The Impact of COVID-19 on Formal Firms: Lessons from Administrative Tax Data

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Abstract

Most low-income countries lack high-frequency firm-level data to monitor the effect of economic shocks in real time. We examine whether administrative tax data can help fill this gap, in the context of the COVID-19 pandemic. In spring 2020, we used the full population of corporate tax returns for 2019 in six developing countries to predict the effect of COVID-induced shocks on formal firms' activity. Comparing the predictions to the realized 2020 data, we find that firms were more resilient than predicted: the share of unprofitable firms increased by only 7 percentage points, while aggregate profits and taxes paid remained stable. The simulations failed to anticipate that labor and capital inputs would flexibly adjust and that large firms would be very resilient. Complementing our simulations with higher-frequency VAT data would have markedly improved predictions.

JEL classification: H25, H32, H61, O12

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1 Introduction

The onset of the COVID-19 pandemic in 2020 forced governments to implement lockdowns and movement restrictions at the risk of curtailing economic activity. While high-income countries often compensated firms and households during the period of reduced activity, developing countries had less fiscal space to do so. It was hence unclear how the shock would impact firms in lower-income countries. The few ex-ante predictions varied considerably across countries and studies (IMF, 2020; World Bank, 2020; Baker et al., 2020; Carletti et al., 2020), but ex-post data on the realized impact is now available.

This paper presents ex-ante simulations of the impact of the COVID-19 shock on firm activity in six developing countries and compares them to the realization. The simulations were conducted in the spring of 2020 to inform governments at the height of the first COVID wave (Bachas et al., 2020). The realized data is reported a year later, in spring 2021. We find that formal firms' profits were much more resilient than we had predicted. Our simulations were overly pessimistic about the size of the shock in terms of lost revenues and failed to anticipate that all input costs would flexibly adjust and that large firms would fare better than smaller firms. The retrospective evaluation highlights both the challenges and promises of using administrative tax data to address policymakers' demands for real-time predictions.

The simulations were conducted for six countries in which we were already working with firms' corporate income tax (CIT) data: Costa Rica, Ethiopia, Dominican Republic, Honduras, Guatemala and Uganda.[1] While high-income countries possess various indicators of firm activity, firm-level data in developing countries is scarce, and CIT returns often contain the most recent data on formal firms. CIT data include the largest firms, which are often missing in survey data, and constitute a panel.[2] We harmonize the CIT data across countries by focusing on variables that are reported in the same way in all countries.

Our simulations were based on firms' total revenue, their cost breakdown and their sector of activity in 2019, and a simple set of assumptions. Specifically, we followed Vavra (2020) to divide sectors into three groups according to the severity of the assumed revenue shock during a lockdown. We assumed that the 2020 lockdown would depress firms' yearly

[1] In our earlier working paper, Bachas et al. (2020), we also included simulations for Albania, Eswatini, Ethiopia, Montenegro, Rwanda and Senegal, but we do not evaluate these additional simulations, as we do not have the realized 2020 data on the outcomes for their firms.

[2] Financial accounting data, such as ORBIS or Compustat can be fairly representative of firm activity in high-income countries, yet it only captures a few very large firms in developing countries: e.g. in Honduras, Orbis includes 46 companies with positive sales in 2019, versus 23,390 firms in the corporate tax data for 2019.

sales by 25%, 12.5%, or 5% depending on their sector. In addition, we assumed that firms' material costs would adjust one-for-one with revenue, labor costs would adjust only if necessary to prevent firms from making losses, and fixed (capital) costs would not adjust. Three factors hence governed the severity of the shock's impact on firms in our simulations: the assumed loss in sales by sector, the sectoral composition of the economy, and firms' input mix. Given the sectoral composition of the economies we study, our assumption implied a yearly revenue drop of 11% on average. We predicted that only 54% of firms would remain profitable in 2020, compared to a 75% average at baseline, and that aggregate profits would fall by over a third of baseline (or by around 2% of GDP), leading to a drop in corporate tax revenue of around 0.5% of GDP.

We retrospectively evaluate the accuracy of these predictions, by comparing them to the realized outcomes reported on the CIT declaration for 2020, filed in 2021. We document that formal firms were very resilient: the share of profitable firms fell in all six countries, but only by 7 percentage points on average, a third of the drop we had predicted. Despite a reduction in the share of profitable firms, aggregate profits and corporate tax collection hardly fell in 2020. These results are broadly consistent across the six countries.

What explains the resilience of formal firms and the overly pessimistic simulation results? Qualitatively, we see that the assumptions we made for our simulations were reasonable. The economic sectors predicted to face a larger reduction in sales did face a larger drop than other sectors, and the relative ranking of input costs by ease of adjustment held: material inputs adjusted more than labor inputs, which in turn adjusted more than capital inputs. Yet the magnitudes were off. First, the size of the revenue shock was smaller than we predicted across all sectors and countries (except in Honduras): firms' year-on-year revenue dropped by only 5% on average between 2019 and 2020, while our simulations assumed that the lockdowns would induce an annual average drop of 11%. Second, total input costs were adjusted flexibly to limit the loss in profits: contrary to our simulations which assumed some degree of rigidity in labor and capital costs, labor costs adjusted close to one-for-one with revenue, and capital costs also adjusted substantially. Third, larger firms fared much better than smaller firms, thus mitigating the aggregate loss in profits and tax revenue. Taken together, the moderate loss in revenue and the full input adjustment explain the modest reduction in the share of profitable firms; adding the resilience of large firms rationalizes the quasi-absence of a reduction in aggregate profits.

Our assumptions on the size of the revenue shock by sector were ad-hoc and followed Vavra (2020). In our retrospective evaluation, we examine how much the accuracy of

our predictions would have improved if we had used 'real-time' data on sales reported in monthly value-added tax (VAT) returns to measure the size of the revenue shock by sector and country. Although we did not have VAT data for all countries at the time, the governments had these data and we obtained access to them in four of the six sample countries for the ex-post evaluation. The reported year-on-year changes to sales in the VAT data between March and June 2020 provide a real-time estimate of the sector-specific drop in sales. We thus augment our simulations by replacing the assumed sales drop with the observed sales drop. This halves the gap between our prediction and the realized effect of the shock on firms' profitability in 2020. High-frequency administrative data is often used for policy analysis in high-income countries, and could increasingly be used in lower-income countries, as the digitization of tax data facilitates their extraction and processing.

Finally, we discuss the role of support policies implemented by governments to explain firms' resilience and the cross-country heterogeneity. Unsurprisingly, the stringency of the lockdowns appears to be a key factor for the cross-country variation: Honduras experienced both the longest restrictions to economic activity (over three months) and the largest drop to firms' revenue, while Costa Rica had short lockdowns (two weeks) and saw the best firm performance among sample countries. In terms of economic support, the policies enacted in the six countries were limited, representing 1-3% of GDP overall, which is much smaller than the typical support packages provided in high-income countries. The measures targeting firms specifically (rather than households) were particularly small. Stimulus policies are thus unlikely to explain the resilience of formal firms.

Our study makes two main contributions. First, we document the unsuspected resilience of formal firms, in a comparable manner across six developing countries, and detail the channels that explain this resilience. Second, we examine a use case for administrative tax data to inform real economic outcomes, in a context where other data are scarce, and where just-in-time policy analysis is crucial for policymakers. Our toolkit could be used, not only to inform the impact of COVID-19 on economic activity, but also for other shocks that could impact firms' sales, profits, employment, and tax revenues. Our work relied on the assembly and harmonization of a novel dataset of corporate tax records for multiple countries, as part of a World Bank project to promote the use of administrative tax data for research and policy evaluation in developing countries.[3]

The paper is organized as follows. Section 1.1 reviews the literature on the impact of the

[3]See Pomeranz and Vila-Belda (2019) and Slemrod (2018) for a summary of recent studies using tax data.

COVID-19 pandemic on firms. Section 2 presents the data and the simulations. Section 3 compares the simulations to the realizations. Section 4 decomposes the channels explaining the differences between simulations and realizations. Section 5 discusses improvements to the simulations and relevant government policies. Section 6 concludes.

1.1 Literature

At the onset of the COVID-19 pandemic, firms worldwide experienced lost revenue, business closures, and worker layoffs.[4] Yet, we find that most formal firms in developing countries were resilient, rebounding quickly and completely after the initial shock. This result is echoed in the literature: the most comparable papers also use VAT return data, but in a single country, and find that firms in China, Rwanda and Zambia, respectively, recovered their sales back to pre-crisis levels fast (Chen et al., 2023; Mascagni and Lees, 2023; Hoy et al., 2022). In Uganda, one study shows that small and medium firms temporarily closed but quickly reopened after the lockdown (Alfonsi et al., 2021); and another finds that most employees returned to their original employer despite mass layoffs at the onset of the pandemic (Bassi et al., 2021).

We also document the heterogeneity of the shock across firms and countries. First, we find that within the formal sector, firms in the top sales decile faced a lower revenue shock than smaller firms, in each of our six sample countries. This adds to the literature on the correlates of resilience, which also finds that younger firms and firms part of a business group fared better (Jain and Kumar, 2023; Adian et al., 2020).[5] Second, we show the importance of these heterogeneous effects in explaining the limited impact of the pandemic on aggregate revenue, profits and taxes, and suggest that the duration of lockdowns had a strong impact on the revenue shock. Our results on tax revenue align with James (2020), who shows that tax collection shortfalls due to the pandemic were lowest in Sub-Saharan Africa and Latin America.

Finally, we add to the literature that predicts and estimates in a timely manner the impact of sudden shocks (such as the COVID-19 pandemic). Our exercise is most closely related to Carletti et al. (2020), who simulated the impact of a three-month lockdown with sector-

[4] See for example Apedo-Amah et al. (2020), Adams-Prassl et al. (2020), Bartik et al. (2020), Fairlie (2020), Humphries et al. (2020), Zou et al. (2020), Hatayama et al. (2022), Khamis et al. (2021), Aga and Maemir (2022), Guerrero-Amezaga et al. (2022), Kawaguchi et al. (2022), and Angelov and Waldenström (2023).

[5] Formal firms were also more resilient than informal firms, after controlling for government support; the adoption of technologies before the pandemic is associated with a higher resilience in Egypt (El-Haddad and Zaki, 2023), and in El Salvador, Guatemala, Honduras, and Nicaragua (Olvera et al., 2022).

specific shocks for Italian firms.[6] More broadly, an expanding body of work uses high-frequency data—on a daily, weekly or monthly basis—to estimate the impact of shocks. The data sources are numerous, including real-time survey data (Adams-Prassl et al., 2020); stock market returns (Alfaro et al., 2020; Baker et al., 2020); electricity and housing prices (Bricongne et al., 2023; Fezzi and Fanghella, 2020); credit card usage (Chetty et al., 2020; Horvath et al., 2023); job adds (Forsythe et al., 2020); and working hours (Bartik et al., 2020; Kurmann et al., 2020). These studies are conducted for the United States and Europe, where such data are available.[7] In lower-income countries, where the aforementioned data sources are typically of lower quality, less relevant or entirely unavailable, we argue that monthly tax data can help generate timely estimates in lower-income countries, and help inform government policies to support the economy.

