The Great Lockdown and the Small Business: Impact, Channels and Adaptation to the Covid Pandemic

Minh-Phuong Le, Lisa Chauvet,
Mohamed Ali Marouani

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Abstract

In this paper we estimate the effects of the pandemic on Tunisian SMEs in 2020 using Difference-in-Difference specifications. Three simultaneous shocks are examined: the lockdown shock, the demand shock and the intermediate input shock. We find that the loss directly induced by the lockdown became less important after the reopening and mostly critical for employment. The demand shock following the lockdown was the major shock to firms' revenue. The intermediate input shortage was alleviated by the decrease in demand and the limited access to customers. Small firms were less exposed to the demand and intermediate input shocks while partially exporting and foreign firms were shown to be more resilient. Finally, using our firm survey, we find that firms that were actually able to make an adaptation were all better off. However the effects of each type of adaptation were different: process adaptation was accentuated in essential sectors while workplace adaptation and trade credit were important to all sectors.

1 Introduction

Understanding the nature of an economic shock is the key feature to mitigate its consequences and prepare the recovery of the economy. The demand/supply nature and the channels through which the Covid-19 crisis is transmitted to the whole economy entail different policy implications and involvement (Baqaee and Farhi, 2022). This crisis challenges economists and policy makers to an unprecedented level with an intricacy of shocks, including various initial and high-order supply and demand shocks.

The labor supply shock resulted from the mandatory closure, social distancing implementation, disease infection or fear of infection. Meanwhile, the shortage of intermediate inputs is the consequence of the reduction in labor witnessed by intermediate-input suppliers. The former is a direct effect of the pandemic and the containment measures and the latter is an indirect effect induced via the production network.

Demand shocks came from the intersectoral and intertemporal shift in households' expenditure composition. Households might reduce demand for high contact-intensive goods such as dining-out, entertainment, travelling and increase demand for non-perishable food, sanitary products and healthcare services. Furthermore, they might prefer to postpone their consumption at the present, which is called by Baldwin and Tomiura (2020) the wait-and-see effect.

This paper contributes to the extensive literature on the economic effects of the Covid-19 crisis and the entailed response policies of governments around the world. Rather than estimating the aggregate effects, we focus on formal SMEs, the dominant employers in the developing countries' private sector (Aga et al., 2015). These firms are especially vulnerable to aggregate shocks, given their limited access to alternative financial

resources and to government's supports.

To isolate the effects of the shocks on SMEs' sales and employment, we run a difference-in-differences specification using a national census, providing exhaustive panel data of Tunisian SMEs. Our key variables are the variations across sectors of the three shocks: lockdown shock, demand shock and intermediate input shock. Lockdown shock is a dummy variable which takes the value 1 if a firm operates in a non-essential industry. Demand shock is proxied by the industrial mean of US firms' changes in annual revenue forecast before and after the Covid-19 outbreak. Finally, intermediate input shock is measured as the industrial share of firms having intermediate input constraints from the World Bank's Enterprise Survey Follow-up on COVID-19.

While demand and supply shocks are the fundamental hazards, other factors may have a hand by amplifying or mitigating these hazards. We identify three sources of amplification/mitigation: technological adaptation, external finance dependence and firms' heterogeneity. To evaluate the contribution of these factors, we firstly add a triple interaction of the shock measure with firms' and industries' characteristics to our baseline models.

To further investigate firm's adaptations in terms of technology and finance, we ran a survey on Tunisian SMEs right after the first lockdown. Three firms' prominent adaptations were examined: workplace adaptation, process adaptation and the use of trade credit.

In overall, we found that the labor supply shock dominated during the first lockdown in Tunisia. No effect of the demand shock and intermediate supply shock were found during this period. When it comes to the entire-year effect, the loss directly induced by the lockdown became less important and mostly critical for employment. The demand shock following the lockdown was the major shock to firms' revenue. The intermediate input shortage was alleviated by the decrease in demand and the limit acces to clients. We also find that small firms were less exposed to the demand and supply shocks while partially exporting and foreign firms were more resilient. Last but not least, our survey results show that firms that were actually able to make an adaptation were all better off. However the effects of each type of adaptation were different: process adaptation was accentuated in essential sectors while workplace adaptation and trade credit were important to all sectors.

The rest of the paper is structured as follows. Section 2 reviews the relevant literature. The data and methodology are described in Section 3. Section 4 presents our results. Finally, Section 5 concludes our findings.

2 Literature Review

Our paper relates to several strands of literature. The first one seeks to decompose the shocks at the macroeconomic level. Given the immensity and prevalence of this literature, we only cite here the Covid-19-related papers. del Rio-Chanona et al. (2020) were among the first authors who predicted the first-order supply and demand shocks on sectoral output, employment and wage. They estimated that the Covid-19 crisis and containment measures reduced one fifth of the aggregate output, one forth of the total employment and nearly one fifth of the total income wage. The aggregate effects were dominated by the supply shocks. Brinca et al. (2021) measured the shifts in labor supply and demand curves using structural-vector-autoregression model and monthly sectoral data. They also found that more than two thirds of the aggregate drop in

working hour growth rate during the lockdown could be attributed to the labor supply shocks. Baqaee and Farhi (2020) and Barrot et al. (2021) focused on the first-order and second-order supply effects of social distancing measures and suggested that the nonlinearities of the production network, together with the heterogeneity of the shocks, could make the second-order shock very costly to the output. Guerrieri et al. (2022) examined the demand shock triggered by the negative supply shocks and found that this secondary shock could be larger than the intial shock if the intersectoral elasticity of substitution was less than the intertemporal one. Baqaee and Farhi (2022) incorporated nominal frictions into the disaggregate Keynesian model with multi-sector and factor. In the presence of complementarities, negative supply shocks outweighted negative demand shocks in terms of output loss and generated Keynesian spillover as well as further output loss. Finally, Pichler et al. (2020) extended the traditional input-output model to account for simultaneous demand and supply shocks and added various firms' rationing to obtain the bottom-up impact estimates. They affirmed the important amplification effects of the production network which were even much larger in the presence of micro-level coordination failures. The common findings of this literature are that (i) labor supply supply shocks predominated during the lockdown; (ii) demand and supply shocks varied substantially across sectors; (iii) the higher-order shocks were much larger than the initial shocks and (iv) nonlinearities, complementaries and market frictions, in most of the cases, amplified the shocks.

