

Coping with COVID-19

Does Management Make Firms More Resilient?

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Abstract

The spread of COVID-19 has disrupted firm operations on a global scale. Using a comprehensive data set that observes over 3,000 firms in 16 countries, including several developing countries, shortly before and after the pandemic, we relate firms' structured management practices to post-COVID-19 outcomes, and report four main findings. *First*, structured management practices are associated with more limited downside impacts of the crisis on firm sales and survival in manufacturing but not in services. Better managed manufacturing firms, on average, experience a

smaller reduction in sales. *Second*, in both manufacturing and services, structured management practice scores are correlated with a firm's ability to adjust or convert product mix and shift to online work arrangements. *Third*, management scores are not correlated with firm's ability to adjust on employment margins. *Fourth*, the resilience of better managed firms is related primarily to incentive practices and is uncorrelated with operations or targeting practices. Monitoring practice scores show a modest correlation with a firm's ability to switch to remote work arrangements.

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Coping with COVID-19: Does Management Make Firms More Resilient?

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1 Introduction

The COVID-19 pandemic has disrupted the daily operations of firms on a staggering scale. Sharp, short-term impacts of the pandemic on firms have been reported across geographies and sectors, with some of the largest effects concentrated in small and medium-sized firms (Apedo-Amah et al., 2020), the back-bone of many developing economies. Using a novel data set collected by the World Bank Group and several partner institutions in 51 countries covering more than 100,000 businesses, their work provides a comprehensive assessment of the short-term impact of the COVID-19 pandemic on businesses across the world-wide with a focus on developing countries. Their findings provide a better understanding of the magnitude and distribution of the shock, the main channels affecting businesses, and how firms are adjusting. While their findings suggest that the distribution of impacts across firms within nations, sectors, and size categories varies widely, and that organization-level factors may be driving these outcomes, they do not offer insights on the mechanisms through which firms become more resilient. This paper explores one such channel, that is, whether structured management practices can help firms cope with the COVID-19 crisis.

A large literature finds that structured management practices are strongly related to firm performance, explaining one-fifth of the variation in total factor productivity across firms within countries (Bloom et al., 2016). This positive association extends to environmental stewardship (Bloom et al., 2010), fair labor practices (Distelhorst et al., 2017), and health or educational outcomes in hospitals and schools, respectively (Bloom et al., 2013, 2015). Given the important and multifaceted role of structured management practices in long-run firm outcomes, it is of interest to understand if these disciplines also help firms adjust in the face of shocks such as the COVID-19 pandemic. On the one hand, highly structured practices could lead to less nimble decision-making, if they require analysis of (not yet available) data or reaching consensus; or, these practices could lead to more sound decisions in crisis, for example, if employees are attuned to changing circumstances and motivated to act in the best interest of the firm.

To the best of our knowledge, this study is the first to examine the role of management practices as a potential mediator of firm-specific responses to the current pandemic. This is despite a large literature on the role of management practices in steady-state firm performance (see for example (Bloom et al., 2016)), and suggestive evidence from earlier studies of firm responses to crisis (Pal et al., 2014; Aghion et al., 2020). The World Bank Enterprise Survey (WBES) collected panel data on firms before and after the onset of the pandemic in 16 countries, where the pre-COVID-19 panel includes a module on management practices. Although the full data set includes over 8,000 matched observations of firms, the management module in the case of manufacturing sector was restricted to firms with over 20 employees. Arguably, this is reasonable and consistent with the size threshold used in Grover and Torre (2019) and Grover et al. (2019), although it limits the subset of firms in the manufacturing sector. We use the subset of the sample that were administered the management module to examine the role of structured practices as a potential mediator of firms' pandemic responses. In addition, we examine whether these effects are influenced by specific types of practices related to operational efficiency, incentives, targeting, and monitoring. A unique feature of our data set is that it spans both manufacturing and services firms, allowing us to examine how management's role varies across these sectors.

We report four main findings. *First*, structured management practices are associated with more limited downside impacts of crisis on firm performance in manufacturing but not in services. Better managed manufacturing firms, on average, experience a smaller reduction in sales. This effect is most pronounced among firms experiencing an above-median decline in sales. They are also less likely to close temporarily or permanently. Services firms, however, are more exposed to lockdown conditions and demand shocks such that management practices may have less of an opportunity to influence changes in sales and firm closures. *Second*, in both manufacturing and services, structured management practice scores are correlated with firm's ability to adjust or convert product mix and shift to online work arrangements. *Third*, most structured management practices are not associated with a firm's

ability to adjust on employment margins. *Fourth*, the resilience of better-managed firms is related primarily to structured incentive practices, and is uncorrelated with operations or targeting practices. Monitoring practices show a modest correlation with the firm’s ability to switch to remote work arrangements.

The remainder of this manuscript is organized as follows. In Section 2, we review the literature that motivates our analysis. In Section 3, we describe our data sources, processing, and summary statistics. Section 4 examines the relationship between structured management practices and firm responses to COVID-19. Section 5 concludes.

2 Related Literature: Systemic Shocks and Firms

We focus our review of the literature on firm responses to one-time shocks that were both unexpected and severe. Examples from prior studies include the 2008-2009 Financial Crisis, terrorist attacks, and natural disasters; among these, the financial crisis is perhaps closest recent analog to COVID-19, since both are systemic global shocks, although COVID-19 disruptions arguably had a greater impact on day-to-day firm operations through multiple channels, beyond finance.

Prior studies have examined the antecedents of crisis resilience, but few have focused on factors related to management. For example, firm performance after the financial crisis has been linked to access to capital and network resources, which provide strategic and operational sources of flexibility and resilience (e.g. see Pal et al. (2014) for Sweden). Firms with decentralized decision-making, measured by the extent of delegation to local plant managers, are found to outperform firms with more centralized structures (Aghion et al., 2020). Firms with high social capital (defined by the intensity of social responsibility investments) had higher stock market returns after the financial crisis by 4-7 percentage points, compared to firms with low social capital, and performed better on measures of profitability, growth, sales per employee, and ability to raise debt (Lins et al., 2017). Family ownership and related

governance structures were also found to insulate firms during the financial crisis (Minichilli et al., 2016). The one study to examine the management-crisis response nexus found that managerial ability helped dampen the negative effect of crude oil price uncertainty on firm performance in the United States between 1983 and 2016 (Phan et al., 2020).