2 Data and Simulations

2.1 Data

Corporate Income Tax Returns. Our data contains all CIT returns for 2019 and 2020, for six countries: Costa Rica, the Dominican Republic, Ethiopia, Honduras, Guatemala, and Uganda. We arrived at this sample by selecting, among the countries for which we simulated the impact of COVID-19 on firm activity at the onset of the pandemic, those countries that shared their 2020 data to compare simulations to realizations. CIT data face two main limitations: they cover only formally registered firms and thus do not include the informal sector;[8] and the reported values could differ from true values. Despite these drawbacks, the CIT data present several advantages over other data on firms in developing countries and are arguably the most accurate data on the formal sector: they contain the most recent information on firms' activity; they include the largest firms which might not respond to surveys; and they are often the only panel on firms.

While the structure of corporate income tax returns differs across countries, we were

[6] Carletti et al. (2020) use Orbis data and assume a drop in firm revenues in each sector that is proportional to the fraction of value added forgone in the corresponding industrial sector as a result of lockdown. They assumed that labor costs would go down and material and fixed costs would remain constant. We instead allowed material costs to adjust, which turned out to be consistent with observed firms' responses.

[7] Administrative data on payroll and benefit claims has also been used in richer countries, see for example Cajner et al. (2020) in the US, Alstadsæter et al. (2020) in Norway, and Cui et al. (2022) in China.

[8] Unincorporated firms and firms filing under simplified regimes are also excluded from this analysis because their tax treatment differs across countries (thus the data available on these firms also differs): some firms for example only pay presumptive taxes on sales or assets and do not report profits and costs.

able to harmonize the data to obtain measures of revenues, costs and profits that are as comparable as possible. We break down the costs into material inputs, labor costs and fixed costs.[9] We use data on firms' economic sector to assign them to one of three impact groups, low, medium and high, following a revenue-shock-severity taxonomy for the pandemic designed by the World Bank (Vavra, 2020). We will use the terms sales and revenue interchangeably. In the CIT data, revenue includes sales and other sources of income, but the latter are very small and hence treated as sales in the simulations.

We run our simulations on a balanced panel of firms that appear in both 2019 and 2020. This allows us to have a simulated and a realized outcome for each firm. To be in the sample, firms must have filed a CIT return in 2019 and 2020, and the return must contain information on the variables used in our analysis: revenue, gross tax base, costs (either labor or material costs must be reported, or both), and industry group. Firms reporting zero sales in either 2019 or 2020 are dropped. The net change in the number of firms between 2019 and 2020 is summarized in Table A1. Table 2 shows descriptive statistics for each country's firms in 2019 and the distribution of firms across the three impact sectors.[10]

Value-Added Tax Returns. To measure the monthly realization of the revenue shock we use monthly VAT returns for 2018-2020, obtained ex-post in 2021. We define a *semi-balanced* panel of firms by including firms that a) filed VAT returns at least once every quarter of 2018 and 2019, and b) filed at least once in the second or third quarter of 2020. This sample allows us to capture the intensive margin change in revenue in the first half of 2020.[11] While we do not limit ourselves to a matched CIT-VAT sample of firms, the overlap between the two datasets is high: An average of 65% of firms appearing in the CIT data also appear in the VAT data.

Other Data. To capture the nature of lockdowns, we use the data assembled by Hale et al. (2021) on the timing and stringency of firm closures and movement restriction policies.

[9] In Bachas et al., 2020, we validate the cost breakdown in the administrative data by comparing it to the World Bank Enterprise Surveys (Figure A3 in Bachas et al., 2020), and show that cost shares vary with firm size, allowing larger firms to more easily adjust to demand shocks (Figures A1 and A2).

[10] In the countries where we can trace firm entry and exit over a longer period, we do not observe a substantial change in the number of firms in 2020 compared to previous years (Figure A1). Our analysis hence focuses on intensive margin changes.

[11] We also use alternative definitions of the panel and obtain similar results. In addition, we compute the revenue shocks for a fully balanced panel of firms. As expected, the shocks are slightly smaller but not significantly different, except for Costa Rica. The divergence in results in Costa Rica is due to a change in filing requirements that occurred in the middle of our sample period.

This data also contains information on economic support policies, which we complement with qualitative data on the list of policies implemented from the ILO (2020).

2.2 A Simple Framework to Simulate the Impact of Lockdowns

Lockdown Shock. We simulate a scenario in which a transitory demand shock generates a drop in firms' sales over three months, after which firms' activities return to their pre-shock level. The three-month window can be interpreted either as the length of lockdowns with perfect compliance with movement restrictions, or as a way to proxy the reduction in activity over a longer period of time with imperfect compliance. The severity of the revenue shock is modeled as the percentage drop in monthly sales which, in our simulation, depends on the economic sector: firms in the high, medium, and low impact sectors face a 100%, 50% and 20% drop in demand respectively during the lockdown period, which translates into a yearly drop in firms' revenues of 25%, 12.5% or 5%. Table 1 lists the sectors and their severity assignment as per Vavra (2020). Sectors with low impact include industries that were expected to be less disrupted during the pandemic due to their essential nature and the possibility for remote work (e.g. agriculture, I.T.). Sectors with medium impact were expected to face noticeable disruptions related to changes in demand (e.g. manufacturing). Finally, high-impact sectors were significantly affected by the pandemic and often had to close entirely due to governmental restrictions (e.g. restaurants, transportation).

Production Function and Adjustment Costs. Firms produce a unit of output with a Leontief production function which requires material, labor and capital in fixed proportions.[12] These proportions are estimated from firms' 2019 tax declarations. We assume that each input adjusts differentially to the revenue shock, given the nature of adjustment costs:

- **Material inputs** fully adjust in proportion to the revenue shock. This is because firms should be able to adjust inventory and raw materials quickly to match expected demand drops.

- **Labor costs** only adjust if necessary to avoid making losses, because we assume that re-contracting workers is costly and hence preferably avoided if firms expect the demand

[12] We assume that firms are price takers and that all prices are fixed at their pre-pandemic level, such that the margin of adjustment is quantity.

shock to be temporary. Thus, firms that can absorb the demand shock without losses prefer not to lay off workers, even if profits temporarily decrease.

- **Fixed costs** are assumed to be non-adjustable as firms continue to honor longer-term contracts (rental agreements, debt payments, etc).

Hence, we conjecture that firms face substantial adjustment costs for labor and capital, and that they aim to weather this transitory shock to be in a position to scale back their production fast, without changing their production technologies.

Predictions from Simulations. In the spring of 2020, using the above-stated assumptions, we generated predictions for how the COVID-19-induced lockdowns would impact firm activity, to engage with policymakers in partner countries as the crisis was unfolding. These predictions relied on the 2019 corporate income tax returns which had just been submitted. The analysis was published in the form of country-specific notes, accompanied by a replication package, a blog and a synthesis paper (available here).[13]

The results of our simulations are shown in Table 3, in the second row for each country. For firm-level outcomes, we report the average year-on-year change (relative to 2019). Aggregate outcomes are in levels and can be compared to the 2019 baseline in the first row. The main predictions are similar across countries and can be summarized as follows:

- We predicted a drop in yearly aggregate sales of 11% on average. This follows from the above-stated assumption about the sales drop for each impact sector, and the sectoral composition of the countries' economies.

- We expected firms to reduce their costs on average by 55% of the size of the revenue shock. This follows from the assumption we made on the adjustment of material, labor and capital costs, and the observed composition of firms' costs in the 2019 data: Materials constituted on average 45% of total costs, labor 20% and capital 35%.[14]

- The sales shock was expected to reduce the share of profitable (non-loss-making) firms by 21 percentage points. This is because, although an average of 75% of firms are profitable at baseline, the median baseline profitability of firms is low (2-3% of revenue). Aggregate

[13] The original predictions covered ten countries and we were able to update the data to 2020 for six of them. The predictions also included simulations on the potential effects of employment support programs (which were rarely implemented in practice in lower-income countries) and on firm exit from the formal sector.

[14] Some firms did not report any materials costs in 2019, implying that material costs do not adjust one for one with revenue.

(positive) profits were expected to fall by 36% compared to baseline, and total losses were expected to increase by 62%. The drop in aggregate profits would in turn lead to a fall in corporate tax revenue of the same proportion.

3 Realization Versus Simulations

How did firms' revenue and profits actually fare during the pandemic year 2020? And how do the realized outcomes compare to our predictions?

Figure 1 compares our simulations to the realizations for the year 2020, and to the baseline year of 2019, in each of the six countries. Panel (a) displays the size of the shock, measured as the aggregate reported revenue (sales plus other income), as a percentage of the 2019 baseline. In 2019, the total revenue reported by firms in the six countries ranged from USD 14 Billion in Ethiopia to USD 89 Billion in the Dominican Republic. Our simulations predicted a drop in total revenue of around 11%, varying slightly across countries depending on their sectoral mix. The realized data shows that aggregate revenue indeed fell in five out of six countries, but the average aggregate drop across countries is less than half of the prediction. The results are fairly heterogeneous: in Costa Rica aggregate revenue rose, in Honduras revenue fell by more than we predicted,and in the other four sample countries realized revenue lies somewhere between the prediction and the baseline 2019 revenue.

Given the revenue loss, firms' profits are expected to decrease. Figure 1, Panel (b) shows the share of profitable firms (non-loss-making): at baseline, 75% of firms were profitable on average across countries. We predicted that the share of profitable firms would drop by 21 percentage points on average, with variations across countries depending on the sector mix, the cost structure of firms, and the initial distribution of profits. In practice, firms' profitability was resilient: although the share of profitable firms fell in five of the six countries (it stayed stable in Ethiopia), it only dropped by an average of 6.7 percentage points, a third of the predicted drop.

Figure 1, Panel (c), plots the aggregate taxable profits. At baseline, profits represented 5-10% of aggregate revenues depending on the country, and ranged from USD 1.2 billion in Uganda, to USD 6.2 billion in the Dominican Republic. Reported losses are not counted as negative values in this measure. In our simulations, the combination of a large reduction in revenue and high adjustment costs for labor and capital inputs implied very large drops in aggregate profits, of the order of 35% of the baseline on average. In practice, the

aggregate profits hardly fell on average. Aggregate profits dropped in three countries (Dominican Republic, Ethiopia, Honduras) and rose in the other three countries (Costa Rica, Guatemala, Uganda).[15] Table 3 reports on the same outcomes as Figure 1, and adds several others, including the average profit margin, aggregate taxes paid, and aggregate losses.[16] [17]

To summarize, Figure 1 shows that the average revenue shock was smaller than predicted and that the share of profitable firms fell by only 7 percentage points, about a third of our prediction. Despite drops in aggregate revenues and in the share of profitable firms, aggregate profits remained stable. This is contrary to our pessimistic prediction of a 35% drop in profits, which would have shaved a third of the corporate income tax base.