The approach in this paper is closer to that of the second strand of the literature that looks at the effect and the responses to the shock at the firm level. These studies exploit the exogenous variation in the shocks or in the predisposition to shocks across sectors or economies. For instance, Tong and Wei (2008) and Isyuk (2013) used the variation in sectoral demand sensitivity and firm's financial constraint to isolate the effect of demand shock and credit supply shock on firms' stock price during the 2007-2009 financial crisis. The index of demand sensitivity was constructed by Tong and Wei (2008) based on the response of the consumer confidence, proxied by firm's stock price, to the September 9 terrorism. They found that firms more affected by the credit contraction than the reduction in consumer confidence. Calomiris et al. (2012) studied the change in equity returns of firms around the world during the financial crisis. They found a lower equity returns in firms that were sensitive to the global demand shock, the credit crunch and the equity selling pressure. Claessens et al. (2012) compiled firm-level data from 42 countries to study the three transmission channels of the financial crisis: credit supply, domestic demand and trade. Their conclusions with the data on real firms' performance are different: firms in higher demand and trade sensitivity sectors experienced more output loss. Nguyen and Qian (2014) used a survey on Eastern European firms and reached the same conclusion that the demand shock was more damaging to firms' sales and employment than the credit shock. In the same spirit, Coviello et al. (2022) examined firms' responses to a persistent adverse demand shock using the a quasi-experiment: the 2008 law on fiscal rule that impacts only Italian municipalities with population greater than 5,000. They showed that firms responded to a persistent demand shock by cutting capital rather than labor.

The literature that studied more specifically the impact of COVID-19 at the firm level shows a heterogeneous impact depending mainly on firms' size and the level of development of their country of operation. Based on a US survey of 28,000 firms Alekseev et al. (2022) find that larger and older firms are more likely to operate during the crisis and that they were more concerned about the demand than the supply shock. Apedo-Amah et al. (2020) confirm the disproportionate impact on small firms with a survey on 51 countries and 100,000 businesses. Using a survey on 35,000 small busi-

nesses in Latin America, Guerrero-Amezaga et al. (2022) predict a substantial impact on the medium term on small firms, due to the low assistance that these firms benefited from. Drawing on firms surveys in 38 countries, Aga and Maemir (2022) show that Sub-Saharan African firms are disproportionately impacted by the health crisis, due to structural pre-pandemic characteristics. The authors also find a higher propensity to adapt to the shock in Sub-Saharan Africa, despite lower financial and technological resources. Using a 5,000 UK firms panel survey, Bloom et al. (2020) highlight the large contraction of less productive firms in 2020-21, which partly offsets the large reduction in within-productivity on overall total factor productivity. Drawing on firm-level data on 34 countries, Muzi et al. (2022) also find a higher probability of exit of unproductive firms, characterized by low digitalization and innovation. They also find that small firms drive this relationship.

3 Data and Methodology

3.1 Methodology

3.1.1 Shock evaluation

As mentioned above, the supply and demand shocks induced by the lockdown and the Covid-19 were aggregate shocks but their effects were very heterogeneous across sectors. We deploy this sectoral variations of the shocks to decompose their effects on Tunisian SMEs.

As the baseline model, we apply the traditional two-way-fixed-effect (TWFE) Difference-in-Differences model. The model is set up as follows:

$$y_{ijrt} = \gamma_1 LS_j \cdot Post + +\gamma_2 DS_j \cdot Post + \gamma_3 IS_j \cdot Post + \beta X_{ijr(t-1)} + \alpha_j + \eta_r + \lambda_t + \epsilon_{ijrt} \quad (1)$$

where y_{ijrt} is the annual sales/employment of firm i in industry j and location r. The dummy variable $Post$ takes the value 1 if firm is observed in 2020 and the value 0 otherwise. α_j and η_r capture time-invariant industry-specific and location-specific effects while λ_t accounts for the time trend. A set of firm covariates $X_{ijr(t-1)}$ controls for pre-crisis time-varying firm-level characteristics, including firms' log age, square of age, size, foreign ownership and export status. LS_j measures exclusively the direct effect of the shutdown of stores and plants in April and May 2020. DS_j is a proxy for the intertemporal and intersectoral demand shifts induced by the Covid-19. IS_j measures the sectoral exposure to intermediate input shocks. Details on the identification of these shocks are presented in the section 3.2. Except for the lockdown shock, others are standardized so that their effect sizes are comparable. We expect the estimations of γ_1, γ_2 and γ_3 to be negative, meaning that the shocks have negative impacts on firms' sales/employment.

To examine which firms were hit harder by the shocks, we interact the measures of shocks with firms' characteristics as follows:

$$\begin{aligned} y_{ijrt} =& \rho_1 Covariate_{ijt} \cdot Post + \pi_1 LS_j \cdot Covariate_{ijt} + \gamma_1 LS_j \cdot Post + \delta_1 Covariate_{ijrt} \cdot LS_j \cdot Post \\ &+\gamma_2 DS_j \cdot Post + \gamma_3 IS_j \cdot Post + \beta X_{ijr(t-1)} + \alpha_j + \eta_r + \lambda_t + \epsilon_{ijrt} \end{aligned} \quad (2)$$

where $Covariate_{ijrt}$ is a dummy variable indicating firms' size, foreign ownership, offshore status and partial export status. $X_{ijr(t-1)}$ is the set of time-varying covariates, except for the $Covariate_{ijrt}$. We also interact the measures of shocks with sectoral indicators of financial and technological characteristics (in this case $Covariate_{ijrt}$ is replaced by $Covariate_j$), since this information is not covered by the RNE database (Tunisian

firms' census). Furthermore, firm-level technology and financial conditions tend to be endogenous, hence, the use of an aggregate indicator will alleviate the endogeneity problem. The construction of these two variables is also presented in the section 3.2 below.