The pandemic has prompted a new wave of studies quantifying effects on firms, primarily using surveys. Baker et al. (2020) show that COVID-19 increased economic uncertainty. Revenue loss, mass layoffs, closure, and liquidity have been impacted for firms in China (Dai et al., 2020), the U.S., and Europe (Bartik et al., 2020; Humphries et al., 2020; Abigail Adams-Prassl, Teodora Boneva, Marta Golin, 2020; Fairlie, 2020). While many firms confronted multiple effects at once, depressed demand is most often reported and has become a more prominent concern where pandemic disruption persists (Dai et al., 2020; Balleer et al., 2020). Firms in the United States show increases in cash holdings in March 2020 as COVID-19 fears mounted (Acharya and Steffen, 2020), while revenue loss has led to financial distress among SMEs in hard-hit locations (Bartik et al., 2020; Zhang). Among these studies, there are very few systematic surveys of firm responses across sectors and countries. Beck et al. (2020) show evidence from 500 firm survey responses across 10 emerging countries that firms responded to the pandemic by reducing investment than by reducing payrolls, while surveys of firms operating on e-commerce platforms reveal sales and employment suffered among SMEs (Facebook and World Bank, 2020). These are not unexpected findings, given that the pandemic has been strongly associated with increased uncertainty among firms (Altig et al., 2020). Data collected by the World Bank from over 100,000 firms in 51 primarily low- and middle-income countries using short COVID-19 Business Pulse Surveys (COV-BPS), reveal that firms focused post-COVID-19 labor adjustments along the intensive margin, by increasing furloughs and reducing working hours, with only a small fraction laying off workers (Apedo-Amah et al., 2020). This study further underscores that the shock has exacerbated financial constraints most among small firms. While the long-run effects of the shock have yet to be measured, Barrero et al. (2020) use survey evidence to argue that the pandemic is in

part a reallocation shock, estimating that 42% of COVID-related layoffs may be permanent.

The rapidly growing literature on COVID-19 sheds initial light on factors that have enabled firms to cope with and survive the shock, but thus far none has focused on management. Among these factors, prior studies suggest that access to government support plays an important role. For instance, short-term government support has been shown to speed up economic recovery, especially for SMEs (Bruhn, 2020; De Mel et al., 2012). Initial studies of the Paycheck Protection Program in the United States showed that receiving grants was associated with increased employment and business survival, but allocation of these grants was skewed towards larger firms (Humphries et al., 2020). Perhaps the only study to consider a broad range of internal and external factors using a large data set in the COVID-19 setting is Ding et al. (2020), which finds that a stronger pre-COVID-19 financial position, less exposure to COVID-19, non-financial corporate (as opposed to hedge fund) ownership, more corporate social responsibility activities, and less entrenched executives were associated with higher post-lockdown stock market returns. The relationship between management and firms' COVID-19 responses has not yet been well studied.

3 Data and Stylized Facts

3.1 Data Preparation

We rely on two waves of data collected by the World Bank Enterprise Surveys (WBES). The first wave of data was conducted in 2018 or 2019, which we combine with observations of the same firm in a short follow-up COVID-19 survey conducted after April 2020. Our sample therefore provides a snapshot of firm status before and after the onset of the pandemic (approximately six months to 1.5 years apart). The first wave includes detailed information about a firm's productive activities, financial situation, employment, and management practices. Of the 29 countries covered by the WBES in the COVID-19 follow-up surveys, we focus on those 16 countries where a survey module on management practices was adminis-

tered.¹ Our final data set includes 8,748 firm observations. However, management practice information for manufacturing firms was collected only if the firm had over 20 employees, which reduced our sample size to about 4,000 firms.²

The overall or general management score is calculated using eleven questions from the management practice module. These questions map to eight questions from the United States Management and Organizational Practices Survey (U.S. Census Bureau, 2015). They cover four categories of practices: target-setting, monitoring, incentives, and operations. Firms' responses to questions on management practices are aggregated into an overall management score following Bloom et al. (2019) in two steps. First, the responses to each of the management practice questions are normalized on a 0-1 scale: the response associated with the most structure and prevalence is normalized to one, and the one associated with the least is normalized to zero. Second, the overall management score is calculated as the unweighted average of the individual question scores. We use these scores to compute descriptive statistics. For regression analysis, we take the z-score of the overall management score for ease of interpretation. Summary statistics for management practices and other firm characteristics are shown in Appendix Table A2.

3.2 Descriptive Analysis

In this paper we focus on six outcomes reported in the WBES COVID-19 surveys, including: (i) change in sales (%), (ii) closure (temporary and permanent), (iii) number of employees furloughed or laid off (as a share of total pre-COVID-19 initial level), (iv) partial or full adjustment or conversion in product or service mix (“pivoting”), (v) an increase in online work arrangements, and (vi) probability to fall into arrears.³ In our descriptive analysis,

¹We dropped observations for the Turkish Cypriot Community (TCC) and Armenia due to lack of data on lockdown stringency, and for Mongolia due to concerns about the quality of data on management practices.

²Manufacturing firms with more than 20 employees had 35 times larger median pre-COVID-19 revenue and experienced 1.4 times higher labor productivity relative to those with fewer than 20 employees. A larger share of these firms are exporters and have a website. These firms also witnessed lower decline in sales post-COVID-19, and were more likely to remain open. See Appendix Table A1.

³Outcomes (ii), (iv), (v), and (vi) are binary responses.

we focus on four categories representing major adjustment margins: change in sales, firm closure (temporary or permanent), pivoting, and an increase in remote work arrangements.⁴ To make comparisons across various dimensions, our regressions always control for size, sector, timing of survey, and country fixed effects.

We find several interesting patterns. *First*, post-COVID-19 reductions in firm sales and closure rates were lower in high-income countries (Figure 1). The wide variation in the cross-country post-COVID-19 changes in sales, conditional on other characteristics, ranged between 12% and 54% broadly follows differences in income level. A country’s ability to devote more resources (medical, financial, or otherwise) to managing the pandemic may have mitigated firm-level disruption. The predicted probabilities of remaining open tell a similar story: in general, firms in wealthier countries show a lower predicted probability of firm closure relative to poorer countries.⁵

Second, the probability of adjustments to operations appears to be related to the severity of impact (measured as decline in sales) experienced by the country (Figure 1). Predicted probability of pivoting ranges from 0.05 to 0.75, with hard-hit countries displaying the highest rates. Less affected high-income countries showed a lower propensity to pivot their product mix. Pivoting may be more strongly affected by country-specific characteristics relevant to the COVID-19 response (e.g. presence of a relevant manufacturing base). Cross-country variation in shifting online is relatively large, with a probability in the country with the highest propensity to use remote work arrangements (Russian Federation) of nearly twenty-five times that of the country with lowest propensity (Bulgaria). Countries experiencing the lowest closure rates (Slovenia, Hungary, and Croatia) and the least sales reductions (Hungary, Slovenia, and Belarus) may have mitigated these impacts by moving operations online.⁶

⁴Results for other outcomes (furloughs, layoffs, and probability of falling into arrears) are presented in Appendix Figure A1 (by country), Figure A2 (by sector), and Figure A3 (by size).