To reconcile how aggregate profits could remain stable over time while the share of profitable firms dropped and aggregate losses increased, we turn to examine the distribution of firms' profit margins, before and after the shock. Figure 2 plots the distribution of profit margins, defined as the ratio of profits over revenue, for each country, comparing the 2019 baseline to the 2020 realization. The left and right tails are winsorized at -25% and 25% profitability. The right tails of the distribution are comparable, meaning that there are as many very profitable firms, with profit margins above 25%, in 2020 as in 2019. The key changes in the distribution are (1) a compression around the modal profitability of 2-3%, and (2) a rising number of firms reporting large losses in the left tail. These distributional results help rationalize the previous finding: the same number of firms remain very profitable, but fewer firms report moderate profits, and more report large losses. The distributional analysis highlights the heterogeneity in responses across firms, which we return to below when studying effects by firm size.

4 Where Did Predictions Go Wrong? Decomposing the Key Channels

The realized 2020 data shows that formal firms were more resilient than predicted during the pandemic. We now examine the factors that explain the discrepancies between simula-

[15] Note that in our simulation all firms lost revenues and none could grow, so lockdown-induced losses for some firms could not be offset by growth of other firms or during the post-lockdown period.

[16] We saw in Figure 1 Panel (c) that aggregate profits remained fairly stable, implying stable corporate income taxes paid (Table 3, column (9)). However, aggregate losses increased slightly (Table 3, column (10)), a result which has negative long-term implications for corporate tax revenues and firms' health.

[17] The quality of the 2019 data—reported in early 2020—could be affected by the pandemic. To address this concern, Table A2 shows the robustness of the simulations to changing the baseline year to 2018. The results are qualitatively similar, indicating that the reporting conditions of 2019 do not drive the results.

tions and realizations.

Drop in Revenues. We assumed that the lockdown shock would lead to an annual drop in reported revenues of 25% for the high-impact sectors, 12.5% for the medium-impact sectors, and 5% for the low-impact sectors. Figure 3, Panel (a), displays for each country and sector, the realized drop in sales compared to the simulation. The figure reveals two key patterns. First, the qualitative ranking of the size of the revenue drop across sectors was as expected: in all countries, the high-impact sectors (e.g. restaurants, transport) were more impacted than the medium-impact sectors (e.g. manufacturing), which in turn were more impacted than the low-impact sectors (e.g. agriculture). Second, revenue fell much less than expected in all sectors, across countries: the average realized revenue drop for the high-impact sectors was 18% (compared to a 25% prediction), for the medium-impact sectors 7% (compared to a 12.5% prediction), and for the low-impact sectors 1% (compared to a 5% prediction) (see Table A3). We will examine in Section 5 how much better our simulations could have fared if we had used monthly sales data from VAT declarations to calibrate the size of the revenue shock for the simulations. We will also see that the size of the shock is associated with the duration of the lockdown.

Cost Adjustments. Although firms' revenues did not fall by as much as we predicted, they still dropped in most sectors and countries. How did firms' input costs adjust? Figure 3, Panel (b), combines all sectors to show the average change in material, labor and fixed costs, respectively, and compares them to the changes in revenues. In our simulations, we had assumed a one-for-one adjustment of material inputs to revenue changes, a partial labor adjustment, and no adjustments to fixed costs. The figure shows that the relative ranking of cost adjustments was generally as expected: material costs adjusted the most, followed by labor costs. Fixed costs adjusted least. Yet, the magnitudes we had assumed were off. In four countries, material costs adjusted slightly *more* than one for one with revenue. More importantly, labor costs adjusted close to one for one with revenues, and fixed costs also adjusted some. Our assumption of labor and fixed cost rigidity was incorrect. Overall, firms reduced their total costs approximately in proportion to the revenue drop. This in turn implies that firms' profitability was less impacted than we predicted.

We note that, had we modeled firms' production function as Cobb-Douglas instead of Leontief, firms could have reduced the easy-to-adjust input (material) more than proportionally to the revenue shock, and substituted it with harder-to-adjust inputs (labor, capital).

Thus, with a Cobb-Douglas production function, our simulations would have predicted a slightly smaller drop in profits.[18]

Heterogeneity by Firm Size. Given the skewness of the firm size distribution, a large share of profits and taxes are accounted for by the largest firms: across the sample countries, the 10% largest firms in each country (ranked by total sales) account for 83% of total sales and 86% of total profits. To understand differences in aggregate values of revenues and profits between the simulations and the realization, we examine the heterogeneity of the shock across the firm size distribution. Figure 4 ranks firms by deciles of revenue within their country, and shows the year-on-year changes in revenues by decile. The dotted lines plot the year-on-year revenue changes between 2018 and 2019, which could approximate the pre-pandemic 'equilibrium' growth. We observe that most firms were growing in the year before the pandemic, and small firms were growing faster than large firms. The crossed lines show firms' revenue change between 2020 and 2019, thus including the effect of the pandemic. The slope of revenue growth by firm size is now inverted: larger firms fared substantially better than (or, put differently, not as badly as) smaller firms. Graphically, this relative reversal of firm growth by size can be seen by comparing the area between the two lines for the top deciles versus the bottom deciles. Between 2020 and 2019 the gap in firm growth rapidly falls across deciles, where red intervals denote a year-on-year reduction in the growth of that firm size decile and green intervals a year-on-year increase.

To summarize, our simulations predicted a bleak outcome for formal firms in developing countries following the Covid-19 pandemic shock. In practice, firms' activity was quite resilient, and only in one of six sample countries (Honduras) was the shock to revenues as large as anticipated. On average, aggregate profits and corporate taxes hardly suffered in 2020. Although our assumptions about which sectors would be most impacted and about the relative adjustment of inputs held qualitatively, the assumed magnitudes were off. Revenues fell by only half of our predictions, and we did not anticipate that large firms would fare better than small ones. Further, while we assumed that labor and fixed costs would be difficult to adjust, firms were able to adjust all inputs, such that total costs fell proportionally to revenue. Taken together, the moderate loss in revenue and the strong adjustment of

[18] While we can calculate how much better our simulations would have fared if we had made different assumptions on the cost adjustments within the Leontief framework, conducting the simulations with a Cobb-Douglas production function would require additional assumptions on the elasticity of substitution of different inputs and a parametrization of the fixed cost of adjustment.

inputs explain the limited fall in the share of profitable firms. These facts, together with the resilience of large firms rationalize the stability of aggregate profits.

5 Improved Predictions and Government Policies

We now examine the extent to which timely data on sales, reported in monthly VAT declarations, could have improved our predictions. We then discuss the heterogeneity of outcomes across countries and the interactions with policies enacted during the pandemic.

5.1 Monthly Value-Added Tax Data to Measure the Size of the Shock

When performing the simulations, the most recent data we had access to was the latest set of annual corporate income tax returns, typically filed in the first quarter of a year. Firms also remit at a monthly frequency the value-added tax (VAT), which is the main tax on consumption in the six sample countries. As part of our retrospective evaluation, we obtained access to VAT data for four of six sample countries, allowing us to study the year-on-year change in monthly sales variations for VAT-registered firms.

Figure 5 plots the year-on-year change in monthly sales from the VAT data. The horizontal line corresponds to the onset of the pandemic, which we mark as starting in March 2020. The low-impact sectors are shown in green, the medium-impact in yellow, and the high-impact in red. First, we observe that in all four countries, all sectors saw a drop in sales starting in March 2020. The lowest point in sales was attained by April 2020 already, and thereafter sales started recovering. Second, the qualitative ranking of impact categories is appropriate (a result we also observed in the corporate tax data): the high-risk sectors were the most impacted and their firms' sales remained at levels lower than pre-pandemic levels for all of 2020. The low and medium-impact sectors, however, quickly rebounded and recovered to their pre-pandemic sales levels by mid-2020. The low-impact sectors were the least affected in all countries.

How much better could our simulations have fared if, instead of assuming a shock size, we had used the observed revenue shock reported in the VAT data contemporaneously? This requires us to assume a time window of observation, which we (arbitrarily) set to four months: in other words, we suppose that we would have observed the VAT sales data as of June of 2020, and assigned the year-on-year sales deviation in the first half of 2020 relative to 2019 as the yearly country-sector size of the shock. We display these shock size numbers in Figure 5. We then make our predictions about firms' profitability and tax

liabilities, keeping assumptions about cost adjustments constant. Note that this approach implicitly assumes that from July 2020 onward the shock is over, which is a simplification but not far from reality as shown in Figure 5.

Figure 6 shows the augmented predictions using the monthly VAT sales data, and compares them to the original predictions, the realization, and the baseline. Using the VAT country-sector-specific estimates of the shock size (as of June 2020) would have produced substantially more accurate predictions. Panel (a) shows that these adjusted simulations predict accurately the size of the aggregate revenue shock, on average across sample countries. This is particularly the case for Costa Rica and Guatemala, the countries where the gap between our baseline simulation and the realization was the largest. The (more) accurate revenue shock prediction then helps improve the predictions for the share of profitable firms and aggregate profits (Panels (b) and (c)): half of the misprediction gap for these outcomes has been closed by using monthly VAT returns data to predict revenue losses. The rest of this gap is due to the mis-specified labor and capital input adjustment costs.

5.2 Lockdown Duration, Government Policies and Heterogeneity Across Countries

Lockdown Duration. The resilience of firms' revenue and of their aggregate profits is not homogeneous in magnitude across the six sample countries. In particular, firms in Honduras fared worse than our predictions, in sharp contrast to firms in Costa Rica that grew.[19] To better understand these patterns, we consider the policies enacted during the pandemic in the six sample countries. We use the comprehensive global database assembled by Hale et al. (2021) to detail the restrictions to economic activity and movement.

Figure 7, Panel (a), shows the restrictions to activity that were in place over each day of 2020. We plot two key restrictions: forced business closures, which directly impact the firms we study; and stay-at-home mandates which impact the consumers (and workers) of the firms. We observe substantial variation in the stringency of restrictions across countries: the least restrictive countries were Ethiopia and Costa Rica, followed by Uganda, while at the other end, the Dominican Republic, Guatemala, and especially Honduras imposed long lockdowns. We obtain similar country rankings with different definitions of lockdowns and using the index of overall restriction stringency constructed by Hale et al. (2021), which combines school closures with business and movement restrictions (Table A4, columns 1-4).

[19] In Table 2, we see that the sectoral mix does not vary substantially across countries, so differential sectoral exposure cannot explain the large differences in outcomes observed across countries.