3.1.2 Firms' adaptation

Facing the strict mandatory closure, a firm in a non-essential industry can adjust its workplace by shifting all its activities online to allow their employees to work from home. Meanwhile, a firm in an essential industry, facing the mobility restrictions, can adapt its working process and products to reduce the physical contact among employees and with clients. Both firms, however, experienced a sudden loss in their revenue, requiring a fast financing alternative to survive through the great lockdown. In this paper, we study the mitigation effect of firms' prominent adaptations to the direct shock generated by the lockdown. The identification of these three adaptation is presented in section 3.2.3. We run the following model using our survey data:

$$y_{ijg} = \alpha + \beta X_{ijg} + \gamma_1 ADAPT_i + \alpha_j + \eta_r + \epsilon_{ijg} \tag{3}$$

where y_{ij} is percentage changes in sales of firm i in industry j and region g during the lockdown compared to the same month of the previous year. X_{ijg} is the set of control variables, including firm's and manager's characteristics. α_j and η_r capture the unobserved governorate- and industry-specific effects. We adjust the standard errors by clustering them at the 2-digit NAT[1] industry level. The main variable of interest $ADAPT_j$ is a categorical variable composed of four categories: (1) firm in non-essential industry and having had no adaptation, (2) firm in non-essential industry and having had an adaptation, (3) firm in essential industry and having had no adaptation and (4) firm in essential industry and having had an adaptation. Three adaptations are examined: workplace adaptation, process adaptation and the use of trade credit.

3.2 Data and variable construction

3.2.1 Sectoral variables

Lockdown shock
The mandatory closure during the lockdown manifested itself mainly as a labor supply shock to non-essential industries of which stores and plants were suddenly forced to close, thousands of workers were suddenly not allowed to leave their houses for work. Since Tunisia's government did not publish a detailed list of essential (or non-essential) industries, we constructed it by ourselves by gathering information from announcements of government agencies. We end up with a list of non-essential industries at the 4-digit NAT level. Our measure of the direct shock induced by the lockdown is a dummy which takes on the value 1 if the firm operated in a non-essential 4-digit industry, and 0 otherwise.

Demand shock
Following Hong et al. (2020) and Barry et al. (2022), we compute demand the shock as the industrial mean of US firms' changes in annual revenue forecast before and after the Covid-19 outbreak. Given that February 20 is the starting date of the pandemic in the US, we choose January 2020 as the most recent non-pandemic forecast period and May 2020 as the revision accounting for the pandemic. The data are provided by the Institutional Brokers' Estimate System (IBES). The predicted revenues are firstly

[1] 2009 Tunisian Nomenclature of Activities 2009

adjusted to account for the fact that a certain fraction of the fiscal year has already been realized before the pandemic. We compute the firm-level change in predicted revenue between January and May 2020, then take the average value at the 4-digit-NAICS (North American Industry Classification System) level. Finally the measure is mapped from the 4-digit NAICS to the 4-digit NAT codes. The demand shock is multiplied by -1 before being standardized so that the increase in a negative demand shock is negatively associated with firms' performance.

Our measure of the demand shock, by construction, captures both the changes in intersectoral and intertemporal preferences. This use of an US proxy of the relevant industry characteristics has been widely practiced in applied economics (see the survey by Ciccone and Papaioannou (2016)), as it is deemed to have less distortions compared to less developed economies.

However, using the US measure of demand shock requires an assumption that the pattern of sectoral demand contractions is analogous across countries. This is a strong assumption, given the differences in consumer preference and the range of substitute products between the two countries. We hence construct an equivalent measure of demand shock using the real change in Tunisian stock prices before and after the lockdown. Tunisia's stock market in 2020 was composed of about the 60 largest companies of Tunisia, many of them from the financial sector. So the demand shock computed from these data is at best considered as a limited indicator for a part of the economy. We plug the two data set to the firm data and calculate the correlation coefficient. It varies between 0.29-0.58 depending on the choice of the time window.

Intermediate input shock
While the intermediate supply shortage was an aggregate problem due to the interruption of the global value chain, a large part of it is still industry-specific (Balleer and Noeller, 2023). We calculate a survey-based measure of intermediate input shortage from the World Bank's Enterprise Survey Follow-up on COVID-19. These cross-section surveys follow the baseline Enterprise Survey and are designed to provide quick information on the impact and adjustments that COVID-19 has brought about in the private sector. The questionnaire contains a question on firm's production during the last month before the survey. Specifically, firms are asked to compare its supply of inputs, raw materials, or finished goods and materials purchased to resell for the last completed month with the same month in 2019, whether it increased, remained the same, or decreased. If firms answer "decreased", then it is classified as input constrained. We aggregate the share of firms having material supply reduced at the 3-digit-ISIC industrial level across 33 countries surveyed from 2020 to 2020 around the world. This measure, hence, capture rather industry-specific than country-specific intermediate constraints. Similar to the demand shock, the intermediate supply shock is also mapped to the 3-digit-NAT codes and standardized.

Teleworkability (Telework)
Studies on firms' response to the Covide-19 suggests that teleworkability is the key to the resilience of firms. To quantify this feature, we use the classification of teleworkable jobs developed by Dingel and Neiman (2020). Their classification covers the questions on work context and generalized work activity in O*NET[2], a US survey database on the nature of occupation and its task composition. The authors define a list of statements that excludes the possibility of telework. If none of these statements are true, the occupation can be performed from home and takes the value 1, otherwise it takes the

[2]US's Occupational Information Network

value 0. The index is available at the 5-digit SOC[3] level. We map it to the NNP-14[4] codes then aggregate it at the 3-didit NAT level.

External finance dependence (EFD)
We proxy firm's sensitivity to financial shock by the external finance dependence (Rajan and Zingales, 1998) of US firms over the period 2010-1019 in the Compustat data base. To smooth temporal fluctuations and reduce the effects of outliers, we sum the firm's use of external finance and investment over 2010–2019 and then take the ratio of these sums. We then take the the industry median at the 2-digit SIC code level and map it to the 2-didit NAT level.

3.2.2 RNE panel data

Our main data set comes from the administrative panel database (RNE) of the Tunisian National Institute of statistics (INS). This is an exhaustive database which covers all registered firms in Tunisia. The database provides information on firms' activity code, characteristics (age, size, ownership and export status) and performance (sales and employment). For this study, we restrict the data set to the SMEs in the period 2015-2020. Table 1 reports the average outcomes and characteristics of firms in our control and treatment groups. The treatment groups include non-essential industries, industries with demand shocks above the 2020 sample median (high demand shock) and industries with intermediate input shocks above the median (high intermediate input shock). Inversely, the control groups include essential industries, industries with demand below the median (low demand shock) and industries with intermediate shocks below the median (low intermediate shock).