⁵Exceptions include the Russian Federation, which experienced a modest change in sales but had a relatively high rate of closure.

⁶There is also a large dispersion between the propensities of Poland and Italy, two high income countries, to increase online work arrangements.

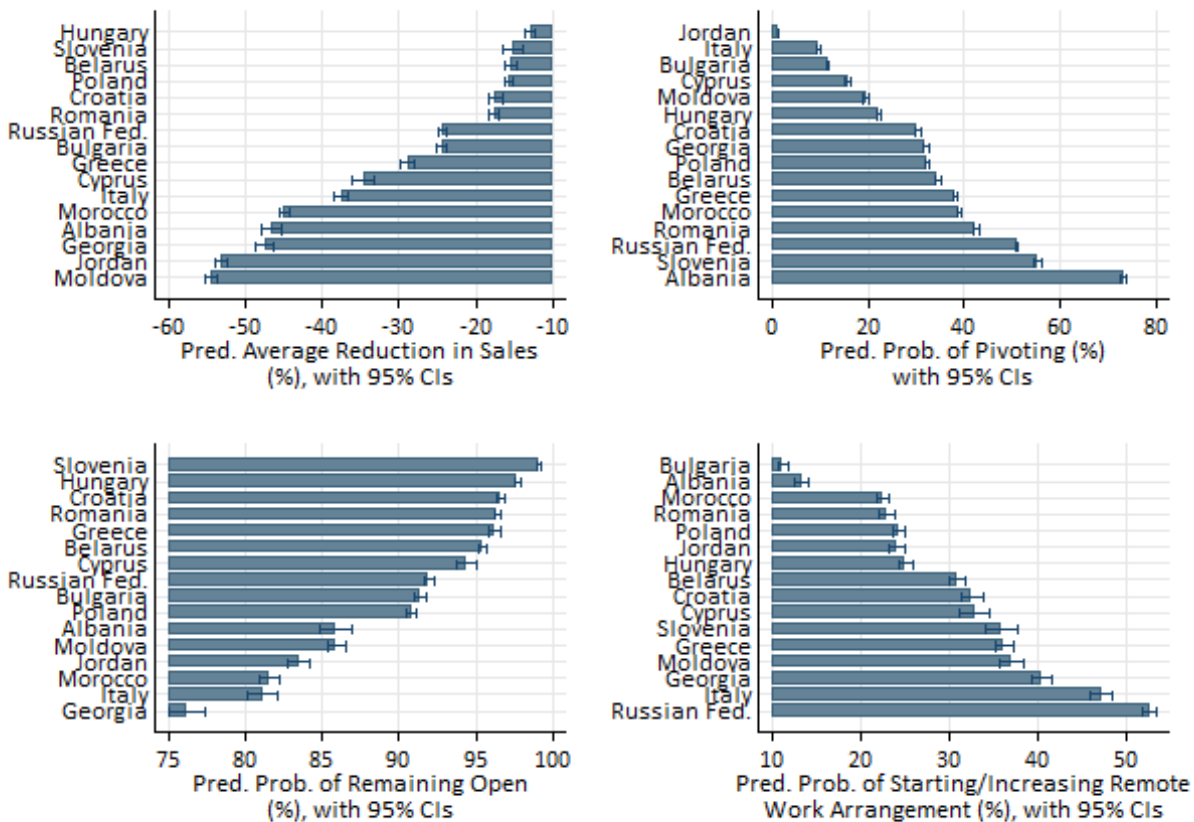


Figure 1: Firm Responses to COVID-19 by Country

Third, firms in the services sector experience sharper reductions in sales after COVID-19, relative to manufacturing firms, and are also more likely to close (Figure 2). This is perhaps not surprising, given that services firms may be more likely to require co-location of employees and close interaction with customers. At the ISIC 2-digit sector level, the average face-to-face interaction index for services is 5.51 compared to 3.98 in manufacturing.

Fourth, adjustments to a firm’s operational model were more prevalent in services relative to manufacturing (Figure 2). Pivoting is much more likely in the services sectors, with the exception of clothing manufacturing, which may have been due to the re-purposing of production lines to make medical supplies and protective equipment. Propensity to increase remote work is similar and shows a high dispersion, although it appears less prominent in “mobile” services industries such as vehicle services and food services/hotels.

