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Women-led firms' performance during the Covid-19 pandemic. Evidence from an emerging economy

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Abstract

In this paper we analyze the on-impact effect of the Covid-19 pandemic on Ecuadorian firms and, conditional on this, we analyze firms' short-run performance. We estimate various econometric models on a combined dataset of almost 5,000 firms that includes fiscal-year performance variables from the Ecuadorian *Superintendencia de Compañías - SIC* and results from a survey conducted by a major financial institution in Ecuador at the beginning of the pandemic. Our main result is that micro women-led firms and women-led firms outside of the main Ecuadorian cities were more affected at the onset of the pandemic. Despite this impact, their performance by the end of 2020 was not worse compared to less affected firms. We also find that smaller firms as well as firms in the hospitality sector were both more affected and performed worse than other firms. Finally, younger firms were less affected and performed better than older firms, but at the cost of increased debt and less cash.

1 Introduction

Beyond its impact on public health, the Covid-19 pandemic has had a very large negative effect on societies and economies around the world (Delardas et al., 2022) leading to a profound recession (International Monetary Fund, 2020) and social, political, and economic distortions that are still playing out (Delardas et al., 2022). Firms faced a multitude of simultaneous challenges including a suspension of face-to-face operations, declining demand, supply chain disruptions, and broad mobility restrictions. This impact varied significantly across firms along size, sector, and other dimensions (Bartik et al., 2020; Fairlie et al., 2022; Guerrero-Amezaga et al., 2022; Torres et al., 2022). In this paper, we analyze how firms' gender leadership moderated the impact of the pandemic on firms during its initial months as well as on firms' performance by the end of 2020.

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A large literature has analyzed leadership gender effects on firms' performance (see e.g. Marquez-Cardenas et al., 2022). Yet, only a few studies have analyzed this dimension in the context of the Covid-19 pandemic (see e.g. Torres et al., 2022). This research is particularly limited for emerging economies and most of the scant evidence for Latin America has focused on listed firms (Marquez-Cardenas et al., 2022). We look at the experience of Ecuador and ask two related questions. First, were women-led firms differently affected at the onset of the pandemic? Second, conditional on this impact, did these firms perform differently from non-women-led firms during the first year of the pandemic?

Our main finding is that women-led firms in general were neither more affected nor did they perform worse than non-women-led firms. However, we find evidence that women-led *micro* firms were indeed more severely affected at the onset of the pandemic, as were women-led firms operating outside the main Ecuadorian cities. Yet, when looking at the 2020-2019 difference in performance, these firms performed in line with other, less affected, firms.

We also find evidence that smaller firms were significantly more affected at the onset of the pandemic and that micro firms performed significantly worse than larger firms when looking at the 2019-2020 change. Surprisingly, younger firms were less affected by the pandemic, and they managed to perform better than older firms, although at the cost of more debt and a worse cash profile.

We also find evidence consistent with international evidence that firms in the construction, real estate, hospitality, and entertainment sectors were more negatively affected by the pandemic. However, except for hospitality, these sectors' 2019-2020 performance was in line with the benchmark sector. The administrative and support services sector performed worse in the 2019-2020 comparison, despite not having been significantly more affected at the onset of the pandemic.

Our paper contributes to the literature on the effect of gender diversity on firms' performance (Adams and Ferreira, 2009; Carter et al., 2003; Fernández-Temprano and Tejerina-Gaite, 2020; Golubeva, 2021; Zaid et al., 2020) and also to the literature on the impact of the Covid-19 pandemic on firms' performance (Kraus et al., 2020; Fairlie et al., 2022; Muzi et al., 2022; Torres et al., 2022; Shen et al., 2020). More precisely, it contributes to the limited evidence on firms' responses to the pandemic in developing countries (Guerrero-Amezaga et al., 2022; Marquez-Cardenas et al., 2022) by looking at both the on-impact effect and firms' short-run performance thereafter.

The paper is structured as follows. In the next section we discuss the data sources and provide a descriptive analysis. Section 3 presents the empirical strategy. In the following section we look at the econometric results regarding the impact of the pandemic and the firms' performance thereafter. Section 5 concludes.

2 Data and empirical strategy

2.1 Data sources

We combine three datasets, one corresponding to a survey conducted by a major private Ecuadorian bank at the beginning of the lockdown and two publicly available administrative datasets. The latter datasets allow us to evaluate the firms' financial situation in 2019 –before the pandemic– as well as in 2020 –following the initial impact of the pandemic–.

The survey includes almost 5000 firms and was conducted by Banco de la Producción S.A. (Produbanco) during the months of April and May 2020. The survey provides information on whether a firm was in operation and, if so, the degree of operation, the firm's ability to pay its labor costs, its situation with customers and suppliers, and the strategies that the firm was adopting.[1] Produbanco matched this data with firms' leadership gender. This allows to identify female-led firms, which we define as firms in which women own more than 50% of the stock or they own between 20-50% of the stock and they occupy a position at the top level of management.

The second dataset corresponds to the firms' annual financial balances from the *Superintendencia de Compañías* (*SIC*). This data allows identifying firms' industry in addition to information on assets, earnings, cash, sales, operational margins, etc. We match this dataset with the information from the firms' survey and also with the information from the *Directorio de Empresas*. This dataset, also from the *SIC* contains information on firms' entrance and exit, along with the firms' number of workers.

Not all firms in Ecuador are subject to the control of the *SIC*, and therefore not all firms must report their annual general and profit and loss balances. In our descriptive analysis we therefore consider two different samples. The full sample includes information exclusively from the survey ($N = 4,840$), while the limited sample includes the information from the survey along with financial information for firms that report to the *SIC* ($N \approx 3,300$).[2]

An important conclusion that emerges from our descriptive analysis is that firms that report to the *SIC* are different from those that do not. This is not problematic for our analysis of the *impact* of the pandemic as we have responses from all firms in the sample. But, as firms' selection to report to the *SIC* does not seem to be random, in our econometric analysis of firms' performance we implement a selection-correction estimation based on Heckman (1979). As we show below, it turns out that selection is not a problem in the majority of specifications.

2.2 Impact and performance variables

2.2.1 On-impact effect of the pandemic

To measure the on-impact effect of the Covid-19 pandemic we consider two main variables from the survey conducted by Produbanco. Firms' survival is a basic measure of performance that has been used in previous studies (Bartik et al., 2020; Obrenovic et al., 2020; Torres et al., 2022). We thus look at whether firms remained in operation at the beginning of the pandemic. We analyze both a dichotomous outcome which simply states whether a firm was in operation or not and also an interval-coded outcome with six ranges of operation levels: 0%, 1-10%, 11-25%, 26-50%, 51-75%, and 76-100%.

A second key dimension is related to layoffs (see e.g. Bartik et al., 2020). In the case of Ecuador, however, layoffs are much harder to implement because of a tight regulatory framework. Because of this, the pandemic put a particularly strong financial pressure on firms in terms of paying for their labor costs.[3] Therefore, we analyze whether firms

[1] The survey questions are summarized in Appendix A.

[2] The exact number of observations varies across regressions because the number of missing values varies across variables.

[3] Of course the regulatory framework affects mostly firms in the formal sector, but these are precisely the firms that do report to the *SIC* as well as those that manage to obtain credit from a financial institution, and therefore appear in the Produbanco's dataset.

were able to pay their payroll during the month of April 2020, the first full month under the state of emergency decreed by the Ecuadorian government as a response to the pandemic and also the month of the first wave of Covid-19 cases.

2.2.2 Short-run firms' performance

We also analyze firms' performance during the 2020 fiscal year. To do this, we combine the results from the survey with administrative data from the *SIC*. This allows us to control for the severity of the pandemic's impact on firms and also to include a measure of firms' strategic responses and their impact on performance.

Although firms' performance is of central interest for society in the context of the Covid-19 pandemic, it is not obvious how to measure it because of its multidimensional character (Fernández-Temprano and Tejerina-Gaite, 2020; Golubeva, 2021). Furthermore, in the specific context of the Covid-19 pandemic, standard measures of performance may be less adequate due to the new set of challenges and uncertainties faced by firms (Kraus et al., 2020). We therefore analyze a broad set of variables that capture various dimensions of firms' performance.

First, recall that entrepreneurs in Ecuador have a choice of constituting their companies so as to be required to report to the *SIC* or not. As we showed above, companies that report are different from firms that do not report. Thus, we first look at the determinants of this decision.