[3]US's Standard Occupational Classification
[4]Tunisia's 2014 National Occupational Classification

Table 1: Average outcomes and characteristics of firms in control and treatment groups - RNE data (2015-2020)

	All		Essential		Demand shock		Intermediate supply shock	
			Yes	No	Low	High	Low	High
	N	Mean	Mean		Mean		Mean	
Firms' outcome								
Log sales	64,838	13.90	14.04	13.85	13.87	13.89	14.24	13.73
Log employment	64,838	2.86	2.63	2.94	2.72	3.03	2.83	2.95
Firms' characteristics								
Log age	64,409	2.47	2.60	2.42	2.44	2.49	2.54	2.38
Sq. Log age	64,409	6.81	7.47	6.59	6.68	6.88	7.12	6.41
Medium	47,430	0.17	0.11	0.19	0.12	0.22	0.16	0.20
Partial Export	50,025	0.15	0.12	0.17	0.15	0.15	0.17	0.15
Offshore	50,025	0.19	0.03	0.24	0.13	0.27	0.11	0.30
Foreign	50,025	0.10	0.01	0.12	0.08	0.12	0.06	0.14
Industry's characteristics								
Telework	64,830	0.24	0.23	0.24	0.30	0.15	0.22	0.27
EFD	63,829	-0.05	-0.09	-0.03	0.11	-0.21	0.14	-0.20

3.2.3 COVID-19 survey data and SMEs' adaptation

To investigate SMEs' adaptation, we run a firm survey conducted after the first lockdown in 2020. The survey provides us with firms' and managers' characteristics, including firm's age, size, import status, export status (non, partial, total exporter) and ownership (local or foreign); manager's experience and education. It also covers strategic management questions containing details about the firm's performance as well as the strategies adopted for coping with the pandemic. Firms' performance during the lockdown is proxied by change in sales in May 2020 with respect to sales in May 2019. Table 2 describes the data from this firm survey and the sectoral variables used in this study. Figure 1 and Figure 2 compare firms distribution and average sales growth in the RNE panel data set and the survey data set. Manufacturing firms and hotel/restaurants are over-represented in the survey data set. Furthermore, the average sales growth in May 2020 is much larger than that of the entire year 2020 due to the fact that most of firms were completely shut down during April and the first half of May 2020.

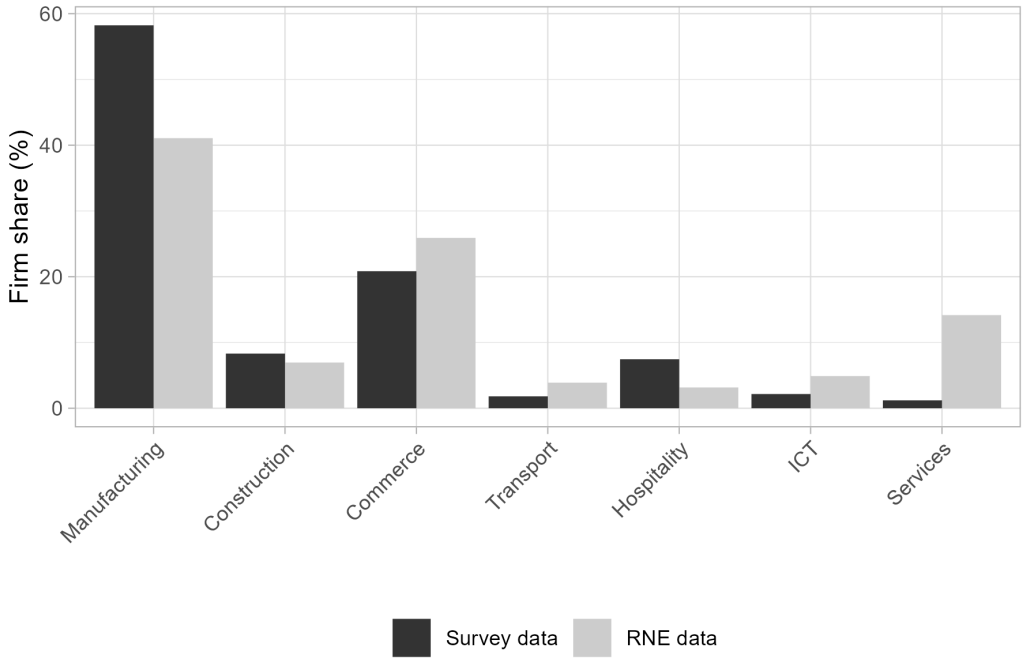

Figure 1: Firm distribution across sectors (%)

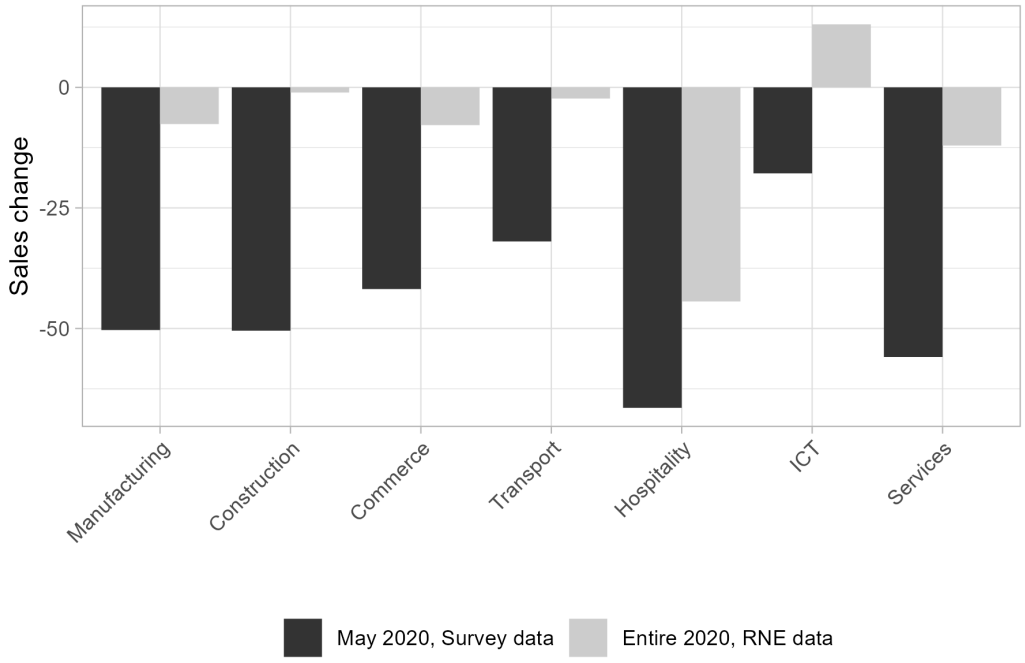

Figure 2: Sales change across sectors (%)