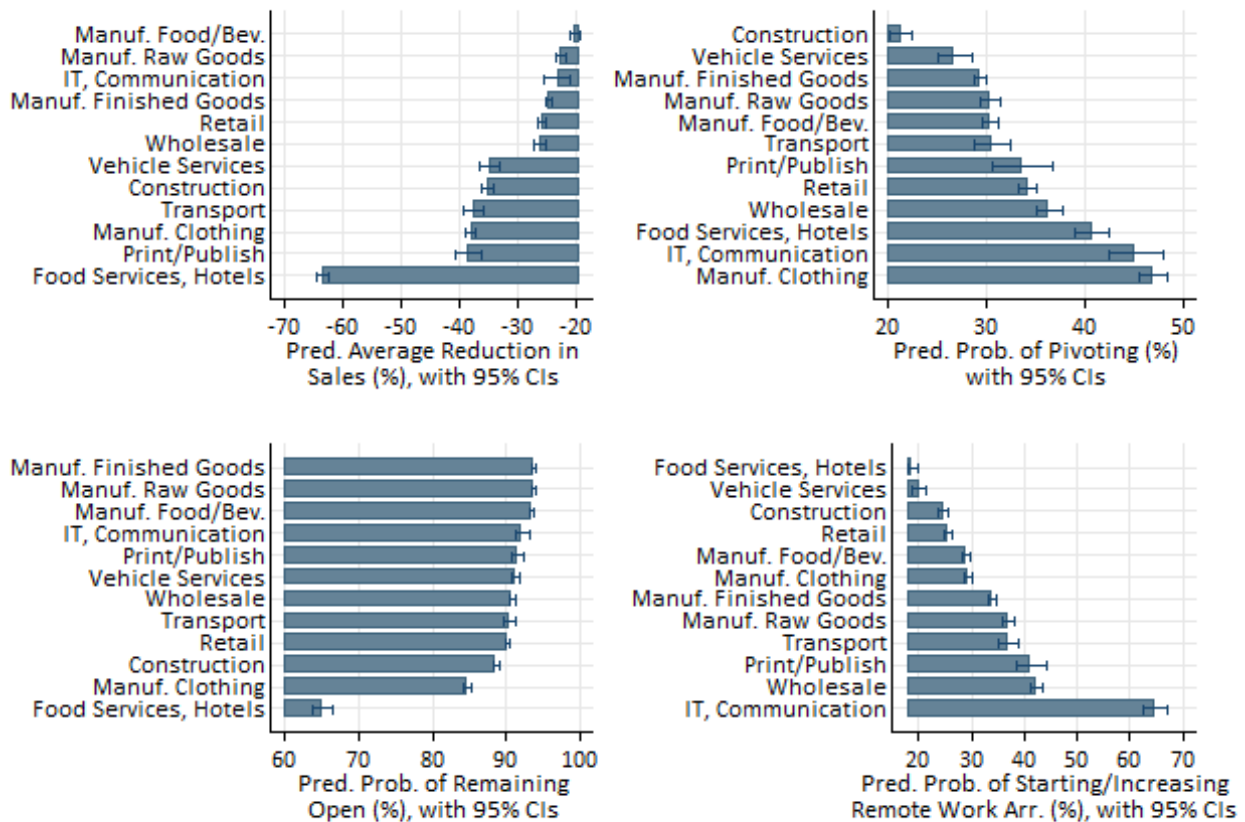


Figure 2: Firm Responses to COVID-19 by Sector; Remote Work Arr. is remote work arrangement

Fifth, there are sharp and significant differences between small and large firms in terms of the impact of COVID-19 (Figure 3).⁷ Small firms were hit hardest on all measures: they experienced larger reductions in sales and to be more likely to close, conditional on other characteristics. They are also less likely to pivot, or to move to a remote work arrangement, relative to both medium and large firms. These differences are all statistically significant. These findings on firm size are broadly consistent with those reported in Apedo-Amah et al. (2020).

⁷Small firms have fewer than 20 employees, medium firms have 20 to 100, and large firms have more than 100.

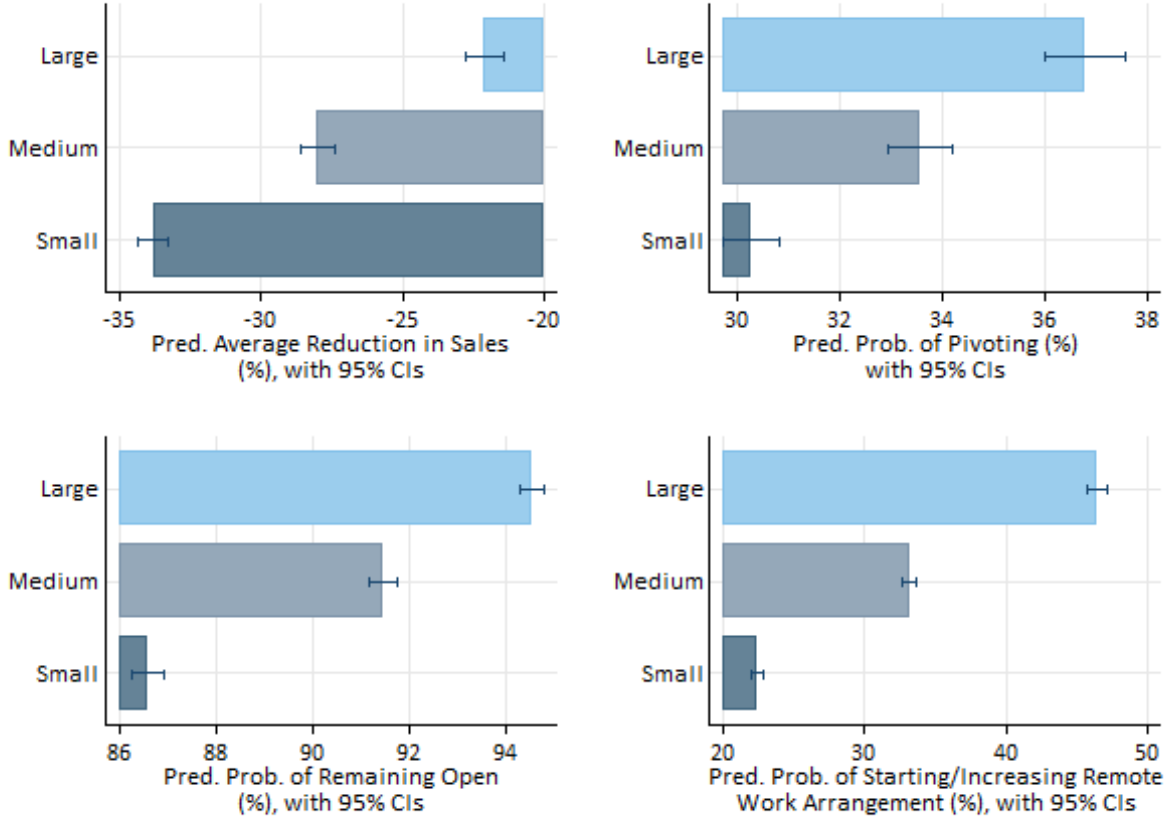


Figure 3: Firm Responses to COVID-19 by Firm Size

4 Management Practices and Resilience to COVID-19

4.1 Empirical Approach

Next we turn to examine whether management practices measured prior to the onset of COVID-19 are associated with firms' post-COVID-19 outcomes. Using regression analysis, we examine correlations between management practices and a vector of eight outcome measures ΔY , described in the prior section. To our knowledge, this is the largest set of COVID-19 outcomes considered in any study thus far. We estimate the following regression specification:

$$\Delta Y_i = \alpha_0 + \beta_M M_i^{g,e} + \beta_x^T \mathbf{x}_i + \epsilon_i. \quad (1)$$

Regressions are estimated using ordinary least squares (OLS) for continuous variables, with probit models used in the case of binary dependent variables. Controls \mathbf{x}_i included in all regressions are size (log employees), sales (log real USD), age (years), timing of lockdown relative to interview (days), country, sector, and export dummy. Manufacturing and services exhibit distinct responses to the COVID-19 shock. We therefore run regressions for each of these categories separately.⁸

For identification, we rely on the fact that the onset of COVID-19 was not possible to predict prior to the outbreak in Wuhan in early 2020. Reverse causality, e.g. that firms adjusted management practices in response to COVID-19, can be ruled out, given the unexpected timing and short adjustment horizon. The effect of management that we estimate thus reflects the extent to which pre-existing structured practices enabled firms to respond to the shock along various margins. By focusing on the deltas in each outcome variable, we control to some extent for firm-level characteristics, including performance prior to COVID-19. We also explicitly control for variables such as firm size and sales revenue that have previously been found to correlate positively with management (Bloom and Van Reenen, 2007).