Conditional on firms' reporting to the *SIC*, we analyze a set of performance outcomes. First, following Muzi et al. (2022), we look at firms' labor productivity measured as operating income divided by the number of workers reported by firms.[4] Second, we consider two measures of firms' performance: return on assets (ROA) and earnings before income and taxes (EBIT). ROA has been used in previous studies related specifically to the Covid-19 pandemic (e.g. Marquez-Cardenas et al., 2022; Shen et al., 2020; Zaid et al., 2020) and also in pre-pandemic research focused on firms' leadership gender (Adams and Ferreira, 2009; Carter et al., 2003). EBIT is a proxy of firms' profitability also used to measure firms' performance (e.g. Soare et al., 2021). Third, several authors have emphasized the potential impact of the pandemic on the firms' financial situation (Bartik et al., 2020; De Vito and Gómez, 2020; Paine, 2020). Firms' faced reduced cash holdings, potentially increased levels of debt –if they have access to finance–, and liquidity challenges. To test whether leadership gender has an impact on these dimensions, we also include as outcomes net cash, debt, and liquidity.

2.3 Descriptive statistics

The survey includes a total of 4840 firms, of which 1168 (24.1%) are women-led ones. 98.1% of women-led firms report to the *SIC* compared to only 67.1% of non-women-led ones. This difference might signal some fundamental underlying differences between women-led and non-women-led firms as, for example, firms that do not report to the SIC are significantly less likely to operate during the pandemic (60.5% vs. 71.7%). Therefore, we explore several key dimensions to determine whether women-led firms were in an advantageous position before the start of the pandemic. Then, we proceed to analyze the differential impact of the pandemic.

[4]We prefer to use operating income instead of sales, as the former captures operating expenses and thus provides a better measure of the value generated by workers.

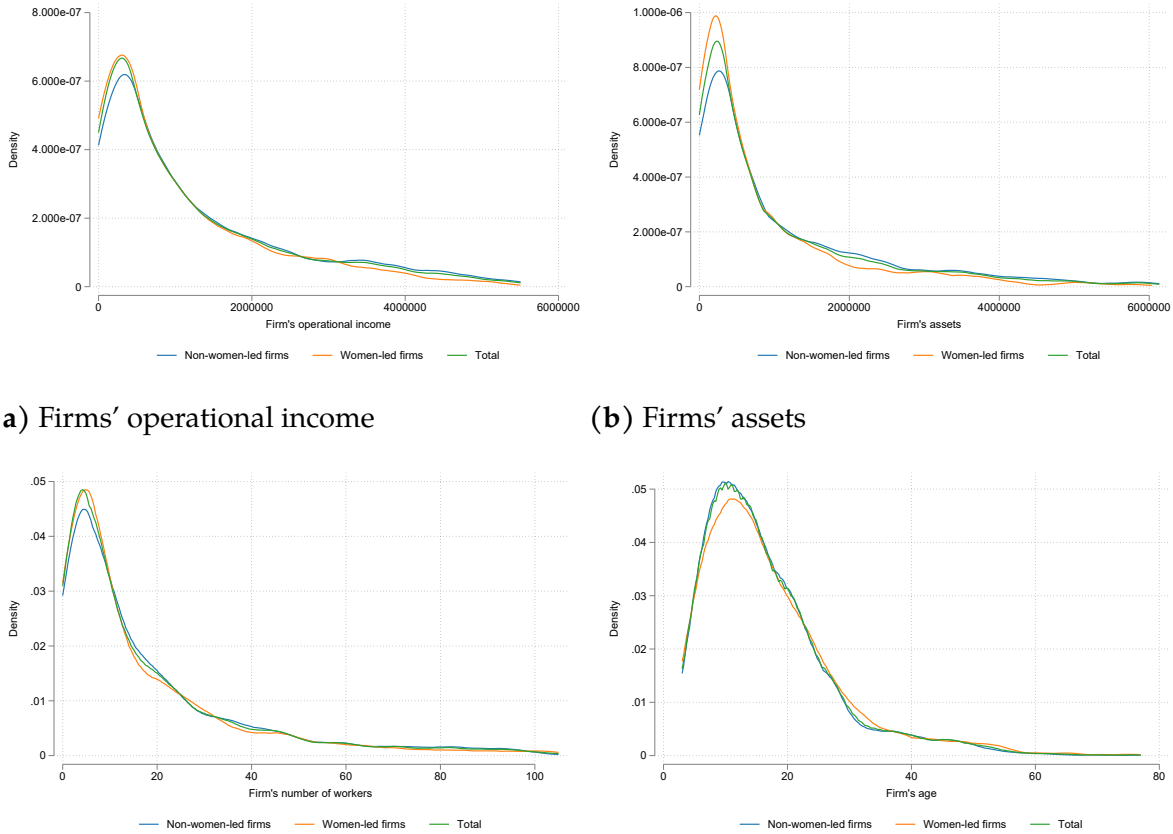
	Non-women-led firms		Women-led firms		Total	
Type	N	Percent	N	Percent	N	Percent
a) Total						
Anonymous	1,507	41.0%	700	59.9%	2,207	45.6%
Financial institution	50	1.4%	0	0.0%	50	1.0%
Others outside SIC control	310	8.4%	21	1.8%	331	6.8%
Natural person	869	23.7%	0	0.0%	869	18.0%
Limited liability	936	25.5%	447	38.3%	1,383	28.6%
Total	3,672	100.0%	1,168	100.0%	4,840	100.0%
b) Firms not reporting to the SIC						
Anonymous	4	0.3%	0	0.0%	4	0.3%
Financial institution	23	1.9%	0	0.0%	23	1.9%
Others outside SIC control	309	25.6%	21	95.5%	330	26.9%
Natural person	869	72.0%	0	0.0%	869	70.7%
Limited liability	2	0.2%	1	4.6%	3	0.2%
Total	1,207	100.0%	22	100.0%	1,229	100.0%
c) Firms reporting to the SIC						
Anonymous	1,503	61.0%	700	61.1%	2,203	61.0%
Financial institution	27	1.1%	0	0.0%	27	0.8%
Others outside SIC control	1	0.0%	0	0.0%	1	0.0%
Natural person	0	0.0%	0	0.0%	0	0.0%
Limited liability	934	37.9%	446	38.9%	1,380	38.2%
Total	2,465	100.0%	1,146	100.0%	3,611	100.0%

Table 1: Full sample distribution of firms by gender, type, and reporting status
The Table shows the number of firms and their share by firms' leadership gender, type of firm, and whether the firms' report to the SIC or not.

To understand the differences between firms that report to the SIC and those that do not, in Table 1 we report the distribution of firm types by gender and reporting status. Panel a) shows that the majority of firms are anonymous (45.6%), followed by limited liability (28.6%). In both cases, the shares are significantly larger among women-led firms. Looking at firms constituted as natural persons, while 23.7% of non-women-led firms are constituted as natural persons, no women-led firm is categorized as such. Likewise, 8.4% of non-women-led firms are constituted as a type of firm that is not under the control of the SIC, but only 1.8% of women-led firms correspond to this type of firm. Most importantly,

These differences are important to understand the distribution of reporting and non-reporting firms. Panel b) in Table 1 shows that more than 97% of the firms that do not report to the SIC are firms that are not required to report: Natural persons and other types not under the control of the SIC. Most of these firms are non-women-led. Indeed, of 1,229 total firms that do not report, 1,207 are non-women-led and 1,178 of these firms (97.6%) correspond to one of these two types. Panel c), however, shows that the structure of firm types among reporting firms is very similar for non-women-led and women-led firms, supporting comparisons among them.