Figure 7, Panel (b), plots the restriction stringency index against the average year-on-year change in realized revenues in each of the six countries. The stringency of restrictions correlates negatively with the change to firms' economic activity. At the extremes, Costa Rica faced short lockdowns and firms fared well, while Honduras faced the longest lockdown and was the country where firms fared worst. Table A4 also compares the six sample countries to the average of their regions (Latin America and Africa). Compared to other countries in their respective regions, the stringency of restrictions is on the higher side in our sample of countries, which could imply that non-sample countries might have faced even smaller revenue shocks.

Economic Support Policies. To counteract the restrictions, governments enacted policies to support economic activity. To capture the importance of these policies we use a measure of the size of the announced stimulus (as a % of GDP) from the IMF fiscal monitor database (IMF, 2024) and qualitative data on the list of policies specifically designed to support firm activity from the ILO (2020). Table A4, column 5, shows the size of the announced stimulus packages in our sample countries, and compares them to averages for Latin America, Africa, and high-income countries. High-income countries spent 10% of their GDP to support the economy, three times as much as countries in Latin America and four times as much as countries in Africa. In four of six countries in our sample, the support packages covered less than 2% of GDP.

The support policies targeted workers and households more than firms. According to our calculations based on the information and legal documents referred by Hale et al. (2021) and the IMF fiscal monitor database (IMF, 2024), Costa Rica, the Dominican Republic, and Guatemala allocated approximately 93%, 95%, and 75% of their respective support packages to households. In Ethiopia, approximately 63% of the support funding was directed towards households. To zoom in on the nature of support to firms, Table A5 lists the policies implemented in our countries. The first column lists relief to tax and social security payments. While there were tax measures in most countries, they were typically not outright tax reductions (except in Ethiopia), but rather tax deferrals. Most deferrals applied to social security contributions, the relevant margin for limiting layoffs. Deferrals would have reduced the real tax obligation only by the rate of inflation, in addition to averting late fees or the requirement to take out short-term loans to meet tax payment deadlines.[20] Other

[20] We are implicitly assuming that deferred tax liabilities were ultimately collected, but enforcement might also have changed during the pandemic.

policies to support firms include the provision of lines of credit to fund working capital and employment flexibilization policies. We did not find evidence of direct transfers to firms.

Given the small size of government support packages in our sample countries, the limited targeting to firms, and the near-absence tax relief measures, it seems unlikely that government policies played a key role in firms' resilience.[21] The exception is Guatemala: it had a larger stimulus program (5% of GDP) and fared relatively well, despite stringent restrictions (second longest lockdown after Honduras).

6 Conclusion

Using micro tax return data in six low and middle-income countries, this paper documents the resilience of formal firms to the shock induced by the COVID-19 pandemic. The number of firms that became unprofitable only increased by 7 percentage points, while aggregate revenue and profits fell even less. The realized outcomes are far more positive than those we predicted to inform governments early on during the pandemic. Our simulations missed the mark because (1) the drop to revenue was smaller than we assumed; (2) firms managed to substantially reduce their input costs, and (3) large firms fared much better than smaller firms which explains the limited aggregate impacts. The realized outcomes are heterogeneous across countries and correlate with the stringency of the lockdown.

This paper also highlights the value of administrative tax data to inform about real economic outcomes in a timely manner. The use of such data is becoming common in high-income countries (Chetty et al., 2020) but remains limited elsewhere. We show that combining the corporate income tax with monthly VAT sales data could have improved the nowcasting of firm activity compared to only relying on the yearly corporate income tax data. In the future, more detailed administrative microdata–such as daily electronic transaction receipts–could permit even more granular insights in close to real time.

[21] Surveying firms across 60 countries, Cirera et al. (2021) show that policy support has been especially limited for the most vulnerable firms and countries. In China, more than half of tax-registered firms did not benefit at all from payroll subsidies due to labor informality (Cui et al., 2022; Chen et al., 2023). Surveys in eight Latin American countries also showed that despite some available assistance to firms, awareness and applications to these programs were low and the impact was short-lived (Guerrero-Amezaga et al., 2022).

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Tables and Figures

Table 1: Shocks to Firms' Revenue from COVID-19

		Assumed shock	Observed shock (VAT sales)			
Impact sector	Industries	Y-o-y revenue drop (%)	CRI	DOM	GTM	HND
Low	A: Agriculture, forestry, fishing; B: Mining and quarrying; C: Manufacturing; J: Information and communication; M: Professional, scientific and technical activities; N: Administrative and support service activities; O: Public administration and defence; compulsory social security; Q: Human health and social work activities; T: Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; U: Activities of extraterritorial organizations and bodies; Z: Other	5.0	3.0	3.6	3.7	4.9
Medium	D: Electricity, gas, steam and air conditioning supply; E: Water supply; sewerage, waste management and remediation activities; F: Construction; G: Wholesale and retail trade; repair of motor vehicles and motorcycles; K: Financial and insurance activities; L: Real estate activities; P: Education	12.5	3.6	6.0	6.6	11.5
High	H: Transportation and storage; I: Accommodation and food service activities; R: Arts, entertainment and recreation; S: Other service activities	25.0	14.1	15.8	6.3	15.4

Note: This table summarizes the COVID-induced revenue shocks for each of the three impact categories: low, medium and high impact. The "industries" column shows the ISIC sections that correspond to each of the three impact categories as used in Vavra (2020). The column labeled "Assumed shock" displays the shock sizes in terms of the year-on-year reduction in gross revenue (sales and other sources of income), assumed for our initial simulation exercise based on Vavra (2020). The columns under "Observed shock" display the sales shocks calculated using monthly VAT data for each country and impact sector. This table is discussed in Sections 2.2 and 5.1. Section 5.1 discusses the details of how the observed sales shocks are calculated.

Table 2: Baseline Data on Formal Firms (Fiscal Year 2019)

	Costa Rica (CRI)				Dominican Republic (DOM)				Guatemala (GTM)				Honduras (HND)				Ethiopia (ETH)				Uganda (UGA)			
Impact sectors:	All	Low	Med.	High	All	Low	Med.	High	All	Low	Med.	High	All	Low	Med.	High	All	Low	Med.	High	All	Low	Med.	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
N firms	27056	6965	15246	4845	50734	26129	19323	5282	16189	3734	10907	1548	21077	6700	9055	5322	12985	4455	7048	1482	14020	4271	7438	2311
Profitable (%)	82.7	77.1	84.7	84.4	66	68.8	63.4	61.4	75.8	73.2	76.7	75.5	79.6	79.3	82	76	77.5	75.9	79.6	72.8	68.9	63.7	73.9	62.2
Profit Margin (%)																								
Profit margin (mean)	3.5	1	3.9	5.6	-4.3	-3.6	-4.8	-6.1	-0.2	-1.4	0.2	0.6	1.5	1.2	2.2	0.5	6.5	5.1	7.5	5.9	-3.3	-5.2	-1.1	-6.5
Profit margin (median)	3.6	3.2	3.4	4.7	2.4	2.3	2.7	1.7	3.3	3.4	3.2	3.4	1.8	1.8	1.9	1.6	7.7	7.8	7.6	7.5	1.3	1.4	1.3	1.2
Costs (% Total Costs)																								
Material costs	42.7	37.3	52.1	21	41.7	50.3	32.4	33	46.8	50.6	48.7	24.2	31.6	29.5	38.7	22.1	58.9	55.8	63.9	44	51.1	44.2	61.1	31.8
Labor costs	19.8	20.4	19.1	21	44.2	38	50.4	52.8	24.1	22.8	23.7	30.1	25.5	28.8	22.1	27.2	15.3	16.8	13.1	21.3	11.5	13.5	9.4	14.8
Fixed costs	37.5	42.3	28.7	57.9	13.6	11.3	16.6	13.9	29	26.6	27.5	45.7	41.4	40.2	37.9	48.7	25.2	27	22.2	34.1	37.1	42	29.4	53.1
GDP Per Capta (USD)	12669				8173				4647				2519				840				823			

Note: This table shows the baseline characteristics of the firms in the six countries in this study: Costa Rica, Dominican Republic, Guatemala, Honduras, Ethiopia, and Uganda. In each country, the data comprises firms belonging to a balanced panel of firms between 2019 and 2020. The table shows the share of profitable firms, their mean and median profit margin, and the breakdown of costs into labor, material and fixed costs. There are four columns for each country. The first column summarizes the information for all firms, while the following three columns split the full sample of firms into low, medium, and high impact categories. The data set used to construct this table is presented in Section 2.1.

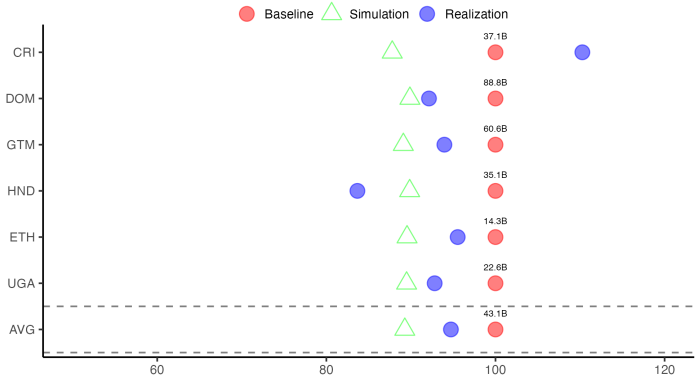
Table 3: Simulated vs Realized Outcomes

	Firm-level outcomes (Means)						Aggregate outcomes (As a share of GDP)			
	Revenue (1)	Material (2)	Labor (3)	Fixed (4)	Profitable (%) (5)	Profit margin (6)	Revenue (7)	Profit (8)	Tax paid (9)	Loss (10)
CRI										
Baseline	—	—	—	—	82.7	3.5	56.6	3.7	0.7	1.3
Simulation	-12.2	-11.4	-7.3	0	54.9	-3.3	52.1	2	0.4	2.6
Realization	10.3	13.3	10.3	6.2	72.9	1.3	65.5	4.3	0.9	1.7
DOM										
Baseline	—	—	—	—	66	-4.3	97.7	6.8	1.8	2.1
Simulation	-10.1	-9.4	-7.3	0	61	-7.2	93.2	4.5	1.2	3
Realization	-7.9	-9.3	-12.2	6	59.3	-8.9	95.6	6.3	1.7	2.7
GTM										
Baseline	—	—	—	—	75.8	-0.2	87.2	5	1.2	0.8
Simulation	-10.9	-10.1	-7.7	0	54.7	-5.2	79.4	2.7	0.7	1.5
Realization	-6	-7.1	-3.8	-6.5	69.3	-3.2	83.8	5.4	1.3	1
HND										
Baseline	—	—	—	—	79.6	1.5	147.4	10	2.5	3
Simulation	-10.1	-9.6	-7.2	0	40.8	-5.9	143.9	6.4	1.6	5.4
Realization	-16.3	-20.2	-11.6	-8.7	69.4	-3.1	134	9.1	2.3	3.8
ETH										
Baseline	—	—	—	—	77.5	6.5	16.8	2.8	0.9	0.5
Simulation	-10.5	-10.7	-3.6	0	70.8	2.8	14.4	2.3	0.7	0.5
Realization	-4.5	-3.8	-3.3	-4.4	77.9	6	15.4	2.6	0.8	0.5
UGA										
Baseline	—	—	—	—	68.9	-3.3	64.9	3.4	1	1.9
Simulation	-10.5	-10.5	-6.7	0	44.4	-9	56.8	2.1	0.6	2.9
Realization	-7.2	-6.4	-9.6	-8.8	61.9	-5.7	58.9	3.6	1.1	2.2
AVG										
Baseline	—	—	—	—	75.1	0.6	78.4	5.3	1.4	1.6
Simulation	-10.7	-10.3	-6.6	0	54.4	-4.6	73.3	3.3	0.9	2.6
Realization	-5.3	-5.6	-5	-2.7	68.4	-2.3	75.5	5.2	1.3	2