4.2 Manufacturing

Using estimation results of equation (1) for the manufacturing sector are reported in Table 1, we make several observations. *First*, Management practices help mitigate the negative effect of COVID-19 on firm sales and on the probability of temporary and permanent closures. The relationship between management and the change in sales (reported as share change from last year’s sales) is positive, and statistically-significant: a one standard deviation increase in management score trims the reduction in sales by 3.6%. This impact is larger than the

⁸Incomplete observations for some independent variables reduce the precision of model estimates. We retain only those variables that result in a net increase in the regression R-squared or pseudo R-squared in at least one of the specifications, and do not reduce it in others.

pre-COVID-19 economic size effect (measured in log of sales).⁹ It suggests that structured management practices may play an important role in coordinating internal responses to shocks. We also examine the magnitude of the effect of management practices across the full range of the dependent variable using quantile regression, and find that the effect is highly significant for the firms hit hardest by COVID-19 (Table A3). Structured management practices are also associated with a reduced likelihood of a firm’s temporary or permanent closure during the pandemic: a one-standard-deviation increase in management score reduces both the likelihood of temporary and permanent closure by 2.3%.

Second, there is no statistically-significant relationship between management score and the share of employees that were furloughed or laid off.

Third, management practices in manufacturing strongly correlate with firms’ ability to adjust their product or service mix. Pivoting may ultimately help limit reductions in sales or lower probability of firm closure. Management score is strongly and significantly associated with pivoting and with switching to a remote work arrangement.¹⁰ These responses are likely to be new imperatives specific to COVID, and firms capable of making such shifts may also be more resilient to sales, closure, and furlough pressures because these adjustments enabled them to sustain or seek new sources of revenue and/or reduce costs.

Fourth, firms with higher scores on the incentive practices component of the overall management score show a positive and significant correlation with post-COVID-19 outcomes (Table 2). The result holds for sales reduction, temporary closure, pivoting product mix, and moving to remote work arrangements. Adjustments on the margins of employment (furloughs and layoffs), and permanent closure of firms are the only outcomes that are invariant to incentive practices. This is consistent with the challenge of increased uncertainty due to the

⁹The dependent variable is the difference in post-COVID-19 sales compared to the same month in 2019, while the pre-COVID-19 log sales is the annual sales in 2019. It proxies for firm size and together with employment it controls for firm’s labor productivity. Including labor productivity, in lieu of sales, does not change our results.

¹⁰As shown in the Table 1, pivoting is not correlated with pre-COVID-19 size or sales measures. Switching to remote work arrangements is associated with these initial conditions but to a lesser extent than management.

Table 1: Relationship between general management and post-COVID outcomes; manufacturing.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ Sales	Temp.	Perm.	Furloughed	Laid Off	Pivot Product	Remote Work	Arrears
Management	0.036*** (0.013)	-0.330*** (0.109)	-0.353*** (0.124)	-0.028 (0.070)	0.052 (0.079)	0.141** (0.061)	0.231*** (0.061)	-0.207*** (0.066)
Size (log)	0.004 (0.007)	-0.127* (0.070)	0.043 (0.068)	0.177*** (0.046)	0.097** (0.049)	0.040 (0.039)	0.107*** (0.039)	0.005 (0.042)
Sales (log)	0.023*** (0.005)	-0.056 (0.040)	-0.092** (0.042)	-0.118*** (0.031)	-0.057* (0.032)	-0.031 (0.026)	0.088*** (0.026)	-0.066** (0.027)
Observations	2332	2229	1863	1767	2386	2391	2391	2208
Adjusted R^2	0.181							
Pseudo R^2		0.178	0.153	0.149	0.098	0.103	0.111	0.103
df_m	24	21	19	22	24	24	24	24

Notes: Standard errors in parentheses

(1) is change in sales (share). (2) is temporary firm closure. (3) is permanent firm closure. (4) and (5) are whether workers were furloughed or laid off. (6) refers to pivot of product or service offered. (7) is starting or increasing remote work arrangement. (8) is whether the firm is likely to fall into arrears. Lockdown is # days from lockdown to interview. All specifications include controls for country, sector, number of days from lockdown, firm age, and export dummy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Relationship between management sub-scores and post-COVID outcomes; manufacturing.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ Sales	Temp.	Perm.	Furloughed	Laid Off	Pivot Product	Remote Work	Arrears
MS: Operations	0.004 (0.007)	-0.074 (0.079)	-0.124 (0.076)	-0.015 (0.040)	0.044 (0.043)	0.032 (0.034)	0.008 (0.034)	-0.001 (0.037)
MS: Monitoring	0.005 (0.007)	-0.022 (0.077)	-0.103 (0.093)	-0.103** (0.044)	0.015 (0.049)	0.032 (0.038)	0.090** (0.037)	-0.035 (0.042)
MS: Targeting	0.003 (0.008)	0.012 (0.081)	-0.041 (0.081)	0.042 (0.050)	0.024 (0.052)	0.017 (0.042)	-0.013 (0.041)	-0.048 (0.045)
MS: Incentives	0.025*** (0.009)	-0.289*** (0.096)	-0.095 (0.093)	0.043 (0.054)	-0.027 (0.063)	0.094** (0.048)	0.114** (0.047)	-0.159*** (0.052)
Size (log)	0.001 (0.008)	-0.051 (0.080)	0.141* (0.079)	0.208*** (0.052)	0.117** (0.055)	0.027 (0.043)	0.110** (0.043)	0.020 (0.047)
Sales (log)	0.024*** (0.005)	-0.093** (0.043)	-0.131*** (0.047)	-0.122*** (0.034)	-0.069* (0.036)	-0.020 (0.028)	0.081*** (0.028)	-0.074** (0.030)
Observations	2063	1958	1551	1567	2108	2113	2115	1954
Adjusted R^2	0.187							
Pseudo R^2		0.166	0.150	0.160	0.099	0.111	0.109	0.106
df_m	27	24	21	25	27	27	27	27

Notes: Standard errors in parentheses

All specifications include controls for country, sector, number of days from lockdown, firm age, and export dummy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

pandemic, which may have reduced the importance of routine operating and target-setting practices, relative to the ability to motivate employees to adjust course to reconfigure daily practices or take advantage of emerging opportunities.

Fifth, for certain outcomes, monitoring practices also appear to be important. For example, strong monitoring practices are positively associated with shifting to remote work arrangements (column 8, Table 2), perhaps because it gives leaders the confidence that employees will not shirk, although this effect may depend on the presence of strong incentives. Monitoring practices are associated with reduced furloughs (column 4, Table 2).