In Figure 1 we look at key firms' characteristics before the pandemic; specifically, we show the distribution of reporting firms' 2019 operational income, assets, number of workers, and age, by firms' leadership gender. In general, non-women-led firms perform better in the sense that a smaller share of such firms is at lower levels of oper-



(**a**) Firms' operational income

(**b**) Firms' assets

(**c**) Firms' number of workers

(**d**) Firms' age

Figure 1: Pre-pandemic density of firms' key variables by gender.
The figure shows kernel densities of firms' operational income, assets, number of workers and age. For operational income, assets, and the number of workers we limit the horizontal axis to the value corresponding to the 95th percentile to be able to observe the differences in the distributions. Differences are minimal to the right of these levels.

ational income, assets, and number of workers than women-led firms. In other words, non-women-led firms have larger operational incomes, more assets, and are larger by the number of workers. Firms' age is different as women-led firms are slightly more mature on average. We perform Komogorov-Smirnov tests to evaluate whether the gendered distributions are indeed different for each variable. We find that operational income, assets, and number of workers are lower among women-led firms ($p = 0.002$, $p = 0.000$, and $p = 0.015$, respectively). However, we cannot reject the hypothesis that the distribution of firm age is equal among non-women-led and women-led firms ($p = 0.492$). We can thus conclude that although women-led firms are much more likely to report to the SIC, before the onset of the pandemic, among firms reporting to the SIC, non-women-led firms were in a better situation.

We next turn to a description of the impact of the pandemic on firms. Table 2 provides information on the percentage level of operation, as measured by the share of the labor force working. This variable has six categories corresponding to different estimated levels of operation: 0%, 1%-10%, 11-25%, 26-50%, 51-75%, and 76-100%. The pandemic had a very large negative impact on firms' operations as almost one-third (31.2%) of all firms in our sample was not operational. Firms that did not report to the SIC were significantly more likely ($p = 0.000$) to be non-operational (39.5%) relative to

	Non-women-led firms	Women-led firms	Total
a) Total			
Not operational (0%)	31.5%	30.2%	31.2%
1%-10%	5.8%	6.3%	5.9%
11%-25%	9.4%	8.0%	9.1%
26%-50%	17.1%	22.0%	18.3%
51%-75%	14.6%	16.5%	15.1%
76%-100%	21.7%	16.9%	20.5%
b) Firms not reporting to the SIC			
Not operational (0%)	39.8%	27.3%	39.5%
1%-10%	6.0%	0.0%	5.9%
11%-25%	8.0%	13.6%	8.1%
26%-50%	13.0%	27.3%	13.3%
51%-75%	12.5%	9.1%	12.5%
76%-100%	20.7%	22.7%	20.8%
c) Firms reporting to the SIC			
Not operational (0%)	27.4%	30.2%	28.3%
1%-10%	5.6%	6.5%	5.9%
11%-25%	10.1%	8.0%	9.4%
26%-50%	19.1%	21.9%	20.0%
51%-75%	15.6%	16.8%	16.0%
76%-100%	22.2%	16.8%	20.5%

Table 2: Firms' operational status by gender and reporting status
The table shows the firms' operational status by leadership gender and whether firms report to the SIC or not, based on the full sample of firms.

those that did report (28.3%). Among firms that remained in operation, those that report to the SIC were more likely to operate at higher levels, particularly at the 26%-50% level (20.0% vs. 13.3%) and at the 51%-75% level (16.0% vs. 12.5%).

Table 2 Panel a) also provides information about the operational differences by firms' governance structure, in particular, firms' leadership gender. There were no systematic differences ($p = 0.419$) in the share of firms not operating at the beginning of the pandemic: 30.2% of women-led firms were non-operational, compared to 31.5% of non-women-led firms. This difference is reversed among firms reporting to the SIC, where 30.2% of women-led firms reported not being operational, compared to only 27.4% of non-women-led firms. There are some differences at the positive operating levels as well. For instance, the share of women-led firms operating at 26%-50% was almost five percentage points (p.p.) higher than among non-women-led firms –22.0% vs. 17.1%– but this was essentially reversed at the 76%-100% level, which was reported by 16.9% of women-led firms, but by 21.7% of non-women-led firms. These differences remain when we look at firms reporting to the SIC. Although it seems that women-led were somewhat more affected –particularly in the reporting group–, it is not clear in either group that women-led firms were systematically more affected.

Firm size is an important dimension that also mediates the impact of the pandemic. Table 3 shows the shares of operational categories by firm size and leadership gender for the restricted sample ($N = 3,303$). Panel a) provides aggregate evidence consistent with the previous literature that smaller firms were more negatively affected than larger firms (Bartik et al., 2020; Fairlie et al., 2022; Muzi et al., 2022). While only 9.1% of large

	Not operational	1-10%	11-25%	26-50%	51-75%	76-100%
a) Total						
Micro	41.0	7.8	9.2	16.4	10.7	14.8
Small	30.0	6.2	10.2	20.2	15.2	18.3
Medium	20.1	4.7	9.9	22.5	18.1	24.8
Large	9.1	4.0	4.6	18.8	22.7	40.9
Total	27.4	5.8	9.7	20.3	15.8	21.0
b) Non-women-led firms						
Micro	35.5	7.1	10.5	17.6	9.6	19.8
Small	29.2	5.9	10.1	20.1	15.1	19.6
Medium	21.4	4.8	12.0	19.8	16.8	25.2
Large	10.3	4.8	4.8	15.1	20.6	44.4
Total	26.5	5.6	10.5	19.4	15.2	22.9
c) Women-led firms						
Micro	50.5	9.0	6.9	14.4	12.8	6.4
Small	31.5	6.6	10.6	20.3	15.4	15.6
Medium	16.7	4.4	4.7	29.1	21.4	23.8
Large	6.0	2.0	4.0	28.0	28.0	32.0
Total	29.5	6.2	7.9	22.1	17.3	17.1

Table 3: Share of operational categories by size and gender
The table shows the shares of operational ranges by firm size categories and leadership gender, using the restricted sample. The numbers in the table correspond to percentages so that each row adds up to 100%.

firms were non-operational at the beginning of the pandemic, 41% of micro firms fell into this category. At the other extreme, while 40.9% of large firms' operational level was 76% and above, only 14.8% of micro firms feel into this category. The results are broadly monotonic when we include small and medium-sized firms, i.e. operational levels were highest among large firms, somewhat lower among medium firms, even lower among small firms, and lowest among micro firms.

As a preamble to our main result, Panels b) and c) in Table 3 provide similar information, but separated by firms' leadership gender. Although there are some differences across all firm sizes, the major differences seem to be among micro firms. For instance, although the share of firms operating at the highest operational category (76-100%) is higher among non-women-led firms for all firm sizes, the difference is much larger among micro firms (19.8% vs 6.4%). Likewise, while 35.5% of micro non-women-led firms were non-operational, this percentage increased to 50.5% for micro women-led firms.

In terms of economic sectors, Table 4 shows that operational status (whether firms were operational or not) varied significantly across sectors and depending on leadership gender. sectors are defined at the ISIC section level, for a total of 18 sectors. Our sample does not include sectors O (Public administration and defense; compulsory social security), T (Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use, and U (Activities of extraterritorial organizations and bodies).

At the aggregate level, a little over 72% of firms were operational, but this varied across sectors from a maximum of 90.3% in sector A (Agriculture, forestry and fishing) to a minimum of 25.0% in sector R (Arts, entertainment and recreation). Aside

ISIC section	Description	Non-women-led firms		Women-led firms		Total	
		No	Yes	No	Yes	No	Yes
A	Agriculture, forestry and fishing	10.2	89.8	8.2	91.8	9.7	90.3
B	Mining and quarrying	23.8	76.2	60.0	40.0	35.5	64.5
C	Manufacturing	26.5	73.5	28.2	71.8	27.1	72.9
D	Electricity, gas, steam and air conditioning supply	10.0	90.0	66.7	33.3	23.1	76.9
E	Water supply; sewerage, waste management and remediation act.	22.2	77.8	-	100.0	18.2	81.8
F	Construction	51.7	48.3	42.9	57.1	49.4	50.6
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	30.6	69.4	27.0	73.0	29.4	70.6
H	Transportation and storage	18.1	81.9	23.3	76.7	19.9	80.2
I	Accommodation and food service activities	44.0	56.0	37.5	62.5	41.5	58.5
J	Information and communication	15.6	84.4	24.0	76.0	17.2	82.8
K	Financial and insurance activities	12.8	87.2	7.1	92.9	11.5	88.5
L	Real estate activities	46.9	53.1	41.7	58.3	45.0	55.0
M	Professional, scientific and technical activities	26.8	73.2	28.6	71.4	27.2	72.8
N	Administrative and support service activities	16.7	83.3	48.0	52.0	30.4	69.6
P	Education	36.0	64.0	25.8	74.2	30.4	69.6
Q	Human health and social work activities	20.5	79.5	34.8	65.2	25.8	74.2
R	Arts, entertainment and recreation	71.4	28.6	83.3	16.7	75.0	25.0
S	Other service activities	15.4	84.6	-	100.0	11.8	88.2
Total		26.8	73.2	29.7	70.3	27.7	72.3

Table 4: Operational status by firms' and gender
The table shows the shares of operational status by firms' ISIC section and leadership gender, based on the restricted sample. Our sample does not include sectors O (Public administration and defense; compulsory social security), T (Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use, and U (Activities of extraterritorial organizations and bodies).

from sector A, sectors K (Financial and insurance activities) and S (Other services activities) report very high operation levels. On the contrary, sectors F (Construction), I (Accommodation and food service activities), and L (Real state activities) had operation shares below 60%. This is consistent with some economic sectors being more adept at teleworking and thus better able to respond to the restrictions imposed to counteract the impact of the Covid-19 pandemic. Looking at the difference between women-led and non-women-led firms, in general, they move in line with the aggregate shares, but there are some very large differences in operation levels favoring non-women-led firms in sectors B, D and N, while in sector E there is a very large difference in favor of women-led firms.