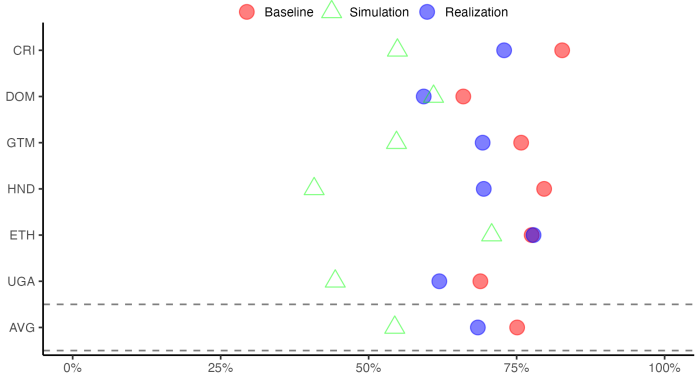
Note: This table compares the results from the simulations to the realizations for the year 2020 in each of the six countries. Firm-level outcomes (columns 1 to 6) are averages relative to the baseline (2019), except for columns 5 and 6, which are levels. Aggregate outcomes (columns 7 to 10) are relative to GDP. See Sections 2.2 and 3 for further discussion of these results and Figure 1 for a graphical illustration. Table A2 shows that the results are very similar when using as a baseline the data from 2018 instead of 2019.

Figure 1: Impact of COVID-19 on Firm Activity: Simulation vs Realization

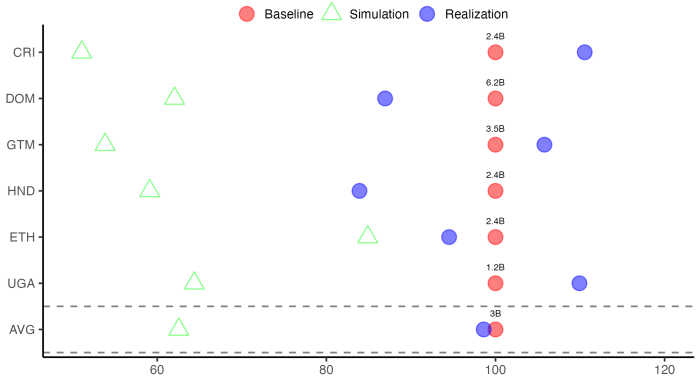
(a) Aggregate revenue (percentage change from baseline)



(b) Share of profitable firms (percentage points)

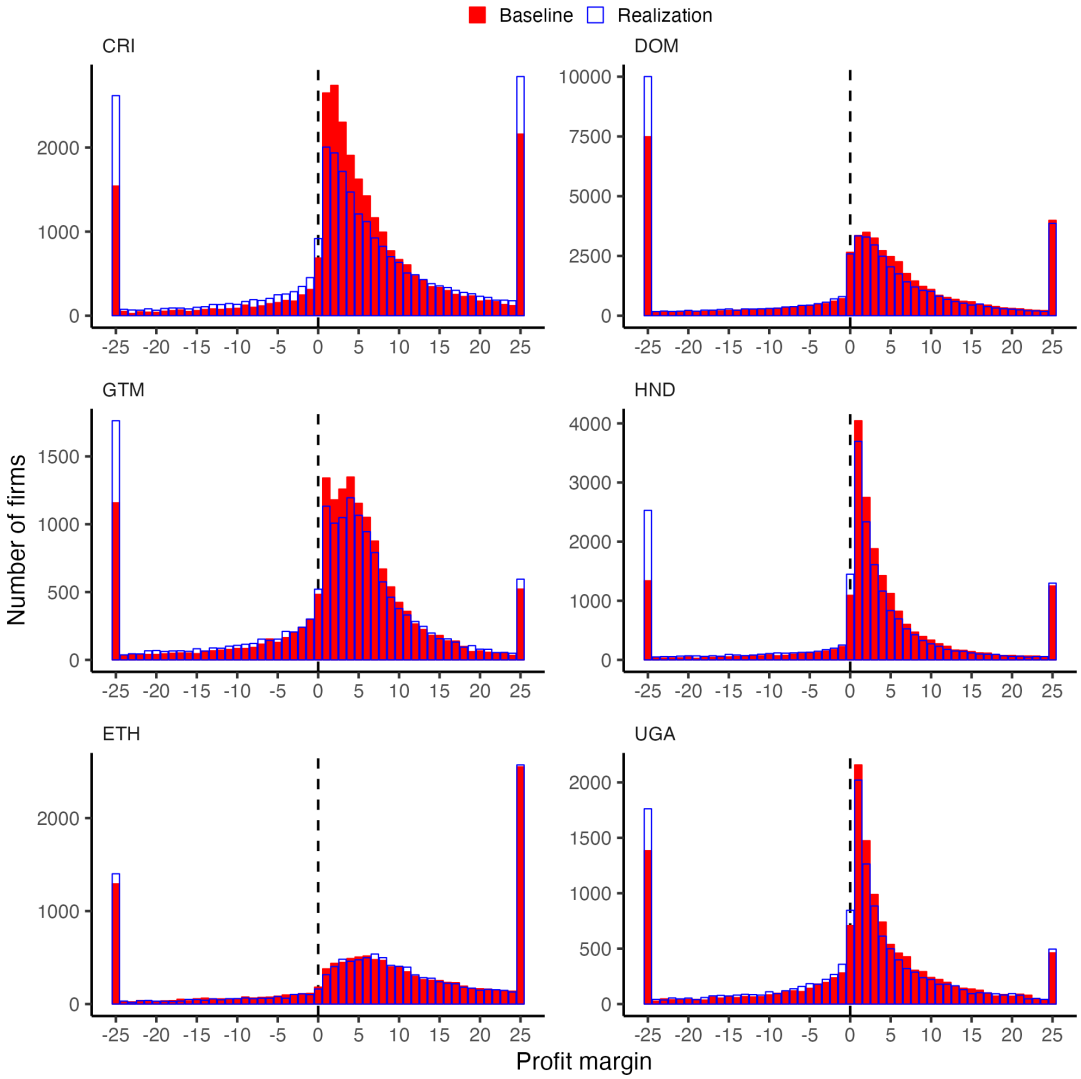


(c) Aggregate profits (percentage change from baseline)



Note: This figure shows the simulated and realized impact of the 2020 lockdowns on firms' reported revenues and profits, for the six countries in our study. Panel (a) shows the aggregate revenues reported, Panel (b) the share of profitable firms, and Panel (c) the aggregate (positive) profits reported. The baseline corresponds to the reported outcome in the year 2019 (red dots), the realization concerns the reported outcome in the year 2020 (blue dots), and the simulations correspond to predictions made in the Spring of 2020 based on 2019 data and our assumptions (green triangles). See Table 3 for the numbers displayed in this figure and Section 3 for further discussion of these results.

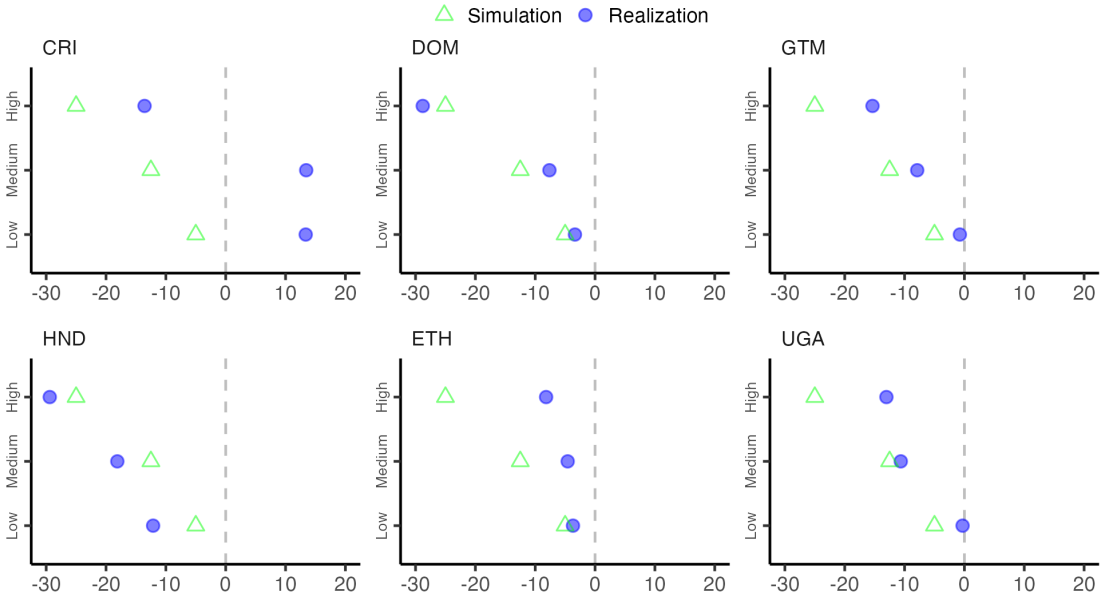
Figure 2: Distribution of Firms' Profit Margins



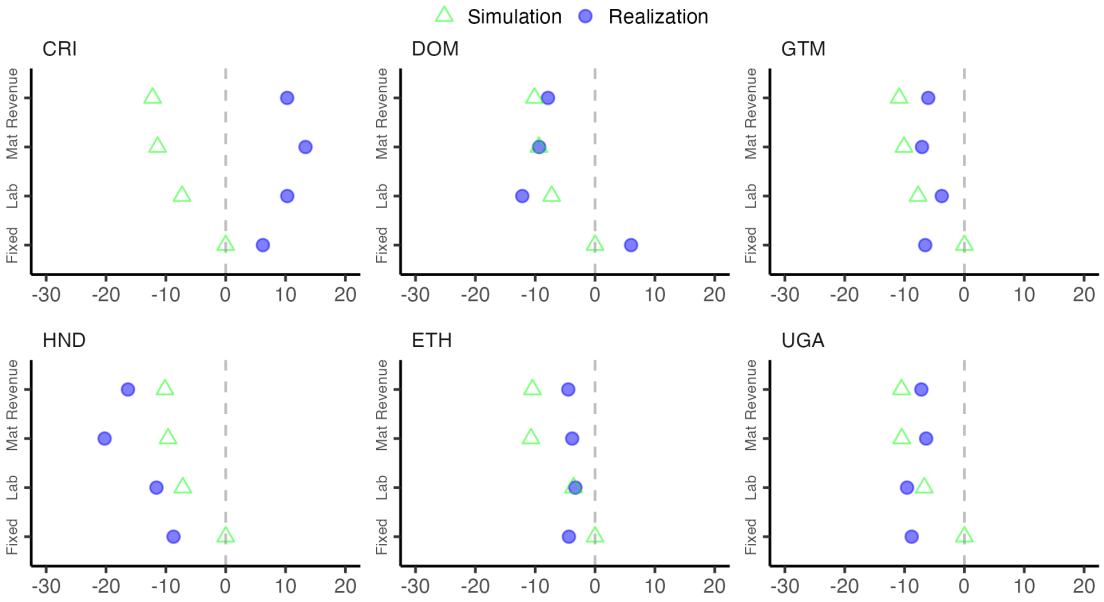
Note: This figure plots the distribution of firms' profit margin, defined as the ratio of profits over revenues, for each country, comparing the 2019 baseline to the 2020 realization. The left and right tails are winsorized at -25% and 25% profitability. See Section 3 for further discussion on these results.