Table 2: Average outcomes and characteristics of firms in control and treatment groups - Survey data

	All		Essential		Demand shock		Intermediate supply shock	
			Yes	No	Low	High	Low	High
	N	Mean	Mean		Mean		Mean	
Firms' outcome								
Sales change (%), May 2020	831	-48.80	-26.43	-55.70	-39.60	-57.56	-42.42	-55.20
Firms' adaptations								
Workplace adapt., April	831	0.17	0.27	0.14	0.22	0.13	0.16	0.19
Use of trade credit	831	0.19	0.19	0.19	0.19	0.20	0.15	0.23
Process adapt., April	830	0.23	0.26	0.22	0.28	0.18	0.24	0.21
Firms' characteristics								
Log age	826	2.43	2.44	2.42	2.44	2.41	2.51	2.33
Sq. Log age	826	6.57	6.73	6.52	6.62	6.49	6.94	6.17
Medium	831	0.25	0.15	0.28	0.18	0.30	0.24	0.27
Import	831	0.52	0.46	0.54	0.47	0.56	0.51	0.54
Partial Export	831	0.11	0.12	0.11	0.10	0.11	0.14	0.09
Offshore	831	0.19	0.08	0.23	0.09	0.30	0.12	0.26
Foreign	831	0.13	0.08	0.14	0.09	0.16	0.12	0.14
Mng's experience	820	12.34	11.20	12.70	11.89	12.68	13.28	11.32
Mng having a college degree	831	0.66	0.61	0.68	0.66	0.66	0.70	0.62
Industry's characteristics								
Telework	831	0.17	0.22	0.16	0.25	0.10	0.18	0.15
EFD	819	-0.06	0.01	-0.08	0.13	-0.23	0.09	-0.22

Firm's technical adaptations are classified into process and workplace adaptations. Firms are identified as having a process adaptation if they responded yes to any of the following questions:

1. Did your company start selling online to reduce the proximity to clients;
2. Did your company start selling over the phone to reduce the proximity to clients;
3. Did your company change your product to reduce the proximity to clients;
4. Did your company change its mode of transportation due to mobility restrictions and
5. Did your company change its imported/exported products to cope with the pandemic?

Firms are identified as having a workplace adaptation if some or all of their employees were able to work from home. Firms that could sell online or over phone did not necessarily have their employees work from home. Indeed, among 12% firms that were able to turn their storefront into an online business, only 65% of these firms had their employees work from home.

Finally, firms that were able to use trade credit during the lockdown are considered as having a financial adaptation.

4 Results

4.1 Effect of the shocks on firm's performance

Figures 3 and 4 plots the linear trends of the sales and employment over time for our control and treatment groups. Despite the different levels, the two groups had roughly similar pre-trends in most shocks and outcomes. Furthermore, there is a clear divergence in firm performance when the Covid-19 broke out in 2020. One exception is the widening difference between the non-essential and essential groups that might cause our treatment effect overestimated. This difference is, however, expected to be ruled out once the industry-specific effects are controlled for.

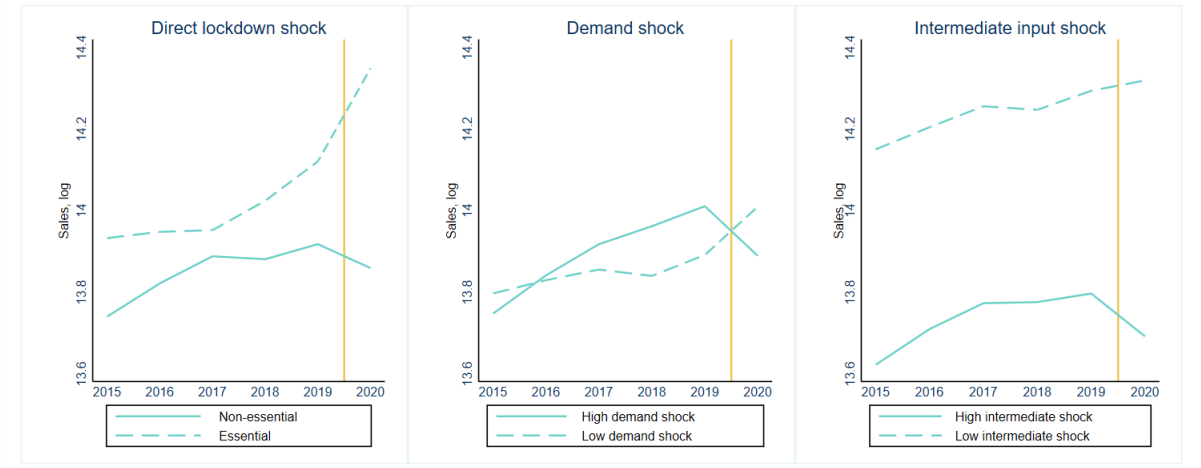

Figure 3: Sales trends (2015-2020)

Figure 4: Employment trends (2015-2020)

Table 3 displays the results of the baseline model (1) for SMEs' sales. The model is estimated using administrative panel (RNE) data on formal firms provided by the National Institute of Statistics. Column (1) shows that the direct effect of the lockdown on SMEs' sales is significant and negative. Firms in non-essential activities experienced a 11.3 percent lower in sales than those in essential activities. Column (2) exposes a negative association between the demand shock and SMEs' sales: one standard deviation increase in our industrial measure of demand shock is associated with 9.1 percent loss in sales. Finally Column (3) shows that Tunisian SMEs also suffered a negative impact from the intermediate input shock, although the magnitude is much lower than that of the demand shock: one additional standard deviation in our industrial measure of intermediate input shock is associated with 4.8 percent loss in firms' sales. However, when we introduce the three shocks at the same time in Column (4), the coefficient on the intermediate input shock is not significant anymore, that is to say, the lockdown shock and the demand shock are much more important than the intermediate supply shock. The fall in demand as well as the limited access to clients, even when firms were not closed, indeed alleviated the pressures on input supply.