Province	Non-women-led firms		Women-led firms		Total	
	Operational firms					
	No	Yes	No	Yes	No	Yes
Pichincha	26.1	73.9	25.6	74.4	25.9	74.1
Guayas	28.1	71.9	31.3	68.7	29.2	70.8
Manabi	36.5	63.6	39.1	60.9	37.5	62.5
El Oro	16.3	83.7	20.4	79.6	17.8	82.2
Azuay	37.1	62.9	27.3	72.7	34.0	66.0
Rest of country	22.2	77.8	37.9	62.1	27.5	72.5
Total	26.8	73.2	29.7	70.3	27.7	72.3

Table 5: Operational status by firms' province and gender
The table provides information on firms' operational status by the firms' province of registration and leadership gender, based on the restricted sample.

There are also significant differences by firms' province of registration.[5] We limit the categorization to include the five main provinces (by population and economic activity) and the rest of the country, which includes the remaining 19 provinces. Firms in the province of El Oro were more likely to be in operation than firms in any other province, while the lowest share of operation was in Manabi. The share of firms in operation in the two largest provinces –Pichincha and Guayas– was close to the country average, although more than three p.p. higher in Pichincha than in Guayas (74.1% vs. 70.8%). Women-led firms were less likely to be in operation in the provinces of the Coast (Guayas, Manabí and El Oro) and in the "Rest of country", but more likely to be in operation in the Highland provinces (Pichincha and Azuay).

Finally, we turn to the variables used to evaluate firms' performance between 2019 and 2020. As explained above, we consider firms' labor productivity, EBIT, Net cash, ROA, Debt, and the current ratio as a measure of firms' liquidity. Table 6 shows the mean and standard deviation of the 2019-2020 percent change of these variables, once the top and bottom five percent of observations were winsorized. We separate these measures by firms' leadership gender and a dichotomous indicator of operational status at the beginning of the pandemic. The Table also includes the mean and standard deviation of the firms' number of workers and firms' age.

The most important insight is that firms' performance was negatively affected between 2019 and 2020. Labor productivity fell on average by 16.1%, net cash fell by 14%, ROA fell by 79%, and debt increased by 44.5%. Despite these outcomes, EBIT increased by 3.7%, and liquidity increased by 16.2%.

The aggregate results mask large differences across subgroups. First, women-led firms' performed worse than non-women-led firms. Productivity fell on average by almost four p.p. more among women-led firms, net cash by around four p.p. more, and ROA by around 33 p.p. more. EBIT actually *declined* by almost 5% compared to an increase of almost 8% among non-women-led firms. Debt among women-led firms increased by 12 p.p. more than among non-women-led firms, and liquidity among the former increased by a little over two p.p. *less* than among the latter.

Second, firms that managed to remain operational during the pandemic performed better than firms that had to stop operating. Labor productivity fell by almost 18 p.p.

[5]Our dataset does not include information about the firms' actual place of operation, but only where firms registered.

		Non-women-led firms			Women-led firms			Total		
		Operational firms								
		No	Yes	Total	No	Yes	Total	No	Yes	Total
Δ% Prod.	Mean	-25.9	-10.9	-14.8	-35	-12.2	-18.7	-29.1	-11.3	-16.1
	SD	38.8	36.2	37.4	39.1	40.3	41.2	39.1	37.5	38.8
Δ% EBIT	Mean	-32.6	21.8	7.7	-40.2	9.3	-4.8	-35.3	17.8	3.7
	SD	228.1	228.5	229.6	241.2	258	254.2	232.7	238.3	237.9
Δ% Net cash	Mean	-9.2	-14	-12.7	-16	-16.9	-16.6	-11.6	-14.9	-14
	SD	69.2	76.7	74.8	83.3	77.3	79.1	74.4	76.9	76.2
Δ% ROA	Mean	-147.6	-40.3	-68.1	-159.7	-78.1	-101.7	-151.8	-52.2	-79
	SD	468	364	396.3	478.7	425.2	442.7	471.5	384.6	412.1
Δ% Debt	Mean	33	43.6	40.8	28.1	62	52.8	31.4	49.3	44.5
	SD	143	162.4	157.5	142.2	181.9	172.6	142.6	168.8	162.4
Δ% Liquid.	Mean	15.1	17.6	17	17	13.7	14.7	15.7	16.4	16.2
	SD	64.7	60.8	61.8	70.9	60.2	63.5	66.9	60.6	62.4
Workers	Mean	20	31.2	28.2	15.9	25.9	22.9	18.6	29.6	26.5
	SD	34.4	71	63.5	22.7	46.9	41.4	31	64.5	57.4
Age	Mean	17.9	16.4	16.8	17.4	17.1	17.2	17.7	16.7	17
	SD	11.5	9.8	10.3	11.9	10.6	11	11.6	10.1	10.5
Observations		601	1,644	2,245	314	744	1,058	915	2,388	3,303

Table 6: Firms' performance by gender and operational status
The table provides the mean and standard deviation of the 2019-2020 percent change in labor productivity, EBIT, Net cash, ROA, Debt and the Liquidity (as measured by the current ratio) by firm's leadership gender and operational status, based on the restricted sample. We winsorized the top and bottom five percent of observations. The bottom of the table also includes the mean and standard deviation of the firms' number of workers and age.

more among the latter than the former, and ROA fell by almost 100% more. EBIT fell by 35.3% among non-operational firms while it actually increased by 17.8% among operational ones. Still, net cash declined by more than 3 p.p. more among operational firms, and debt increased by almost 18 p.p. more among these firms compared to non-operative ones. Thus, remaining in operation was positive for firms' performance, but it also was costly.

3 Empirical strategy

3.1 On-impact effect of the pandemic

We look first at the impact of the pandemic on firms' behavior at the beginning of the pandemic. To do this, we implement the following econometric model:

$$x_{i,2020} = \alpha_0 + \alpha_1 Gender_i + \sum_j \alpha_{2j} X_{ij,2019} + \epsilon_i, \tag{1}$$

where $x_i, 2020$ represents one of the results x for firm i obtained from the firms' survey, corresponding to the following questions: 1) the extent of a firm's operation, and

2) whether the firm was able to pay its labor costs in April 2020.[6] $Gender_i$ represents an indicator variable identifying whether firm i is led by women or not. $X_{ij,2019}$ denotes a vector of control variables defined for 2019 and available for the full sample. It includes a dummy variable that takes the value of 1 if a firm reports to the *SIC*, firm type as identified in Table 1, and a dummy variable that takes the value of 1 if a firm belongs to a vulnerable sector defined as an ISIC section where the labor force has lower levels of education on average.[7] These sectors are A, C, E, F, G, and I (see Table 4 for the corresponding definitions).

We also run the same regressions with additional controls for the restricted sample. In this case, we also interact firms' leadership gender with firms' size to determine whether the impact of the pandemic depended on the combination of firms' characteristics along both dimensions. The regression that we run is the following:

$$x_{i,2020} = \beta_0 + \beta_1 Gender_i \times Size_i + \sum_j \beta_{2j} X_{ij,2019} + \sum_k \beta_{3k} X_{ik,2019} + \varepsilon_i, \qquad (2)$$

where $Size_i$ is a categorical variable of firms' size (Micro, Small, Medium, Large) and $X_{ik,2019}$ is a vector of control variables denoted including firm age, ISIC section, province of firm's registration, and the share of exports in firm's sales, all measured in 2019. ε_i are the errors.