4.3 Services

The relationship between management practices and post-COVID-19 outcomes for services firms is estimated using estimation equation (1) and reported in Table 3. We make the following observations: *First*, when compared to manufacturing firms, patterns in the services sector are different with respect to firm outcomes on sales and survival.¹¹ Management is not correlated with post-COVID-19 performance in services, as measured by sales changes and temporary closure, although better managed services firms show some resilience from permanent closures.

Second, the patterns in the services sector are similar to that in manufacturing when it comes to adjustments on employment and operating model. We see a null relationship between management practices and furloughs and layoffs and a positive and significant relationship with respect to pivoting product mix and switching to remote work arrangements. Regardless of size, these strategies may have helped services firms overcome structural disadvantages, due to employment size, sales, or face-to-face contact requirements of the core business, offsetting negative pressures but not resulting in gains in the short-run.

¹¹In order to obtain a more direct comparison with manufacturing firms, we run regressions that exclude services firms with less than 20 employees (as management scores are only reported for manufacturing firms with greater than 20 employees). Significance on the management coefficient disappears completely, and results are otherwise similar in direction and significance to those reported for the full sample.

Table 3: Relationship between general management and post-COVID outcomes; services.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ Sales	Temp.	Perm.	Furloughed	Laid Off	Pivot Product	Remote Work	Arrears
Management	-0.027 (0.017)	0.171 (0.138)	-0.282* (0.163)	0.067 (0.078)	0.014 (0.091)	0.265*** (0.075)	0.398*** (0.076)	-0.043 (0.076)
Size (log)	0.004 (0.012)	-0.197** (0.091)	-0.070 (0.105)	0.088 (0.056)	0.171** (0.069)	0.028 (0.051)	0.179*** (0.051)	-0.120** (0.054)
Sales (log)	0.021** (0.009)	0.030 (0.058)	-0.029 (0.058)	-0.044 (0.037)	-0.064 (0.042)	0.026 (0.033)	0.070** (0.034)	-0.014 (0.035)
Observations	1377	1124	1048	1189	1224	1426	1425	1326
Adjusted R^2	0.269							
Pseudo R^2		0.306	0.119	0.107	0.061	0.133	0.158	0.107
df_m	28	24	24	26	25	28	28	28

Notes: Standard errors in parentheses

All specifications include controls for country, sector, number of days from lockdown, firm age, and export dummy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Third, for services firms, the pre-COVID-19 firm size (employment and sales) holds greater explanatory power than management practices in explaining firm outcomes on sales, survival and employment adjustment on intensive margins. There are several possible reasons why these factors, rather than management, exerted more influence on services firms' outcomes. The consumer-oriented nature of many services may have left them more exposed to lockdowns and mandatory restrictions on travel (especially in industries such as transportation services and hotels), and hence demand shocks. Hence, services firms have fewer alternatives. Larger firms can access government support more easily (Apedo-Amah et al., 2020), because of the size of the employees potentially affected by closure and in this scenario structured management practices may have little to offer, to the extent that they were beyond a firm's control.

Fourth, as in the case of manufacturing, incentive practices are the strongest predictor of post-COVID-19 observed outcomes in services. As noted above, management practices helped services firm adjust on operational outcomes only, and these adjustments were helped by human resource practices. As in manufacturing, monitoring practices are found to be important for remote working arrangements in services as well, but less so than incentives (the difference between the two coefficients is statistically significant).

Table 4: Relationship between management sub-scores and post-COVID outcomes; services.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δ Sales	Temp.	Perm.	Furloughed	Laid Off	Pivot Product	Remote Work	Arrears
MS: Operations	-0.001 (0.010)	0.082 (0.085)	-0.204** (0.096)	0.022 (0.044)	0.024 (0.055)	-0.039 (0.041)	0.033 (0.042)	-0.017 (0.046)
MS: Monitoring	-0.008 (0.010)	0.172* (0.088)	0.084 (0.084)	0.045 (0.054)	0.060 (0.067)	0.028 (0.049)	0.091* (0.049)	0.020 (0.051)
MS: Targeting	-0.014 (0.011)	-0.126 (0.099)	-0.014 (0.100)	-0.078 (0.057)	-0.183** (0.073)	0.050 (0.053)	0.085 (0.053)	0.016 (0.055)
MS: Incentives	-0.007 (0.013)	0.107 (0.101)	-0.175 (0.124)	0.029 (0.065)	0.059 (0.082)	0.161*** (0.061)	0.172*** (0.060)	-0.075 (0.063)
Size (log)	0.003 (0.014)	-0.176* (0.101)	-0.127 (0.116)	0.095 (0.061)	0.186** (0.076)	0.017 (0.056)	0.187*** (0.056)	-0.085 (0.060)
Sales (log)	0.019** (0.009)	0.002 (0.059)	0.026 (0.062)	-0.034 (0.040)	-0.067 (0.048)	0.043 (0.036)	0.071* (0.037)	-0.034 (0.038)
Observations	1173	867	843	1020	1034	1215	1213	1130
Adjusted R^2	0.266							
Pseudo R^2		0.305	0.133	0.120	0.070	0.153	0.172	0.116
df_m	31	26	26	29	28	31	31	31

Notes: Standard errors in parentheses

All specifications include controls for country, sector, number of days from lockdown, firm age, and export dummy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Conclusion

We quantify changes in performance, labor practices, and operational adjustments during of the early months of the COVID-19 pandemic across firms in 16 countries, focusing on a wide variety of outcomes, including firm sales, closures, and adjustments to employment and operations. In the set of 16 countries examined in this paper, our analysis finds that the severity of the impact of COVID-19 on firm sales and closure was lower in high-income countries, and the probability of adjustments to operations may be related to the severity of the shock experienced. Compared to manufacturing, our descriptive analysis shows that services firms experienced sharper post-COVID-19 reductions in sales, while the probability of pivoting or starting a remote work arrangement was highest in the services industries that rely less on mobility services (e.g., IT, communication). The major exception was clothing manufacturers, which showed the highest probability of pivoting product mix. Among the industries we examined, food service firms and hotels were most likely to close.