Table 3: Effects of the shocks on SME's sales

	(1)	(2)	(3)	(4)
Non-essential*Post	-0.113***			-0.062***
	(0.027)			(0.023)
Demand shock*Post		-0.091***		-0.079***
		(0.027)		(0.027)
Intermediate input shock*Post			-0.048**	-0.015
			(0.019)	(0.013)
Log age	0.079	0.078	0.080	0.079
	(0.061)	(0.061)	(0.061)	(0.061)
Sq. Log age	-0.007	-0.007	-0.007	-0.007
	(0.014)	(0.014)	(0.014)	(0.014)
Medium	1.513***	1.513***	1.513***	1.513***
	(0.063)	(0.063)	(0.063)	(0.063)
Partial exporter	0.383***	0.383***	0.384***	0.383***
	(0.038)	(0.038)	(0.038)	(0.038)
Total exporter	0.127*	0.127*	0.128*	0.127*
	(0.074)	(0.074)	(0.074)	(0.074)
Foreign	0.315***	0.315***	0.315***	0.315***
	(0.060)	(0.060)	(0.060)	(0.060)
Observations	45826	45826	45826	45826
R^2	0.534	0.534	0.534	0.534

Note: This table examines the effects of the shocks on SME's sales in 2020. All models apply the two-way fixed-effect estimator and control for year, 4-digit industry and location fixed effects. Standard errors are clustered at the 4-digit industry level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 5: Differences in sales trends

As a placebo test, instead of interacting the shocks with a dummy indicating the post-crisis period, we interact the shock with year dummies to investigate the effects of the shocks in the years before the Covid-19 event. Figure 5 plot the pre-trend coefficients (before 2020) and the treatment effects (2020). Once the industry-fixed effects are controlled for, it turns out that the average sales level of non-essential industries is larger than that of essential industries, which is contrary to the suggestion by Figure 3. Our measures of the lockdown shock and demand shock do have negative effects on firms sales. Given the positive pre-trend, our estimates of the shock effects might be underestimated, especially in the case of the demand shock.

Table 4 re-estimates Equation (1) but substitutes employment to sales as the dependent variable. The results are different from those exposed in Table 3 since only the lockdown shock is significantly, and negatively, associated with employment. This result is consistent with the fact that the lockdown of some firms directly affected their capacity to hire and employ people, while the demand and input shocks took some time to affect firm employment, since this effect required a decrease in sales at first. At the end of the first year of pandemics, the potential impact of these two shocks on employment of formal firms in Tunisia was not yet perceptible. As for sales, Figure 6 suggests that the difference, before treatment in the treated and control groups, are not significant.

Table 4: Effects of the shocks on SME's employment

	(1)	(2)	(3)	(4)
Non-essential*Post	-0.029**			-0.029**
	(0.014)			(0.014)
Demand shock*Post		-0.012		-0.012
		(0.010)		(0.010)
Intermediate input shock*Post			-0.000	0.007
			(0.006)	(0.005)
Log age	-0.153***	-0.154***	-0.154***	-0.154***
	(0.025)	(0.025)	(0.026)	(0.026)
Sq. Log age	0.044***	0.044***	0.044***	0.044***
	(0.006)	(0.006)	(0.006)	(0.006)
Medium	1.558***	1.558***	1.558***	1.558***
	(0.029)	(0.029)	(0.029)	(0.029)
Partial exporter	0.136***	0.136***	0.136***	0.136***
	(0.014)	(0.014)	(0.014)	(0.014)
Total exporter	0.237***	0.237***	0.237***	0.237***
	(0.038)	(0.038)	(0.038)	(0.038)
Foreign	0.064***	0.064***	0.064***	0.064***
	(0.015)	(0.015)	(0.015)	(0.015)
Observations	45826	45826	45826	45826
R^2	0.658	0.658	0.658	0.658

Note: This table examines the effects of the shocks on SME's employment in 2020. All models apply the two-way fixed-effect estimator and control for year, 4-digit industry and location fixed effects. Standard errors are clustered at the 4-digit industry level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

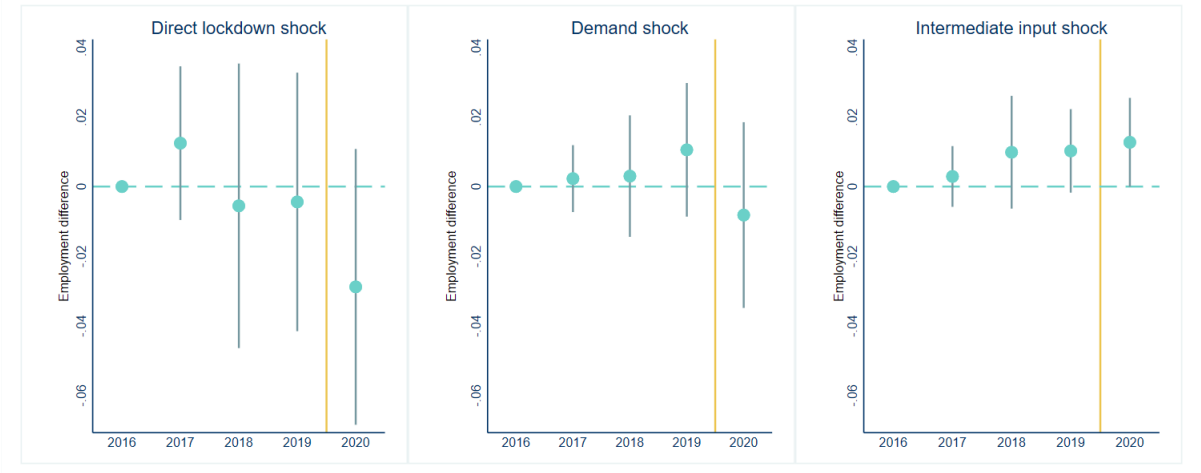

Figure 6: Differences in employment trends

4.2 Heterogeneous effects of the shocks

According to their characteristics and sector of activity, the impact of the COVID-19 crisis may have varied. To examine this question, we estimate Equation (2) on the same sample of firms. In this model, we interact the effect of the three shocks with some firm/industry-level characteristics that may influence how hard was the impact on the firm. The results are displayed in Tables 5 and 6. If a characteristic (covariate) alleviates a shock, the coefficient of the triple interaction should have a positive sign. We firstly distinguish medium firms from small ones (Column 1). We also examine whether outward-looking firms were more strongly impacted by the shocks since they are more involved in global value chains. We notably examine whether firms exporting part of their production (Column 2) and firms which production was entirely exported (the so-called offshore firms) (Column 3) were more harshly hit by the shocks. We also examine whether firms which capital is partly foreign-owned were hit in a distinct way as other firms (Column 4). In Columns 5 and 6, we investigate the case of firms belonging to sectors of activity that structurally need more external financing (hence more vulnerable to shocks) and those in which it is easier to implement work from home (hence less vulnerable to the shocks).