Because of the unexpected nature of the pandemic, potential endogeneity is minimized with respect to the firms' gender structure as well as with all variables defined in 2019. Therefore, our baseline econometric model presented in equation (1) provides important insights into the determinants of firms' performance at the start of the pandemic in Ecuador, when the country faced the strongest restrictions.

Given the structure of the dependent variables defined by the data collection scheme, the actual estimation procedure represented by equation (1) varies. First, operational status is defined by a dummy variable that takes a value of 1 if a firm was in operation at the onset of the pandemic. For this outcome, we run a logit model on equation (1). Second, the extent of firms' operations is a quantitative outcome that is grouped into six intervals: 0%, 1-10%, 11-25%, 26-50%, 51-75%, and 76-100%. Consequently, we implement an interval regression, which is similar to an ordered probit estimation, but with cut points fixed and with β and σ^2 estimated by maximum likelihood (Wooldridge, 2010). Third, firms' ability to pay their labor costs in April 2020 is a dichotomous outcome, which we estimate using a logit model.

3.2 Short-run firms' performance

We complement our analysis of the on-impact effect of the pandemic with an evaluation of its effect on firms' short-run (2020) performance. To do this, we look at various outcome variables corresponding to the full year 2020 and incorporate as controls 2019 outcome variables as well as firms' response to the pandemic as captured by the survey data.

The key challenge is the fact that we observe performance measures only for a subset of firms, i.e. those that report to the *SIC*. Our descriptive analysis showed that firms differ based on their reporting status, i.e. it seems that firms self-select into reporting.

[6] The survey includes additional questions, but, as we explained above, we focus on survival and labor costs as key indicators of the impact of the Covid-19 pandemic.

[7] This data comes from ENEMDU.

To deal with this potential source of bias, we implement a Heckman (1979) selection correction model.

The Heckman (1979) selection model comprises two stages. In the first –the selection stage–, we look at whether firms reported their 2020 financial information to the *SIC*. To identify these firms, we combine information from the *SIC* dataset and the Directorio de Empresas dataset. We distinguish between firms that do not report because they closed or were in liquidation and those that were active but did not report. Because very few firms in our sample either closed or were in liquidation, we focus our analysis on active firms only. In the first stage we run the following regression:[8]

$$y_i = \gamma_0 + \gamma_1 Gender_i + \sum_j \gamma_{2j} Strategy_{ij} + \sum_k \gamma_{3k} Y_{ik} + \mu_i, \tag{3}$$

where y_i is an indicator variable equal to one if firm i reported to the *SIC* in 2020, $Strategy_{ij}$ is a set of indicator variables capturing whether firm i implemented strategy j at the onset of the pandemic. Firms report a total of 10 strategic categories apart from having no strategy, and they broadly include financing, flexible work arrangements, new lines of business, optimization, promotions, new sources of income, and digital use or delivery. Y_{ik} is a set of control variables capturing the initial response of the firm to the pandemic, including the extent of firms' operations grouped into six intervals as discussed above, a categorical variable capturing the situation of the firms' suppliers, a categorical variable capturing the situation of the firms' customers, a dummy variable of whether the firms was able to pay its labor costs in April 2020 and a categorical variable capturing how the firm plans to cover its labor costs in May 2020.

The second stage analyzes firms' performance during the first year of the pandemic on the subset of the firms for which we have financial data. The econometric estimation is the following:

$$\Delta z_i = \delta_0 + \delta_1 Gender_i \times Size_i + \sum_j \delta_{2j} Strategy_{ij} + \sum_k \delta_{3k} X_{ik} + \delta_4 Mills_i + \upsilon_i. \tag{4}$$

This equation focuses on the year-to-year (2019-2020) variation in the outcome variables to isolate the effect of the gender and strategy variables on firm performance. Δz_i represents the 2019-2020 change of a firm's performance variable. As discussed above, we analyze performance by looking at labor productivity, EBIT, net cash, ROA, debt, and liquidity. $Gender_i$ represents the firms' gender structure and $Size_i$ is a categorical variable of firm size. $Strategy_{ij}$ is a set of dummy variables capturing whether firm i implemented strategy j at the beginning of the pandemic. X_{ik} is a vector of control variables including firm age, the extent of firms' operations grouped into six intervals as discussed above, firms' type as in Table 1, firms' ISIC section, firms' registration province, a categorical variable capturing the situation of the firms' suppliers, and a categorical variable capturing the situation of the firms' customers. Finally, υ_i are the errors.

[8] We estimate the model in Stata using the heckman command, which consistently estimates the standard errors of the second stage.

4 Results and discussion

4.1 Impact of the pandemic

We first analyze the on-impact effect of the pandemic on Ecuadorian firms. In Table 7 we report the results of three specific outcomes using the firms' survey responses: whether firms were in operation in May 2020; firms' specific levels of operation measured in ranges as described above; and whether firms were able to pay their labor costs in April 2020.[9] For firms' operation and their ability to pay labor costs in April 2020 we implement a simple logit model and report odds ratios. For the firms' specific levels of operation, we estimate an interval regression (Wooldridge, 2010).

For each variable we report four different models to show the effect of restricting the sample size, including additional controls as in Torres et al. (2022), and allowing for differential effects by firms' leadership gender and firm size. The first model (columns (1), (5), and (9)) corresponds to the full-sample results. The second model (columns (2), (6), and (10)) shows the results of the same econometric specification but using the restricted sample of firms that report to the *SIC*. The third model (columns (3), (7), and (11)) incorporates a series of additional controls to the second model. Finally, the fourth model (columns (4), (8), and (12)) adds firms' leadership gender and firms' size interactions to model three.

The pandemic had a more negative effect on women-led firms' operational status, but only among micro firms. Although there is no general negative effect (columns (1)-(3) of Table 7), we find a statistically significant effect once we incorporate interactions of firms' leadership gender and firms' size (column (4)). Using linear predictions we estimate that the likelihood of having remained operational among non-women-led micro firms was 66%, which declined to 52% among women-led micro firms. This gender effect disappears for firms of other sizes.

As shown in column (3) of Table 7, firms' size played a very significant role in their operational status, independently of leadership gender. Small firms were around 40% more likely to be operational than micro firms; medium firms were 1.5 times more likely to be operational and large firms were almost 4 times more likely to be operational than micro firms. These effects are smaller –and insignificant in the case of non-women-led small firms– when we separate firms by leadership gender (column (4)), but overall small, medium, and large firms were much more likely to remain in operation at the beginning of the pandemic.

[9] In results available from the author upon request we also look at how firms planned to pay their labor costs in May 2020 and the firms' situation with their customers and suppliers at this point in time.

	Operational (Dummy)				Operational (Interval categories)				Paid April 2020 payroll (Dummy)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Woman-led	0.899	0.875	0.980	0.538***	-2.795**	-2.910**	-1.087	-8.817***	0.890	0.886	0.974	0.841
	(0.070)	(0.073)	(0.085)	(0.128)	(1.167)	(1.230)	(1.173)	(3.328)	(0.079)	(0.084)	(0.096)	(0.215)
Small			1.379**	1.078			3.852*	1.189			1.294*	1.225
			(0.195)	(0.187)			(1.990)	(2.433)			(0.198)	(0.228)
Medium			2.466***	1.917***			12.300***	8.871***			2.428***	2.294***
			(0.380)	(0.358)			(2.126)	(2.563)			(0.419)	(0.470)
Large			3.828***	2.770***			19.116***	15.692***			2.766***	2.260***
			(0.949)	(0.800)			(2.867)	(3.457)			(0.729)	(0.668)
Woman-led * Small				1.951**				7.549**				1.154
				(0.521)				(3.737)				(0.331)
Woman-led * Medium				1.981**				9.940***				1.158
				(0.558)				(3.834)				(0.363)
Woman-led * Large				2.753*				10.237*				2.539
				(1.615)				(5.695)				(1.760)
5-9 years old			1.106	1.114			-1.995	-1.891			1.090	1.087
			(0.243)	(0.246)			(3.016)	(3.012)			(0.259)	(0.258)
10-14 years old			1.059	1.066			-4.154	-4.056			1.040	1.038
			(0.230)	(0.232)			(2.996)	(2.993)			(0.245)	(0.245)
15-19 years old			0.839	0.842			-5.131*	-5.054			1.060	1.057
			(0.189)	(0.190)			(3.098)	(3.095)			(0.260)	(0.259)
10-24 years old			0.759	0.765			-7.668**	-7.554**			0.836	0.836
			(0.177)	(0.178)			(3.196)	(3.190)			(0.211)	(0.210)
25+ years old			0.667*	0.672*			-8.451***	-8.400***			1.057	1.055
			(0.152)	(0.153)			(3.142)	(3.143)			(0.265)	(0.265)
Export share			1.002	1.002			0.034	0.034			1.001	1.001
			(0.003)	(0.003)			(0.031)	(0.030)			(0.003)	(0.003)
Vulnerable sector	0.926	0.842**	0.777**	0.773**	-1.987*	-3.172***	-2.053	-2.104	1.245**	1.123	0.994	0.996
	(0.069)	(0.066)	(0.090)	(0.089)	(1.122)	(1.168)	(1.532)	(1.534)	(0.107)	(0.101)	(0.131)	(0.132)
Report to SIC	4.285**				9.834*				1.188			
	(2.979)				(5.281)				(0.792)			
ISIC Section controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Province controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Observations	4,840	3,303	3,303	3,303	4,840	3,303	3,303	3,303	4,840	3,303	3,303	3,303