Figure 3: Revenue Shocks and Input Adjustment

(a) Revenue shock relative to baseline by impact sector

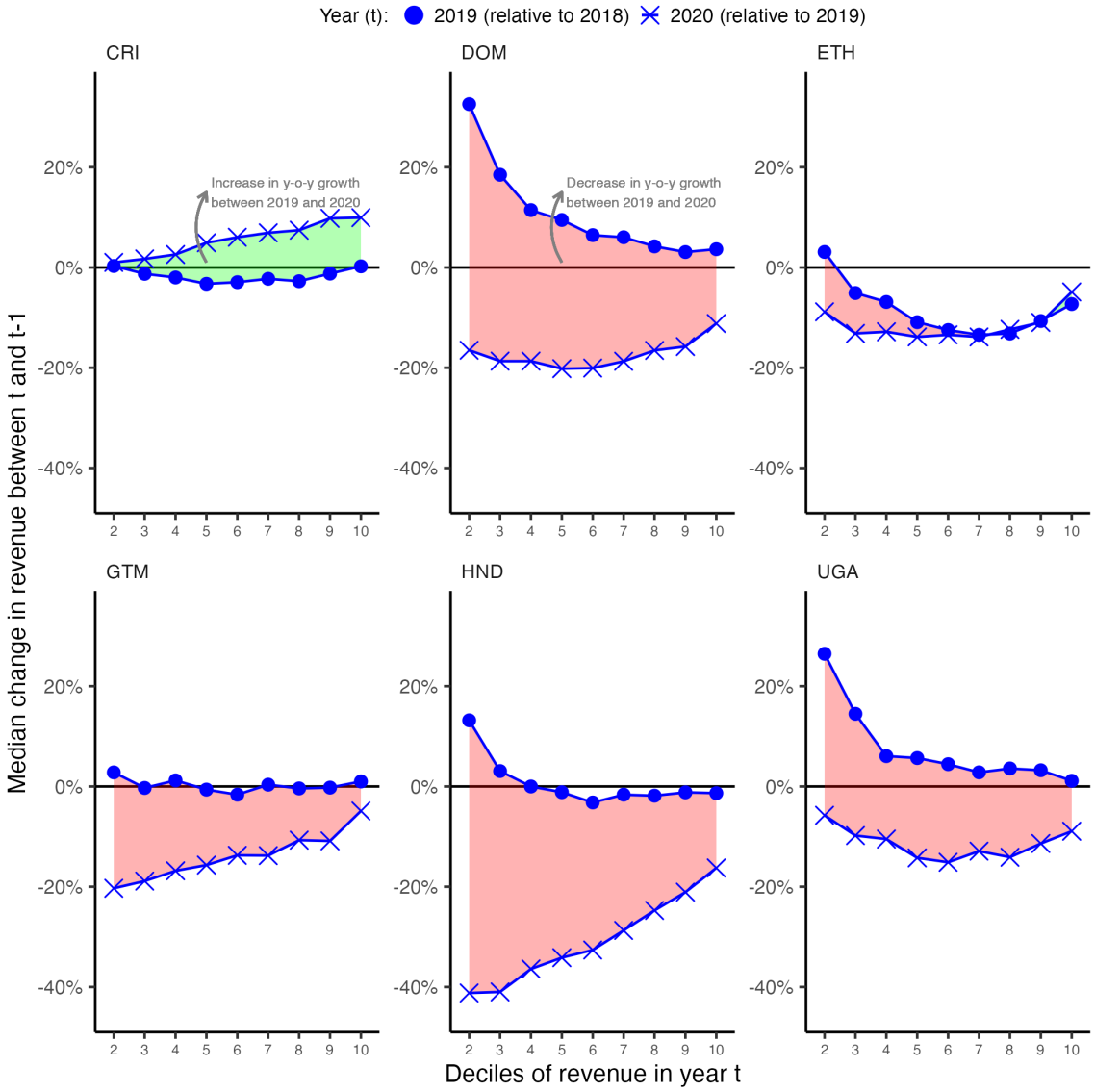


(b) Revenue shock and input adjustment



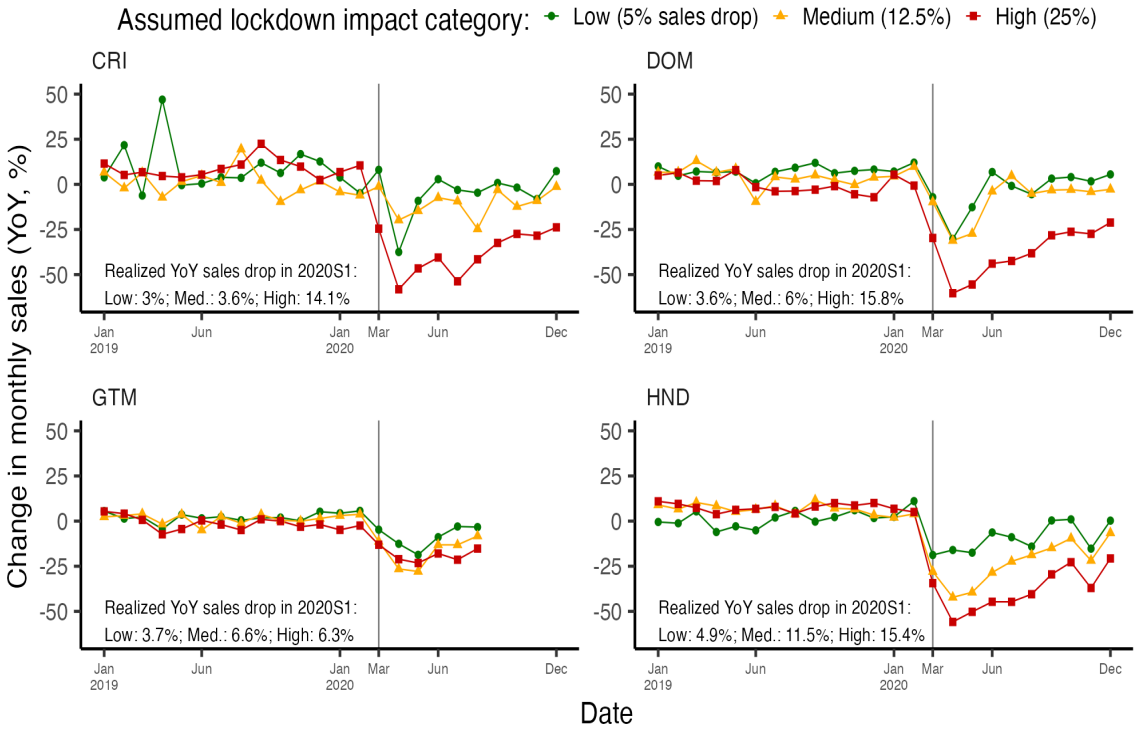
Note: This figure compares the results from the simulations to the realizations for the year 2020. Panel (a), displays for each country and for the three impact sectors, the realized drop in revenue compared to the simulation. Panel (b), combines all three impact sectors, to show the average change to revenue and the change to each of material, labor and fixed costs. These results are displayed in more detail in Table A3. See Section 4 for further discussion on these comparisons.

Figure 4: Year-on-year Changes in Revenue by Firm size



Note: This figure ranks firms by deciles of revenue within their country in the base year. For each decile, it displays the median of the distribution of year-on-year changes in revenue for firms in the decile. The dotted lines represent the change in revenues between 2019 and 2018, while the crossed lines show the evolution of revenues between 2020 and 2019. The area between the two lines is colored red for intervals where there is a reduction in the growth of that firm size decile, and green for intervals with an increase in the year-on-year growth. We omit the first decile from the figure, as the year-on-year changes in revenues are very volatile for these firms. See Section 4 for further discussion on these results.

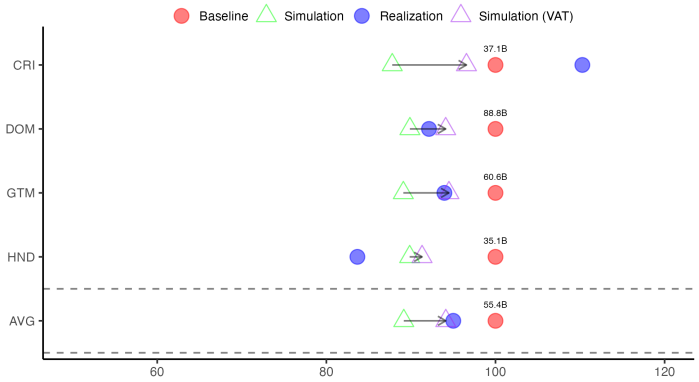
Figure 5: VAT Sales Over Time by Impact Sectors



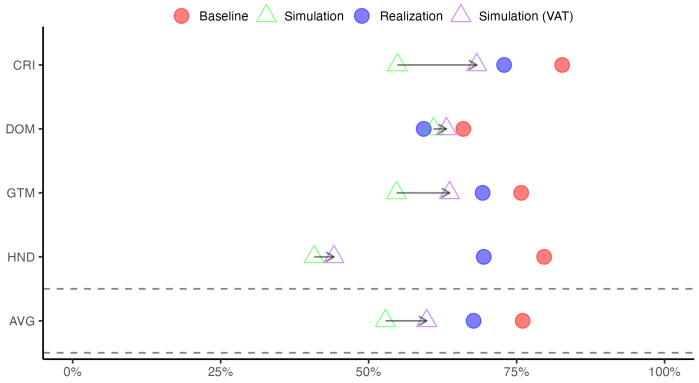
Note: This figure plots the year-on-year change in monthly sales from the VAT data, for the four (out of six) sample countries for which VAT data is available. The grey horizontal line corresponds to the onset of the pandemic, which we mark as starting in March of 2020. The low-impact sector is shown in green, the medium impact in yellow, and the high-impact in red. We use these year-on-year changes to calculate the observed revenue shocks (i.e., shocks calculated with observed VAT data), summarized in Table 1. To do so, we arbitrarily assume a time window of observation of four months since the onset of the pandemic—in other words, we assume that we would have observed the VAT sales data as of June of 2020—and assign the year-on-year sales deviation in the first half of 2020 relative to 2019 as the yearly country-sector size of the shock. See Section 5.1 for further discussion on these results.