Table 5 shows that whatever the specification, the lockdown shock and the demand shock remain significantly negative and in order of magnitude similar to those displayed in Table 3. While both small and medium firms were equally affected by the lockdown and the demand shock, medium firms were more damaged by the intermediate supply shock (Column 1). The F-test for the joint significance of the coefficients of interaction terms *Intermediate shock*Post* and *Intermediate shock*Medium*Post* rejects the null hypothesis at $p-value = 0.01$. Interestingly, partial exporters appear to be the most resilient compared to offshore and domestics firms (Column 2). As the former suffered from the interruption of the global supply chains and the latter were more constrained both financially and technologically, the hybrid SMEs stood out thanks to their flexibility to respond to market demand. Finally, it comes as no surprise that foreign firms were less affected by the demand shock (Column 4).

Table 6 reveals a slightly different pattern of resilience in terms of employment. Medium firms experienced more employment loss than small firms both during and in the months following the lockdown (Column 1). Offshore firms turn out to be the most resilient in terms of employment , regardless of facing greater demand shock (Column 4). Foreign firms were also more able to keep their employment (Column 5).

Table 5: Heterogenous effects of the shocks on firms' sales

	(1) Medium	(2) Partial export	(3) Offshore	(4) Foreign	(5) EFD	(6) Telework
Panel A: Direct lockdown shock						
Non-essential*Post	-0.035	-0.074***	-0.051*	-0.061**	-0.068***	-0.071**
	(0.029)	(0.023)	(0.027)	(0.024)	(0.023)	(0.028)
Covariate*Post	0.107	-0.043	0.126	-0.022	-0.001	0.020
	(0.092)	(0.069)	(0.154)	(0.203)	(0.014)	(0.034)
Non-essential*Covariate*Post	-0.181*	0.081	-0.156	0.010	-0.007	-0.042
	(0.099)	(0.083)	(0.158)	(0.207)	(0.020)	(0.040)
Observations	45826	45826	45826	45826	45119	45821
R^2	0.535	0.534	0.534	0.534	0.536	0.534
Panel B: Demand shock						
Demand shock*Post	-0.067**	-0.091***	-0.081***	-0.087***	-0.045**	-0.084***
	(0.031)	(0.027)	(0.030)	(0.027)	(0.018)	(0.028)
Covariate*Post	-0.027	0.023	-0.025	-0.028	-0.015	-0.020
	(0.031)	(0.027)	(0.029)	(0.040)	(0.017)	(0.019)
Demand shock*Covariate*Post	-0.061	0.099**	0.017	0.135***	-0.062	-0.016
	(0.042)	(0.042)	(0.041)	(0.044)	(0.047)	(0.037)
Observations	45826	45826	45826	45826	45119	45821
R^2	0.535	0.535	0.534	0.535	0.536	0.534
Panel C: Intermediate shock						
Intermediate shock*Post	0.004	-0.020	-0.014	-0.025*	-0.015	-0.015
	(0.019)	(0.013)	(0.020)	(0.014)	(0.013)	(0.014)
Covariate*Post	-0.024	0.025	-0.022	-0.042	-0.010	-0.013
	(0.037)	(0.027)	(0.028)	(0.029)	(0.016)	(0.015)
Intermediate shock*Covariate*Post	-0.074**	0.028	0.002	0.059*	-0.007	-0.007
	(0.034)	(0.029)	(0.028)	(0.030)	(0.014)	(0.012)
Observations	45826	45826	45826	45826	45119	45821
R^2	0.535	0.534	0.534	0.534	0.536	0.534

Note: This table examines the heterogenous effects of the shocks on SMEs' sales. The columns reports the interaction terms of the shocks and the covariate. All models apply the two-way fixed-effect estimator and control for year, 4-digit industry and location fixed effects. Standard errors are clustered at the 4-digit industry level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Heterogenous effects of the shocks on firms' employment

	(1) Medium	(2) Partial export	(3) Offshore	(4) Foreign	(5) EFD	(6) Telework
Panel A: Direct lockdown shock						
Non-essential*Post	-0.015	-0.030*	-0.029**	-0.029**	-0.030**	-0.029**
	(0.016)	(0.016)	(0.015)	(0.014)	(0.014)	(0.014)
Covariate*Post	0.027	0.009	-0.159**	-0.209	-0.003	-0.005
	(0.038)	(0.031)	(0.074)	(0.135)	(0.005)	(0.016)
Non-essential*Covariate*Post	-0.092**	0.003	0.125	0.180	-0.003	-0.002
	(0.038)	(0.038)	(0.079)	(0.137)	(0.009)	(0.017)
Observations	45826	45826	45826	45826	45119	45821
R^2	0.658	0.658	0.658	0.658	0.658	0.658
Panel B: Demand shock						
Demand shock*Post	-0.005	-0.014	-0.020*	-0.014	-0.011	-0.014
	(0.010)	(0.011)	(0.011)	(0.011)	(0.008)	(0.009)
Covariate*Post	-0.041**	0.012	-0.054***	-0.037*	-0.007	-0.004
	(0.017)	(0.016)	(0.015)	(0.021)	(0.007)	(0.007)
Demand shock*Covariate*Post	-0.035**	0.013	0.059***	0.019	-0.015	0.012
	(0.015)	(0.018)	(0.023)	(0.033)	(0.021)	(0.013)
Observations	45826	45826	45826	45826	45119	45821
R^2	0.658	0.658	0.658	0.658	0.658	0.658
Panel C: Intermediate shock						
Intermediate shock*Post	0.014*	0.005	0.003	0.003	0.006	0.007
	(0.008)	(0.006)	(0.009)	(0.006)	(0.005)	(0.005)
Covariate*Post	-0.043**	0.013	-0.053***	-0.049***	-0.010	-0.005
	(0.019)	(0.016)	(0.015)	(0.017)	(0.007)	(0.006)
Intermediate shock*Covariate*Post	-0.026**	0.013	0.023	0.028*	-0.010	-0.005
	(0.013)	(0.014)	(0.017)	(0.015)	(0.007)	(0.005)
Observations	45826	45826	45826	45826	45119	45821
R^2	0.658	0.658	0.658	0.658	0.658	0.658

Note: This table examines the heterogenous effects of the shocks on SMEs' employment. The columns reports the interaction terms of the shocks and the covariate. All models apply the two-way fixed-effect estimator and control for year, 4-digit industry and location fixed effects. Standard errors are clustered at the 4-digit industry level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.3 Adaptations and firms' resilience

Before looking into firms' adaptations to the labor supply shock, we run a regression of firms' sales change in May 2020 with respect to May 2019 on firms characteristics, manager's characteristics and the three shocks. The model controls for region fixed effects and 2-digit-NAT industry fixed effects. Standard errors are clustered at the 2-digit-NAT industry level. The result of this specification is reported in Table 7. Only the coefficient of the labor supply shock is significant. It means that firms in non-essential industries experienced roughly 32-percent sales lower than firms in essential industries during the lockdown. Since the labor supply shock was dominant throughout the lockdown, we focus on the mitigation effect of firms' adaptations to this shock only.