Robust standard errors in parentheses. Significance level *** p<0.01, ** p<0.05, * p<0.1

Table 7: Regression results of the pandemic's on-impact effect on firms.
The table shows the effects of the pandemic on firms' operations (columns (1)-(8)). Columns (1)-(4) report odd ratios from a logistic regression of dichotomous (yes/no) operational status. Columns (5)-(8) report standard coefficients from an interval regression of interval categories. Columns (9)-(12) report odd ratios from a logistic regression of dichotomous firms' ability to pay their labor costs in April 2020. For each variable, the second and third columns allow disentangling the effect of reducing the sample size and of adding controls, while the fourth column includes interactions of firms' leadership gender with firms' size categories.

The results of firms' operations in terms of interval categories provide a more precise perspective of the previous results. On average, women-led firms' level of operation was almost 3 percentage points below non-women-led firms (columns (5) and (6) of Table 7). This result becomes statistically insignificant when we include controls for firm size (column (7)), but again we find that the result is large and statistically significant when we isolate firm size effects by firms' leadership gender (column (8)). Women-led micro firms operated almost 9 p.p. below non-women-led micro firms. Again, small, medium, and large firms' levels of operation were significantly higher. Using linear predictions we estimate firms' levels of operation. While all firms were deeply affected, women-led micro firms' predicted level of operation was 24%, much lower than non-women-led micro firms' predicted level of operation of 33%, small firms' 33-34%, medium firms' 42-43%, and large firms' 49-50%.

Firms' level of operation is also mediated by firms' age. However, contrary to what we expected, older firms (aged 20 and over) operated at around 8 p.p. *lower* than young firms (between 0 and 4 years old). Indeed, estimating linear predictions of operational levels, we find that young firms operated on average at 42% of capacity, but this level declines monotonically as we move to older firm categories. Firm levels of operation were between 34 and 35% for firms 10 years old and above. Finally, firms reporting to the SIC were more than 4 times more likely to be in operation than non-reporting firms.

Economic sectors (not reported) were also important to determine firms' operational status and specific levels of operation.[10] Relative to ISIC section C (Manufacturing), firms in ISIC sections A (Agriculture, forestry and fishing), J (Information and communication) and K (Financial and insurance activities) were more likely to be in operation at the beginning of the pandemic, while those in ISIC sections F (Construction), I (Accommodation and food service activities), L (Real estate activities) and R (Arts, entertainment and recreation) were less likely to be in operation.

Similar results (not reported) are observed regarding firms' levels of operation. Relative to Manufacturing, firms in ISIC sections A, H (Transportation and storage), J, and K had higher levels of operation, ranging from 8 p.p. for firms in section H to 20 p.p. for firms in section A. Also relative to manufacturing, firms in ISIC sections B (Mining and quarrying), F, I, L, and R had lower levels of operation, ranging from -8% in section L to -30% in section R.

Finally, firms' location also mediated the effect of the pandemic (results not reported). Relative to firms located in Pichincha –where the capital and largest city Quito is located–, firms located in the province of Manabí in the Coast were less likely to be in operation. Firms located in Manabí and Azuay operated at 11 p.p. and 7 p.p. lower levels than firms in Pichincha, but firms in El Oro operated at almost 15 p.p. above.

We also run alternative econometric models to evaluate whether the effect of firms' leadership gender on operational status and level interacts with economic sector, firm age, or firm geographical location. Regarding economic sector, in general we found no gender-related differences except that women-led firms in the ISIC section N (Administrative and support activities) were 29 p.p. less likely to be in operation than non-women-led firms in the same sector (52% vs. 81%) and their average operational level was 18 p.p. lower. Leadership gender did not affect the relationship between firms' age and their operational status or level. However, women-led firms located outside of the main cities in the country experienced a negative effect on operation status and levels. While the likelihood of non-women-led firms in this region operating during the pan-

[10] The results are available from the author upon request.

demic was 74%, it was only 61% for women-led firms. Likewise, women-led firms in this region operated 9 p.p. below non-women-led firms.

Regarding firms' ability to pay their payroll in April 2020, we find no difference due to firms' leadership gender. However, as in the case of operation, firms' size played a key role. Medium and large firms were more than twice as likely to pay their payroll than micro firms.

Relative to firms in the manufacturing sector, firms in ISIC sections A and K were more likely to pay their April 2020 payroll, but firms in ISIC section R were less likely to pay it.[11]

4.2 Firms' short-run performance following the pandemic

Having considered the heterogeneous impact of the pandemic, we next turn to the firms' 2020 performance and in particular the effect of firms' strategies. As discussed above, we look at the determinants of firms' reporting to the *SIC*, and, conditional on firms' reporting, we analyze the following six variables: Labor productivity, Earnings before income and taxes (EBIT), Net Cash, Return on assets (ROA), Debt, and Liquidity (current ratio).

Let us first consider the results on firms' reporting, presented in Table 8. The coefficient on women-led firms implies that these firms were 30 p.p. more likely to report to the *SIC* than non-women-led firms. As expected, firms that remained operational at the beginning of the pandemic were more likely to report to the *SIC*. Specifically, relative to firms that stopped operations, firms that operated above 10% during the pandemic were between 5-9 p.p. more likely to report to the *SIC*.

Firms' strategies also mattered for reporting. Relative to firms that had no strategy, firms that opened a new line of business or that implemented promotions were 7 p.p. more likely to report to the *SIC*. Likewise, firms that included financing as part of their strategy were 9 p.p. more likely to report to the *SIC*. Finally, firms that optimized resources and those that incorporated teleworking were 11 and 13 p.p. more likely to report to the *SIC*. Importantly, although previous studies have emphasized the importance of digitization and technology adoption (Bartik et al., 2020) and their role as a differentiator during the pandemic (Akpan et al., 2021), we find that it did not have an effect on firms reporting to the *SIC*.

Finally, the question of how firms planned to pay for their labor costs in May 2020 provides additional insights into the pressures put on firms by the pandemic. We include these controls in our estimations but do not show them for convenience. Relative to those firms that did not know how they were going to cover their May 2020 payroll, firms that were not going to pay for it and those that were going to use their saving to pay for it were 10 p.p. and 5 p.p. less likely to report to the *SIC*.

The results reported in Table 8 confirm our insight that reporting firms are different from non-reporting firms. Since we observe our performance measures only for those firms reporting to the SIC, it is likely that a standard OLS estimation might suffer from selection bias. For this reason, we estimate a Heckman (1976, 1979) selection correction model along with a standard OLS model.

[11] There were no statistically significant differences when looking at interactions between firms' leadership gender and ISIC section, firms' age, and firms' province of registration.