Figure 6: Impact of COVID-19 on Firm Activity: Augmented VAT Simulations

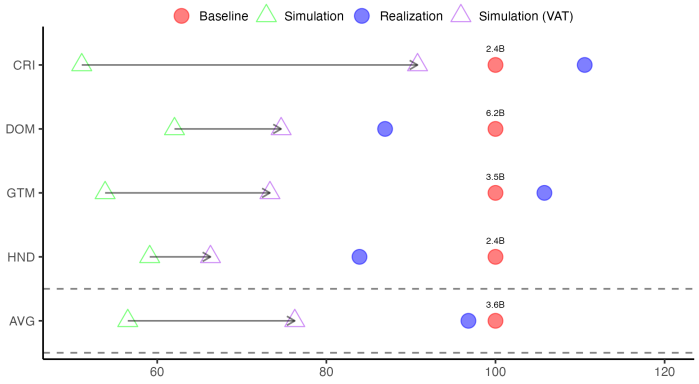
(a) Aggregate revenue



(b) Share of profitable firms



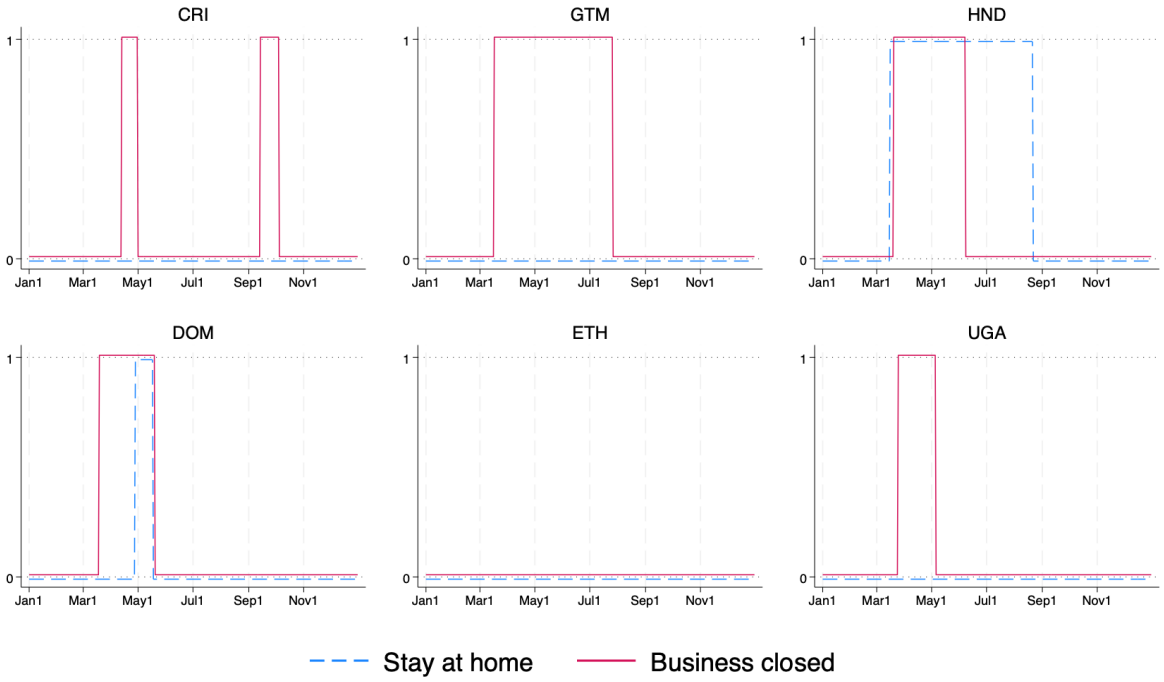
(c) Aggregate profits



Note: This figure shows the simulated and realized impact of the 2020 lockdowns on firms' reported revenues and profits, for the four countries for which monthly VAT data was available. The simulations that include the VAT data use sector-by-firm-size-decile shocks, except for the Dominican Republic, where the shocks are not size-specific. Panel (a) reports the aggregate revenues reported, Panel (b) the share of profitable firms, and Panel (c) the aggregate profits reported. The dots correspond to observed data from 2019 and 2020, the triangles to the simulations. These results are discussed in Section 5.1.

Figure 7: COVID-19 Restrictions

(a) Timing of COVID-19 restrictions in 2020



(b) Restriction stringency and aggregate revenue losses

Note: Panel (a) shows the timing and duration of lockdowns in the six sample countries. The red solid line denotes the dates of forced business closure. The blue dashed line marks the dates of strict stay-at-home orders. Data on the timing of lockdowns are from Hale et al. (2021). Panel (b) correlates the index of restriction stringency constructed by Hale et al. (2021) with the average drop in firms' revenue realized in the six sample countries, using the administrative microdata. This figure is discussed in Section 5.2.

Additional Figures and Tables

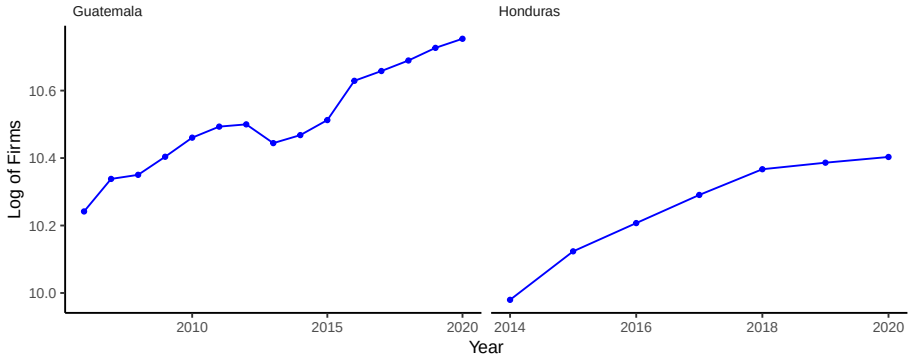
Table A1: Number of Firms

Country	CIT: Balanced		CIT: Unbalanced		VAT		Tax rates (%)	
	2019	2020	2019	2020	2019	2020	CIT	VAT
CRI	27,056	27,056	31,939	28,090	31,374	29,606	10/20/30	13
DOM	50,734	50,734	67,513	69,450	47,722	43,589	27	18
GTM	16,189	16,189	19,331	16,795	88,635	83,618	25	12
HND	21,077	21,077	23,390	21,795	14,140	12,784	25	15
ETH	12,985	12,985	18,473	19,109	–	–	30	15
UGA	14,020	14,020	23,015	24,302	–	–	30	18

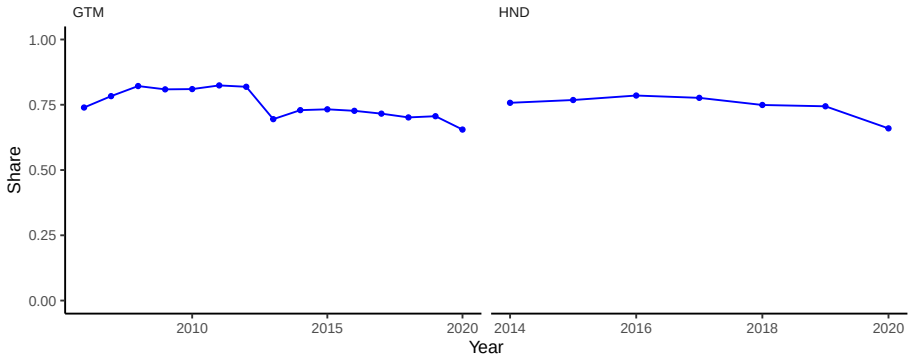
Note: This table presents the firm count for each sample. For the CIT data, we use a balanced sample of firms present in 2019 and 2020, and show the difference with an unbalanced sample. For the VAT data, the sample is semi-balanced: we retain firms that filed at least once every quarter in 2018 and 2019 and appeared at least once in the second and third quarters of 2020, coinciding with the onset of COVID. Disparities in firm numbers between the CIT and VAT samples can be attributed to the fact that not all firms are mandated to file both types of taxes. The last two columns indicate the CIT rate and the general VAT rate for each country in 2020. This table is discussed in Section 2.1.

Figure A1: Stability in the Administrative Data Over Time

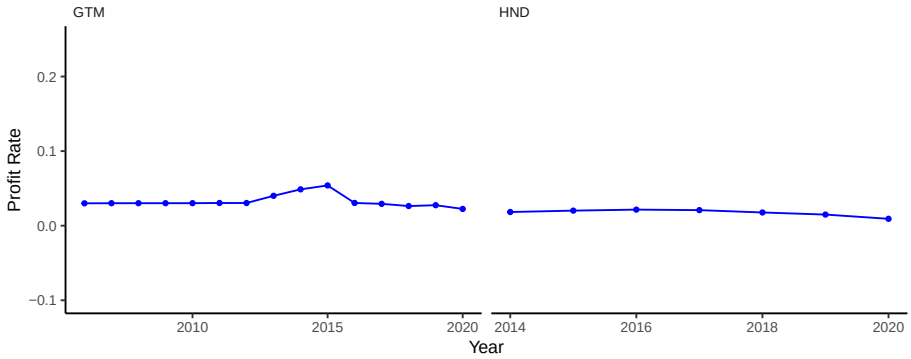
(a) Log number of firms



(b) Share of profitable firms



(c) Median profit rate



Note: This figure shows time series information from the administrative data in Guatemala and Honduras, where we can observe firms for an extended period before 2020. The share of profitable firms is calculated for firms with non-zero total revenue. We can also produce these figures for other countries but would need some additional time for this as we do not have direct access to the long panel. This figure is referred to in Section 2.1.

