obs.	2990	2989	2990	2989
R^2	0.034	0.035	0.044	0.044

Notes: All regressions take the form specified in equation (1). The dependent variable y_i is an indicator variable for whether a firm's employment contracted. Sector FE are sector fixed effect. The Controls are age, total income and an indicator for whether a firm is located in the Lisbon region. The sample is restricted to firms whose sales declined by more than 50%. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

E Additional regression results

Table E6 presents a robustness check for the change in employment results in Figure 1(b) in the main text. In this analysis, the sample is restricted to firms whose sales declined by more than 50% and the dependent variable is an indicator variable for whether a firm's employment contracted. When the sample is restricted in this way, the results from the main text hold with higher productivity firms still being less likely to reduce their employment.

A robustness check for the results on policy use is presented in Table E7. This table exactly replicates the exercise in Table 3 in the main text, except that the samples have been adjusted. For panels (a), (b) and (c), the samples are restricted to firms which are eligible to use each policy. In panel (d), the sample is restricted to firms whose sales decreased by more than 50%. In all cases the results are qualitatively the same and quantitatively similar to those in the main text.

Table E7: Government support by productivity

	(a) *Debt Moratorium*				(b) *Govt. Credit Lines*			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
TFP	-0.070***	-0.067***			-0.029***	-0.026***		
	(0.006)	(0.006)			(0.005)	(0.005)		
TFP Q2			-0.042***	-0.039**			0.014	0.017
			(0.016)	(0.016)			(0.013)	(0.013)
TFP Q3			-0.132***	-0.127***			-0.037***	-0.033**
			(0.016)	(0.016)			(0.013)	(0.013)
TFP Q4			-0.193***	-0.185***			-0.080***	-0.073***
			(0.016)	(0.016)			(0.013)	(0.014)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	5365	5364	5365	5364	5331	5330	5331	5330
R^2	0.043	0.046	0.049	0.051	0.026	0.028	0.030	0.032
	(c) *Tax Deferral*				(d) *Paid Furlough*			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
TFP	-0.036***	-0.036***			-0.048***	-0.048***		
	(0.006)	(0.006)			(0.011)	(0.011)		
TFP Q2			-0.019	-0.019			-0.026	-0.029
			(0.016)	(0.016)			(0.031)	(0.031)
TFP Q3			-0.073***	-0.074***			-0.015	-0.015
			(0.016)	(0.016)			(0.030)	(0.030)
TFP Q4			-0.092***	-0.093***			-0.140***	-0.141***
			(0.016)	(0.017)			(0.031)	(0.031)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Obs.	5541	5541	5541	5541	1870	1869	1870	1869
R^2	0.023	0.023	0.024	0.024	0.051	0.053	0.054	0.057

Notes: All regressions take the form specified in equation (1). In panel (a), (b), (c) and (d) the dependent variable y_i is an indicator for whether a firm used the government's debt moratorium, credit line, tax deferral and paid furlough policies, respectively. Sector FE are sector fixed effect. The Controls are age, total income and an indicator for whether a firm is located in the Lisbon region. For panels (a), (b) and (c) teh sample is restricted to firms who are eligible to use each policy. In panel (d) the sample is restricted to firms who had a decline in sales of more than 50% during the survey period. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

F Wages by firm productivity and sector

The average wage in each quartile of the productivity distribution in each sector is presented in Figure F4.

Figure F4: Relative wages