Variables	Report to the SIC
Woman-led	1.664***
	(0.092)
Op. Level >0% and <= 10%	0.120
	(0.099)
Op. Level >10% and <= 25%	0.250**
	(0.086)
Op. Level >25% and <= 50%	0.324***
	(0.078)
Op. Level >50% and <= 75%	0.270***
	(0.081)
Op. Level >75% and <= 100%	0.170*
	(0.074)
Fully open	-0.055
	(0.586)
Financing	0.306*
	(0.121)
Teleworking	0.470***
	(0.065)
New line of business	0.248**
	(0.077)
Optimizing resources	0.389***
	(0.070)
Other income - consulting	0.400
	(0.282)
Other income - equipment selloff	0.495
	(0.386)
Promotions	0.238*
	(0.098)
Digital use and/or delivery	0.028
	(0.070)
Schedules	-0.012
	(0.103)
Paid April 2020 payroll	-0.118
	(0.068)
May 2020 payroll controls	Yes
Observations	4,839

Bootstrapped standard errors in parentheses.
Significance level *** p<0.001, ** p<0.01, * p<0.05

Table 8: Regression results for firms reporting to the SIC.
Estimation follows a Probit model and we present standard coefficient for consistency with the first-stage estimation of the Heckman selection model. Standard errors are calculated based on a bootstrap with 250 repetitions.

Variables	Productivity		EBIT		Net cash		ROA		Debt		Liquidity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Women-led	-0.592	-11.495	-16.328	-51.808	1.146	12.875	-40.193	-96.693	-11.375	-4.459	13.460	12.751
	(4.036)	(7.116)	(31.404)	(37.198)	(8.383)	(14.444)	(49.574)	(75.356)	(15.565)	(36.084)	(9.211)	(11.934)
Small	22.414***	22.162***	50.434*	50.977**	-0.279	0.695	45.768	44.029	37.528*	37.532*	-4.462	-4.616
	(2.854)	(2.996)	(20.193)	(17.443)	(6.169)	(6.275)	(32.267)	(33.981)	(14.785)	(17.873)	(5.497)	(6.302)
Medium	30.728***	30.391***	60.362**	60.170***	3.055	4.088	96.245**	94.948**	24.361	23.922	-8.231	-8.797
	(2.828)	(3.374)	(20.564)	(18.010)	(5.399)	(6.962)	(34.977)	(32.920)	(15.661)	(19.204)	(5.035)	(6.312)
Large	35.443***	35.226***	73.658**	73.930**	-2.425	-1.516	122.935**	122.094**	34.122	33.614	-9.225	-9.607
	(4.144)	(3.880)	(28.090)	(23.611)	(8.313)	(9.294)	(42.389)	(44.456)	(18.477)	(24.044)	(6.072)	(7.645)
Woman-led * Small	-0.620	0.207	21.855	23.791	-0.982	-3.676	60.381	66.076	18.873	19.490	-19.925*	-19.280*
	(4.419)	(5.148)	(34.574)	(30.874)	(9.767)	(12.598)	(56.122)	(60.213)	(17.183)	(23.822)	(9.515)	(9.520)
Woman-led * Medium	0.872	2.076	11.477	14.947	-7.776	-11.027	-13.132	-3.544	32.398	34.095	-17.072	-16.441
	(4.207)	(5.558)	(36.158)	(28.326)	(9.089)	(11.311)	(57.752)	(68.764)	(22.956)	(26.207)	(10.506)	(9.194)
Woman-led * Large	4.479	5.615	-14.779	-11.121	1.119	-2.044	-60.474	-52.441	48.453	50.511	-26.070**	-24.978*
	(7.347)	(6.659)	(51.721)	(50.293)	(14.784)	(16.415)	(70.186)	(81.577)	(38.995)	(46.821)	(9.708)	(12.236)
5-9 years old	-20.205***	-20.059**	-80.558	-79.950**	47.640***	47.654***	56.384	56.018	-131.263**	-132.104***	-3.744	-3.657
	(5.834)	(6.576)	(44.611)	(31.012)	(11.598)	(12.177)	(51.587)	(50.641)	(50.482)	(36.810)	(8.095)	(7.892)
10-14 years old	-28.634***	-28.342***	-106.617*	-106.722***	48.921***	48.796***	26.700	27.753	-141.793**	-143.151***	-3.980	-4.437
	(5.442)	(6.430)	(43.393)	(30.453)	(9.836)	(11.605)	(51.507)	(46.527)	(50.650)	(38.114)	(8.366)	(7.274)
15-20 years old	-26.837***	-26.745***	-104.070*	-104.185**	52.043***	52.134***	16.997	16.172	-135.196**	-137.292***	-7.623	-7.640
	(5.631)	(6.251)	(41.955)	(33.606)	(11.234)	(11.901)	(52.372)	(50.580)	(48.740)	(37.480)	(8.094)	(6.659)
20-24 years old	-31.139***	-30.940***	-130.513**	-130.404***	49.309***	49.372***	-1.913	-2.393	-139.014**	-139.813***	-10.353	-10.389
	(5.860)	(6.404)	(42.631)	(34.769)	(11.304)	(11.490)	(49.515)	(55.965)	(48.446)	(40.291)	(8.538)	(8.359)
25+ years old	-32.831***	-32.727***	-150.128***	-149.926***	56.250***	56.102***	-68.629	-70.165	-140.796**	-141.627***	-12.178	-12.605
	(5.660)	(6.433)	(43.878)	(31.108)	(11.234)	(11.801)	(52.732)	(52.152)	(50.167)	(39.878)	(7.537)	(6.608)
Op. Level >0% and <= 10%	2.092	-0.400	13.141	2.626	-6.667	-5.103	34.887	22.063	-4.877	-2.559	-4.361	-3.488
	(3.043)	(3.740)	(18.621)	(22.952)	(6.335)	(6.326)	(37.782)	(39.370)	(14.679)	(17.177)	(4.688)	(5.798)
Op. Level >10% and <= 25%	6.903*	3.463	28.353	15.561	-0.684	2.122	83.306**	65.246	3.072	6.839	4.480	4.813
	(3.172)	(3.180)	(14.782)	(17.609)	(5.496)	(6.257)	(26.238)	(33.375)	(12.528)	(13.694)	(5.244)	(5.542)
Op. Level >25% and <= 50%	6.405*	2.103	29.132	13.740	-2.928	0.600	98.606***	76.318*	-1.058	3.023	5.187	5.608
	(2.679)	(2.416)	(15.994)	(17.842)	(4.227)	(5.448)	(25.079)	(34.547)	(13.501)	(14.406)	(4.296)	(5.158)
Op. Level >50% and <= 75%	12.967***	9.072**	46.403**	32.270	-11.689*	-8.703	89.316***	68.793*	5.940	9.173	2.127	2.449
	(2.955)	(2.769)	(17.407)	(19.617)	(5.850)	(5.668)	(23.810)	(34.585)	(13.908)	(16.905)	(4.721)	(4.922)
Op. Level >75% and <= 100%	13.274***	9.880***	41.597*	28.546	0.023	2.545	72.983**	54.199	-5.536	-2.145	2.165	2.450
	(2.852)	(2.755)	(16.152)	(20.094)	(4.710)	(6.032)	(27.383)	(34.605)	(15.448)	(15.207)	(4.598)	(5.241)
λ		-18.847*		-63.836		17.446		-96.785		16.148		1.230
		(7.907)		(45.409)		(19.566)		(77.584)		(35.734)		(14.843)

Bootstrapped standard errors are presented in parentheses. Significance level *** p<0.01, ** p<0.05, * p<0.1

Table 9: Regression results for firm performance.
The Table presents results for labor productivity, EBIT, Net Cash, ROA, Debt, and Liquidity (measured by the current ratio). Odd-numbered columns report results from OLS estimations, while even-numbered columns present results using the Heckman two-stage estimation.

The results are presented in Table 9. Odd-numbered columns correspond to OLS estimations, while even-numbered columns correspond to the second stage of the Heckman selection model.[12] Selection bias does not seem to be a problem in most specifications as shown by insignificant Mills ratios (λ). The only exception is productivity. Still, both because of this specific outcome, and to clearly highlight the effect of controlling for selection bias, our preferred specifications are those corresponding to the Heckman estimation (even columns).

In general, women-led firms' performance was not different from non-women-led firms across the analyzed dimensions. The only significant result is that liquidity among small and large women-led firms fell more than among non-women-led micro firms (the omitted category). However, conditional on the same firm size, there was still no difference between women-led and non-women-led firms.