We present modest evidence consistent with the possibility that better-managed firms are more resilient to the disruption caused by the COVID-19 pandemic, and especially so in manufacturing. Management practices help mitigate the negative effect of COVID-19 on manufacturing firm sales and on the probability of temporary and permanent closures but not on adjustments in employment. Management practices in manufacturing strongly correlate with firms' ability to pivot product mix by adjusting operations, which may translate into better outcomes on sales and firm closures. The patterns in the services sector are different from those in manufacturing with respect to firm outcomes on sales and survival. Services activities may require greater face-to-face interaction with suppliers and customers, exposing these firms to lock-down conditions and resulting demand shocks. Nevertheless, in services firms are similar to those in manufacturing when it comes to the positive association between management score and adjustments on employment and product mix. Better managed services firms are able to pivot their product mix and switch to remote work arrangements. As we cannot narrowly attribute these resilience outcomes to management practices exclusively,

our results should be interpreted as indicating fruitful directions for future work.

Finally, the most striking finding in our paper is the fact that management's relationship to resilience outcomes runs strongly and primarily through incentive practices. Incentive practices may reflect employees' intrinsic motivation to act in the best interest of the firm. Employees may also feel reassured during a crisis that leaders will continue to reward high performance, that they will not lay off workers, and/or that they will work harder or more cooperatively in order to respond. For limiting furloughs and increasing remote work arrangements, we find evidence that monitoring practices are important. Other management disciplines, such as operations and target setting may arguably be more important when operating conditions are stable and predictable. Future research could focus on quantifying the value of investing in incentive practices to mitigate downside risks in the face of crisis.

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Supplementary Material

A1 Data Preparation

Table A1: Differences in manufacturing firms taking the management module or not

	Size<20	Size≥20
Median Pre-COVID-19 sales, USD	282,353	2,880,134
Median Labor productivity, USD/employee	27,042	37,798
Share of exporting firms	28%	57%
Share of firms with website	62%	75%
Post-COVID-19 change in sales (p50)	-30%	-20%
Share firms that pivoted product-mix, post-COVID-19	29%	35%
Share firms that remained open, post-COVID-19	89%	94%
Share of firms that started remote work, post-COVID-19	21%	39%

Table A2: Summary Statistics

	Obs	Mean	SD	p25	p50	p75	p95
MS: Overall	4554	0.50	0.20	0.38	0.53	0.65	0.8
MS: Operations	3979	0.69	0.26	0.67	0.67	1	1
MS: Monitoring	4438	0.41	0.34	0	0.33	0.67	1
MS: Targeting	4506	0.45	0.31	0	0.53	0.7	0.9
MS: Incentives	4539	0.49	0.31	0.33	0.5	0.75	1
R&D expenditure (share)	7506	0.00	0.08	0	0	0	0.01
Log(Size)	8676	3.32	1.36	2.20	3.09	4.32	5.74
Log(Sales)	7692	13.80	2.02	12.41	13.71	15.19	17.25
Skilled labor (share)	4064	0.27	0.24	0.08	0.20	0.4	0.80
Age (years)	8626	20.93	15.14	11	18	27	47

Table A3: Relationship between Management and Change in Sales (Share); Manufacturing

	(1)	(2)	(3)	(4)	(5)
	q10	q25	q50	q75	q90
Management	0.056** (0.023)	0.032* (0.017)	0.046*** (0.016)	-0.000 (0.010)	0.004 (0.016)
Size (log)	-0.011 (0.015)	0.014 (0.011)	0.015 (0.010)	-0.000 (0.006)	-0.000 (0.010)
Sales (log)	0.045*** (0.010)	0.024*** (0.007)	0.017*** (0.007)	-0.000 (0.004)	0.006 (0.006)
Observations	2332	2332	2332	2332	2332
df_m	24	24	24	24	24

Notes: Standard errors in parentheses

All specifications include controls for country, sector, number of days from lockdown, firm age, and export dummy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Relationship between Management and Change in Sales (Share); Services

	(1)	(2)	(3)	(4)	(5)
	q10	q25	q50	q75	q90
Management	-0.029 (0.034)	-0.049** (0.022)	-0.031 (0.022)	0.000 (0.019)	0.008 (0.025)
Size (log)	0.008 (0.024)	-0.000 (0.016)	0.007 (0.016)	0.000 (0.013)	-0.001 (0.017)
Sales (log)	0.018 (0.015)	0.027*** (0.010)	0.022** (0.010)	0.000 (0.008)	0.003 (0.011)
Observations	1377	1377	1377	1377	1377
df_m	28	28	28	28	28

Notes: Standard errors in parentheses

All specifications include controls for country, sector, number of days from lockdown, firm age, and export dummy.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

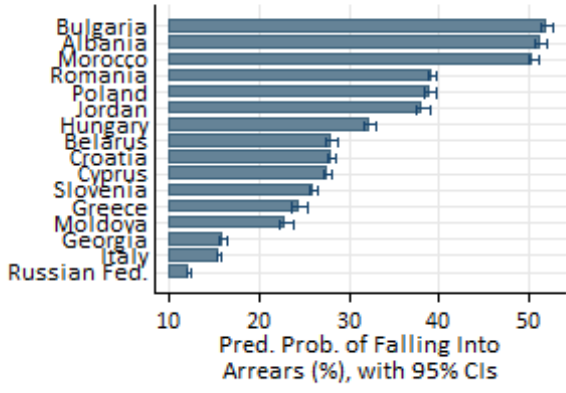
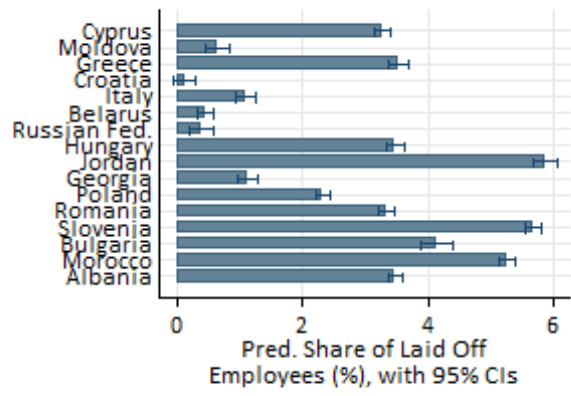
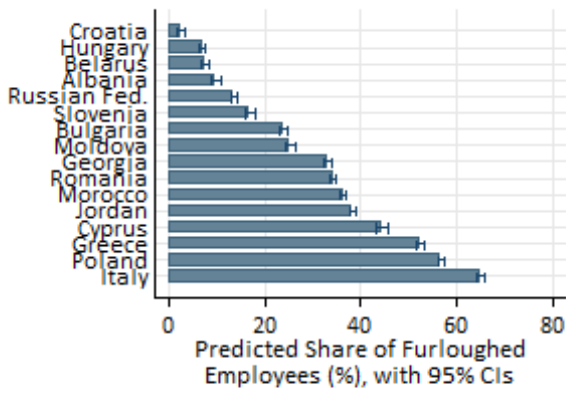