Tables 8, 9 and 10 report the results obtained from equation (3) for workplace adaptation, process adaptation and trade credit. The group of firms in non-essential industries and having had no adaptation is set as baseline. In overall, firms' capacity to adjust the workplace and production process as well as to mobilize trade credit made them more resilient compared to others. However the effects of each type of adaptation were different: process adaptation was accentuated in essential sectors while workplace adaptation and trade credit were important to all sectors.

When we replicate the same regression to the high- and low-teleworkability subsets, the estimates are consistent in the case of process adaptation regardless of telework potential. On the contrary, there is no significant effect of workplace adaptation on firms in low-teleworkable industries. This confirms that the telework potential of these firms were indeed trivial. We also run equation (3) with the high- and low-EFD subsets and the financial adaptation variable. Interestingly, trade credit was necessary for both high- and low- external finance dependence firms only when they were affected by the lockdown. Otherwise, it was not important for firms with low- external finance dependence.

Table 7: Effects of the shocks on SME's sales change 5/2019-5/2020

	(1)	(2)	(3)	(4)
Non-essential	-33.385***			-32.410***
	(4.480)			(4.508)
Demand shock		-5.072		-5.649
		(4.021)		(4.178)
Intermediate input shock			-7.506	-4.314
			(5.351)	(3.591)
Log age	1.399	0.055	-0.406	0.654
	(7.826)	(8.125)	(7.683)	(7.699)
Sq. Log age	1.010	1.310	1.408	1.235
	(1.230)	(1.320)	(1.239)	(1.220)
Medium	3.701	2.868	2.339	3.622
	(3.326)	(3.369)	(3.417)	(3.398)
Importer	12.449***	11.539***	11.870***	12.425***
	(2.866)	(3.169)	(3.167)	(2.941)
Partial exporter	12.663*	13.732*	12.562*	12.405*
	(7.080)	(6.972)	(7.164)	(7.228)
Offshore	10.862**	11.775***	11.757***	10.324**
	(4.283)	(3.907)	(3.716)	(4.356)
Foreign	0.745	2.450	2.214	0.518
	(4.328)	(4.456)	(4.489)	(4.186)
Mng's experience	-0.547**	-0.572**	-0.558**	-0.565**
	(0.218)	(0.217)	(0.215)	(0.211)
Mng having a college degree	2.581	3.215	2.891	2.562
	(3.982)	(3.779)	(3.686)	(3.900)
Observations	814	814	814	814
R^2	0.245	0.218	0.220	0.248

Note: This table examines the effects of the shocks on SME's sales changes between 5/2019 and 5/2020. All models control for 2-digit industry and location fixed effects. Standard errors are clustered at the 2-digit industry level.

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

Table 8: Mitigation effect of workplace adaptation

	All	High telework	Low telework
Essential - No-adaptation	27.504***	35.291***	37.834***
	(6.704)	(4.646)	(4.002)
Essential - Adaptation	37.666***	39.425***	55.204***
	(7.783)	(9.505)	(3.902)
Non-essential - Adaptation	11.285***	18.706***	3.674
	(3.707)	(4.787)	(3.984)
Observations	922	470	452
R^2	0.235	0.248	0.192

Clustered standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Mitigation effect of process adaptation

	All	High telework	Low telework
Essential - No-adaptation	23.705***	28.182***	35.994***
	(6.149)	(5.157)	(3.628)
Essential - Adaptation	53.069***	56.379***	68.243***
	(7.086)	(9.742)	(4.253)
Non-essential - Adaptation	6.780	8.023	6.631
	(4.588)	(7.729)	(6.373)
Observations	923	471	452
R^2	0.242	0.246	0.204

Clustered standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Mitigation effect of trade credit

	All	High EFD	Low EFD
Essential - No-adaptation	23.834***	24.262***	-23.419*
	(6.383)	(7.799)	(12.333)
Essential - Adaptation	43.420***	49.211***	-8.544
	(7.996)	(13.639)	(10.754)
Non-essential - Adaptation	13.179***	13.270**	14.314**
	(3.849)	(5.854)	(5.781)
Observations	923	484	439
R^2	0.242	0.265	0.253

Clustered standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Conclusions

Our paper contributes to the literature on the economic effects of the Covid-19 crisis and the containment measures in three ways. Firstly, we estimate the shock effects at the firms level with a focus on SMEs in a developing country, using DID specifications. Secondly, we identify different sources of shock amplification/mitigation, including teleworkability, external finance dependence and firms' heterogeneity. Lastly, we evaluate the role of firms' prominent adaptations, including workplace adaptation, process adaptation and the use of trade credit.

Our main finding confirms the dominance of the labor supply shock during the first lockdown in Tunisia. This effect decreased quickly after that. The demand shock became the major shock to firm's revenue. Meanwhile, the effect intermediate input shock on firms' revenue was alleviated by the contraction of demand. Formal job losses resulting from the 2020 lockdown were mild while the other shocks had no effect on firms' employment growth.

We find that the loss directly induced by the lockdown became less important after the reopening and mostly critical for employment. The demand shock following the lockdown was the major shock to firms' revenue. The intermediate input shortage was alleviated by the decrease in demand and the limit access to clients. The heterogeneity analysis showed that small firms were less exposed to the demand and intermediate input shocks while partially exporting and foreign firms were shown to be more resilient.

Last but not least, using our firm survey, we show that process adaptation was accen-

tuated in essential sectors while workplace adaptation and trade credit were important resilience factors to all sectors.

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