Micro firms performed worse than larger firms across several dimensions. Relative to micro firms, small, medium, and large firms experienced a larger growth of productivity (22-35 p.p.), EBIT (51-73 p.p.), ROA (95-122 p.p.). Yet, small firms also experienced larger growth of debt (38 p.p.) relative to micro firms. The last point is important because it likely reflects the fact that small firms have better access opportunities to credit than micro firms. Thus, the latter performed better than the former, but at the cost of acquiring more debt. The insignificant effect among medium and large firms can be explained by considering that, although these also have better access to finance, they likely did not need to incur as much debt and/or their debt was cheaper than for small firms.

Younger firms performed better across some dimensions compared to older ones. Relative to firms younger than five years, older firms' productivity grew between 20-33 p.p. less and EBIT grew between 80-150 p.p. less. However, higher productivity and earnings growth among younger firms was associated with lower net cash growth and increased debt. Compared to young firms, 10-year-old firms and older experienced net cash growth that was between 48-56 p.p. higher, while their debt growth was between 131-142 p.p. smaller.

Firms that had high operational levels (above 50%) during the pandemic experienced productivity growth between 9-10 p.p. higher than non-operational ones. Likewise, firms with relatively high operational levels (26-75%) also experienced ROA growth 69-76 p.p. higher than non-operational firms.

We also include in the regressions categorical variables corresponding to the various strategies mentioned by the firms at the beginning of the pandemic (not reported). In general, the strategies adopted did not have either a positive or negative impact on firms' performance. However, firms that implemented a new line of business had somewhat negative effects. Their productivity grew by seven p.p. less than firms without a strategy, and their ROA grew by a whopping 94 p.p. less. The only other strategy with a significant effect consisted of obtaining income by selling equipment, which was associated with a 186 p.p. higher ROA growth.

Firms' economic sector also had a significant effect on performance. Relative to manufacturing firms, firms in ISIC section G (Wholesale and retail trade; repair of motor vehicles and motorcycles) experienced a 24 p.p. higher growth in EBIT, but a 26 p.p. higher growth in debt.

[12] Results from the first stage of the Heckman selection model corresponding to each performance measure are available from the author. The results presented in Table 8 are essentially the same as the ones from these first stages.

On the contrary, firms in ISIC section I (Accommodation and food service activities) experienced significantly negative results. Compared to firms in the manufacturing sector, their productivity grew by 24 p.p. less, their EBIT by 97 p.p. less and their ROA grew by 176 p.p. less. Likewise, firms in ISIC section N (Administrative and support service activities) performed worse. Firms in this section had their productivity grow by 17 p.p. less, their EBIT by 61 p.p. less and their ROA by 138 p.p. less than manufacturing firms.

Firms in ISIC section K (Financial and insurance activities) did very well. Compared to manufacturing firms, these firms' productivity increased by 17 p.p. more, their EBIT increased by 72 p.p. more and their ROA grew by 140 p.p. more.

Productivity of firms in ISIC section P (Education) increased by 16 p.p. less than firms in the manufacturing sector.

ROA of firms in ISIC sections Q (Human health and social work activities) and R (Arts, entertainment and recreation) grew much more relative to manufacturing firms (141 and 218 p.p., respectively).

Geographical variation also had important consequences. Relative to firms registered in Pichincha, firms registered in Guayas experienced faster ROA growth (63 p.p., respectively). And debt among firms located outside the five main cities grew by 32 p.p. less.

5 Conclusions

Profiting from a survey covering almost 5,000 Ecuadorian firms at the beginning of the pandemic, we find that women-led micro firms were more negatively affected in terms of their ability to operate. This effect is on top of the general firm size effects that we document according to which small, medium, and large firms were significantly more likely to operate and to operate at higher levels independently of firms' leadership gender. Medium and large firms also were significantly more likely to pay their April 2020 payroll than micro and small firms. Finally, women-led firms outside of the main five cities in Ecuador faced a significantly more negative impact, likely facing additional challenges in more backward areas of the country.

Contrary to previous evidence, older Ecuadorian firms (20+ years) were less likely to be in operation and also operated at lower levels. This is an important insight likely resulting from younger firms being more flexible and thus better capable of responding to the restrictions imposed by the pandemic and the measures implemented to limit its impact.

Consistent with international experience, we find that construction –and the related real-state activities– along with hospitality and entertainment were more negatively affected by the pandemic. On the contrary, agriculture, information and communication, transportation (in the case of operational level), and financial services were significantly less affected. This reflects a mixture of the firms' ability in different economic sectors to implement measures to palliate the impact of the pandemic such as e.g. teleworking, along with the priorities set by the Ecuadorian government in order to guarantee basic services such as food.

Regarding short-run firms' performance, women-led firms were much more likely to report to the *SIC* during the pandemic. Firms' strategies were also relevant for reporting. Specifically, opening a new line of business, implementing promotions, financing,

optimizing resources, and teleworking were positively associated with firms' likelihood of reporting to the *SIC*.

Finally, we analyzed six performance outcomes to evaluate the short-run impact of the pandemic: labor productivity, EBIT, net cash, ROA, debt, and liquidity. We found that performance did not differ among women-led and non-women-led firms. Together with the results on the on-impact effect of the pandemic on firms, this implies that women-led micro firms and women-led firms outside the five main cities of the country were better able to recover following the initial impact of the pandemic. In particular, despite having experienced worse effects of the pandemic, these firms ended up performing similarly to other, less affected firms.

Firm size and age also mattered for performance. On the one hand, micro firms performed worse than larger firms on productivity, EBIT and ROA. On the other hand, young firms performed better on productivity and EBIT, but this seems to have come at the cost of less net cash growth and more debt. This is broadly consistent with the on-impact results of the pandemic.

Some of the economic sectors that were more severely affected at the beginning of the pandemic managed to recover, for instance, entertainment and recreation. But this was not the case with hospitality which performed significantly worse. Also, administrative and support services performed worse, despite not being differentially affected on impact. The financial sector did much better. Productivity fell in education, while ROA increased much more in the health sector.

Finally, strategies adopted by the firms do not seem to have had an impact on their performance; but firms that implemented a new line of business tended to have negative results on productivity and ROA, likely showing the necessary learning and costs associated with it.

The pandemic had heterogeneous effects on firms depending on their characteristics. In this paper, we delved deeper into the specific dimensions that were relevant in the Ecuadorian case, focusing on firms' leadership gender, size, age, and economic sector. We also looked at how Ecuadorian firms responded during the first year of the pandemic conditional on its initial impact. Recent research shows that some economic effects of the pandemic are likely to persist over time (e.g. Barrett et al., 2023). In the case of Ecuadorian firms, this is a key question that needs to be addressed in future research.

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Appendix

Appendix A. Survey questions

1. Is the firm currently in operation?
2. Was the firm able to pay its labor costs in April?
3. How will the firm pay its labor costs in May?
4. How is the current situation with its main customers?
5. How is the current situation with its main suppliers?
6. Does the firm have a strategy to reactivate its business during lockdown?
7. What strategy does it have?
8. Do you consider that the communication with [the financial institution] and the technological tools have been appropriate during these days?
9. Additional comment by the firm regarding communication with [the financial institution].

Appendix B. ISIC sector codes and description

ISIC section	Description	Non women-led firms		Women-led firms		Total
		N	%	N	%	N
A	Agriculture, forestry and fishing	186	75.3	61	24.7	247
B	Mining and quarrying	21	67.7	10	32.3	31
C	Manufacturing	298	66.7	149	33.3	447
D	Electricity, gas, steam and air conditioning supply	10	76.9	3	23.1	13
E	Water supply; sewerage, waste management and remediation activities	9	81.8	2	18.2	11
F	Construction	118	73.8	42	26.3	160
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	669	65.3	355	34.7	1,024
H	Transportation and storage	182	66.9	90	33.1	272
I	Accommodation and food service activities	50	61.0	32	39.0	82
J	Information and communication	109	81.3	25	18.7	134
K	Financial and insurance activities	47	77.1	14	23.0	61
L	Real estate activities	64	64.0	36	36.0	100
M	Professional, scientific and technical activities	265	77.5	77	22.5	342
N	Administrative and support service activities	126	56.3	98	43.8	224
P	Education	25	44.6	31	55.4	56
Q	Human health and social work activities	39	62.9	23	37.1	62
R	Arts, entertainment and recreation	14	70.0	6	30.0	20
S	Other service activities	13	76.5	4	23.5	17
	Total	2,245	68.0	1,058	32.0	3,303

Table 10: Distribution of firms by leadership gender and ISIC Rev. 4 section