Figure A1: Firm Responses to COVID-19 by Country

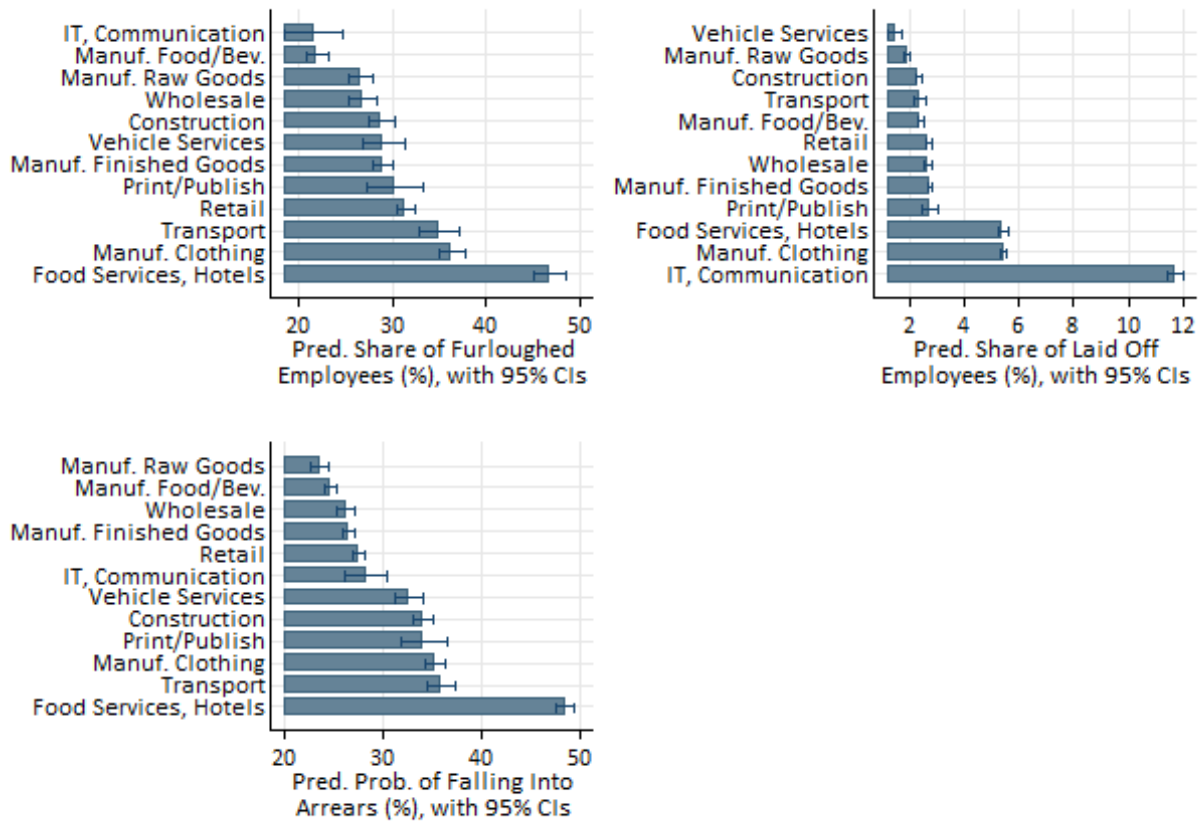


Figure A2: Firm Responses to COVID-19 by Sector

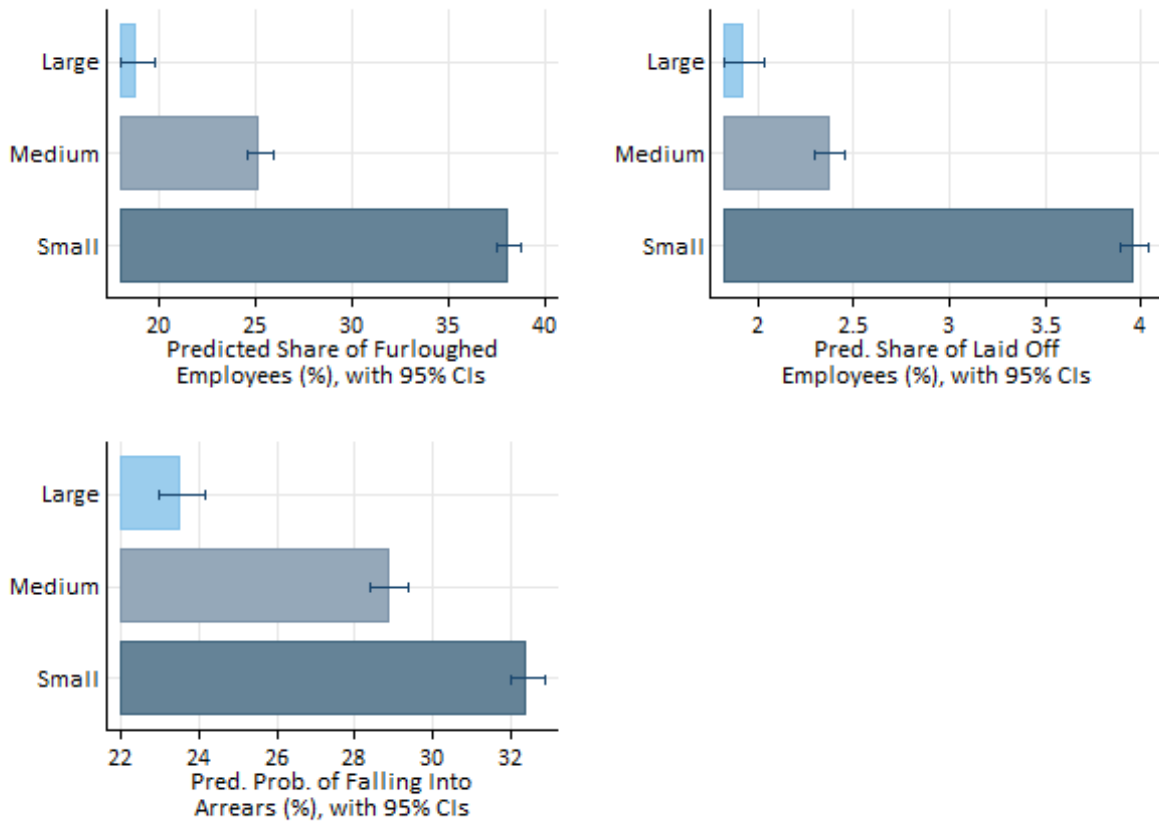


Figure A3: Firm Responses to COVID-19 by Size