Table A2: Simulated vs Realized Outcomes - Robustness to Changing the Baseline

	Firm-level outcomes (Means)						Aggregate outcomes (As a share of GDP)			
	Revenue (1)	Material (2)	Labor (3)	Fixed (4)	Profitable (%) (5)	Profit margin (6)	Revenue (7)	Profit (8)	Tax paid (9)	Loss (10)
Panel A: Baseline 2018										
CRI										
Baseline	—	—	—	—	85.4	3.5	55.8	3.3	0.7	1.3
Simulation	-12.3	-11.4	-7.6	0	55.1	-3.3	49.9	1.6	0.3	2.6
Realization	15.2	15.6	15.2	12.4	72.9	1.3	65.5	4.3	0.9	1.7
GTM										
Baseline	—	—	—	—	74.3	-1	87.5	4.7	1.2	1.1
Simulation	-10.7	-10.1	-7.9	0	53.5	-6	76.9	2.5	0.6	1.7
Realization	-2.8	-5	-1.7	-1.9	69.3	-3.2	83.8	5.4	1.3	1
HND										
Baseline	—	—	—	—	79.4	1	150.1	10.6	2.6	3.5
Simulation	-10.1	-9.5	-7	0	42	-6.7	143.1	6.8	1.7	6.4
Realization	-15.8	-16	-8.7	-16	69.4	-3.1	134	9.1	2.3	3.8
Panel B: Baseline 2019										
CRI										
Baseline	—	—	—	—	82.7	3.5	56.6	3.7	0.7	1.3
Simulation	-12.2	-11.4	-7.3	0	54.9	-3.3	52.1	2	0.4	2.6
Realization	10.3	13.3	10.3	6.2	72.9	1.3	65.5	4.3	0.9	1.7
GTM										
Baseline	—	—	—	—	75.8	-0.2	87.2	5	1.2	0.8
Simulation	-10.9	-10.1	-7.7	0	54.7	-5.2	79.4	2.7	0.7	1.5
Realization	-6	-7.1	-3.8	-6.5	69.3	-3.2	83.8	5.4	1.3	1
HND										
Baseline	—	—	—	—	79.6	1.5	147.4	10	2.5	3
Simulation	-10.1	-9.6	-7.2	0	40.8	-5.9	143.9	6.4	1.6	5.4
Realization	-16.3	-20.2	-11.6	-8.7	69.4	-3.1	134	9.1	2.3	3.8

Note: This table analyzes the robustness of the simulation results to changing the baseline year. Panel (a) is analogous to Table 3, where the baseline year is 2019. Panel (b) uses 2018 as the baseline period instead. Firm-level outcomes (columns 1 to 6) are averages relative to the baseline (except columns 5 and 6, which are levels). Aggregate outcomes (columns 7 to 10) are relative to GDP. See Section 3 for further discussion on these results.

Table A3: Details of Simulation Outcomes

	All				Low				Medium				High			
	Revenue (1)	Material (2)	Labor (3)	Fixed (4)	Revenue (5)	Material (6)	Labor (7)	Fixed (8)	Revenue (9)	Material (10)	Labor (11)	Fixed (12)	Revenue (13)	Material (14)	Labor (15)	Fixed (16)
CRI																
Simulation	-12.2	-11.4	-7.3	0	-5	-5	-1.8	0	-12.5	-12.5	-6.6	0	-25	-25	-21.7	0
Simulation (VAT)	-3.4	-3.2	-2.2	0	-1.7	-1.2	-1.3	0	-2.2	-3.3	-0.8	0	-13.6	-10.3	-12.1	0
Realization	10.3	13.3	10.3	6.2	13.4	12.7	13.7	11.6	13.5	15.2	13.4	10.3	-13.6	-7.9	-13.5	-9
DOM																
Simulation	-10.1	-9.4	-7.3	0	-5	-5	-1.6	0	-12.5	-12.5	-7.1	0	-25	-25	-18.5	0
Simulation (VAT)	-5.9	-5.4	-3.4	0	-3.6	-3.6	-1.1	0	-6	-6	-2.8	0	-15.8	-15.8	-9.1	0
Realization	-7.9	-9.3	-12.2	6	-3.4	-6.9	-5.4	11	-7.6	-8.9	-11.5	7.4	-28.8	-33.3	-26.6	-17.1
GTM																
Simulation	-10.9	-10.1	-7.7	0	-5	-5	-1.7	0	-12.5	-12.5	-7.6	0	-25	-25	-21	0
Simulation (VAT)	-5.5	-5.4	-2.5	0	-3.6	-3.4	-2.1	0	-6.4	-6.6	-2.3	0	-7.2	-7.7	-5	0
Realization	-6	-7.1	-3.8	-6.5	-0.8	-1.7	-2.1	-4	-7.9	-10	-2.8	-6.3	-15.4	-16.9	-12.7	-11.4
HND																
Simulation	-10.1	-9.6	-7.2	0	-5	-5	-2.3	0	-12.5	-12.5	-7.3	0	-25	-25	-22.3	0
Simulation (VAT)	-8.7	-8.6	-5.8	0	-4.5	-4.3	-3	0	-11.4	-11.7	-6.5	0	-15.2	-15.2	-12.4	0
Realization	-16.3	-20.2	-11.6	-8.7	-12.1	-13.4	-6.9	-9.7	-18.1	-25.6	-12.1	-2.6	-29.4	-21.5	-25	-28.4
ETH																
Simulation	-10.5	-10.7	-3.6	0	-5	-5	-1.3	0	-12.5	-12.5	-3.9	0	-25	-25	-13.1	0
Realization	-4.5	-3.8	-3.3	-4.4	-3.7	-2.9	3	-3.4	-4.6	-3.2	-6.9	-1.7	-8.2	-14.7	-15.5	-18.5
UGA																
Simulation	-10.5	-10.5	-6.7	0	-5	-5	-1.5	0	-12.5	-12.5	-8.2	0	-25	-25	-20.8	0
Realization	-7.2	-6.4	-9.6	-8.8	-0.3	-5.1	1.9	3.9	-10.6	-7.3	-17.2	-16.7	-13	2.2	-12.9	-14.1
AVG																
Simulation	-10.7	-10.3	-6.6	0	-5	-5	-1.7	0	-12.5	-12.5	-6.8	0	-25	-25	-19.6	0
Simulation (VAT)	-7.1	-6.9	-3.6	0	-5.2	-5	-2.4	0	-7.5	-7.9	-3.2	0	-13	-12.4	-8.7	0
Realization	-5.3	-5.6	-5	-2.7	-1.1	-2.9	0.7	1.6	-5.9	-6.6	-6.2	-1.6	-18.1	-15.3	-17.7	-16.4

Note: This table extends the simulation results presented in Table 3, columns 1-4. Columns 1-4 of this table reproduce columns 1-4 of Table 3 – firm-level outcomes for firms in all sectors – for ease of comparison. Columns 5-16 show these results for each of the three impact sectors. In addition, for each country, a row is added to present simulation results using monthly VAT data to calibrate the size of the sector-firm-size-specific revenue shock. All outcomes are firm-level averages relative to the baseline. See Section 4 for further discussion on these comparisons.

Table A4: COVID-19 Restrictions and Support Policies

Country	Stay at home (Strict)	Stay at home (Light)	Firm close requirement	Overall stringency	Announced stimulus
	Share of Days in 2020 (%)			Index 0-100	(%) GDP
CRI	0.00	0.00	10.66	54.39	1.09
DOM	5.46	64.48	16.94	63.24	0.90
ETH	0.00	0.00	0.00	56.48	1.67
GTM	0.00	52.73	36.07	64.05	3.11
HND	43.44	79.51	21.86	71.77	3.19
UGA	0.00	75.68	11.48	62.57	0.85
Latin America	7.32	51.96	20.81	56.86	3.47
Africa	2.48	32.77	8.07	47.74	2.7
High Income	2.37	23.69	10.37	49.25	10.10

Note: Columns 1-4 of this table use data assembled by Hale et al. (2021) to measure the share of days in 2020 with restrictions enforced (columns 1-3) and the overall restriction stringency index (column 4). Each of these variables is shown for the six sample countries. For comparison, we add the simple average across all of Latin America, all of Africa, and for high-income countries. We define a "light stay-at-home policy" as individuals being required not to leave their homes, with exceptions for daily exercise, grocery shopping, and 'essential' trips. A "strict policy" is defined as individuals being required not to leave their homes with minimal exceptions. The closing requirement variable forces the closure of businesses. Additionally, the table displays the average stringency index for each country and region, as calculated by Hale et al. (2021). The stringency index is based on ordinary variables categorizing different kinds of restrictions such as school, workplace, and gatherings. Column 5 uses data from the IMF fiscal monitor database (IMF, 2024) to assess the size of the government's economic stimulus package. To represent the economic stimulus package as a share of GDP, we use 2019 GDP data from the World Bank (WBG, 2023). See Section 5.2 for further discussion.

Table A5: Support Policies Targeting Firms

Country	Tax remittance and social contributions	Monetary policies	Loans and credit	Employment flexibilization
CRI	1- Elimination of advance payments of profit tax; 2 - VAT exemption for commercial leases; 3- Tax exemptions for the nationalization of products.	1 - Reduction of the gross interest rate; 2 - Adjusted provisions' minimum accumulation.	1 - Policies for the reduction and extension of credit; 2 - Temporary moratorium on leases; 3 - Renegotiation of loans, without affecting the risk rating of the debtors.	1 - Regulation for the procedure of temporary suspension of employment contracts. 2 - Regulation for reductions of work hours; 3 - Recommendation to grant vacations in advance.
DOM	1 - Extensions for the payment of Income Tax and installment agreements for the VAT; 2 - Deferral of Social Security contributions.	1 - Reduction of interest rates 2 - Provisions of liquidity for banking entities 3- Relaxation of regulations in the financial sector	1 - Authorized freeze of debtor ratings and provisions, unchanged risk rating in credit restructurings; 2 - 60-day grace period for credit line loans; 3 - 90-day extension for updating appraisal-related guarantees.	1 - Recommendation for reduced working hours and increased telecommuting; 2 - Employers of firms that should remain closed should grant paid vacations to eligible employees.
GTM	1 - Deferral fo the Impuesto de Solidaridad (ISO); 2 - Authorized deferral of employer social security contributions;	-	1 - Loans to finance working capital 2 - Creation of funds to support the establishment of credit lines for micro and small businesses	1 - Creation of a procedure for work contract suspensions; 2 - Measures to allow and promote telecommuting.
HND	1 - Income and value-added tax extension for small and medium-sized taxpayers; 2 - Authorized deferral of employer social security contributions; 3 - Additional special deduction from income tax for those who retain all their employees.	-	1 - Facilitation for refinancing and credit restructuring.	1 - Authorization for the implementation of telecommuting
ETH	1 - Tax exemptions; 2 - Processing of Value Added Tax refunds is accelerated.	-	1 - Establishment of a fund to assist private banks in addressing debt and relief challenges;	1 - Workers can take unused annual leaves and anticipate leaves from the next budgetary period.
UGA	1 - Authorized deferral of employer social security contributions;	1 - Reduction of the gross interest rate of 1%; 2 - The Central Bank has committed to providing liquidity assistance to commercial banks facing liquidity distress.	-	-

Note: This table was constructed using the information on country policy responses to Covid-19 from ILO, 2020. The table shows a summary of the main economic policies announced by the governments in support of firms. We do not know to what extent these policies were actually implemented. See Section 5.2 for further discussion.