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The Impact of COVID-19 on Formal Firms: Evidence from Ethiopia

Pierre Bachas, Anne Brockmeyer, Tom Harris, Camille Semelet[1]

SUMMARY

This note uses administrative tax data on firms to measure the direct impact of the COVID-19 containment and prevention measures (referred to as 'lockdown' throughout this note) on firms' profitability, employment and exit rates. It separates the economy in three sectors, which face different size shocks and considers two lockdown scenarios: one lasting three months and one lasting five months. The three-month lockdown scenario aligns, to some extent, with the strictest period of Ethiopia's containment measures - which were scaled-up in April 2020 (at the start of the five-month State of Emergency) and partially eased from June 2020. The five-month lockdown scenario on the other hand could reflect the full period of containment and prevention measures. The simulations estimate losses to corporate income tax revenue, increases in firms' debt levels, cuts in payroll and their mitigation through wage subsidies, and aggregate output losses from firms' exit.

Overall, the impact on the economy is severe, with large falls in tax revenue, increases in debt and decreases in wages and/or employment. Under a three-month lockdown scenario, we estimate that only 53.9% of firms remain profitable and that almost all firms in the highly-impacted sectors register losses. The corporate income tax revenue loss is severe and in 2020 would only collect 75.0% of its baseline.[2] In addition, firms accumulate losses equivalent to 0.6% of GDP, suggesting that firms will need to substantially increase borrowing to survive. Firms would cut 3.3% of total yearly payroll - wage subsidies can save a substantial share of payroll in the medium-impact sector, but will not be able to save employment in the high-impact sector (tourism, transport, personal services), where firms can't pay their fixed costs.

This note faces important limitations: (i) it does not include the indirect impacts of the shocks which operate through firms' trade linkages, (ii) it only models a demand shock and as such firms have no issues obtaining inputs (materials, labor), (iii) Firms do not adapt to the crisis (for example by changing products, selling online etc.). Given these limitations, the numbers in this report should be considered as plausible lower bounds arising from direct effects, in partial equilibrium. Dynamic general equilibrium models of the economy, with linkages across sectors and firms, are needed to gauge longer term effects.

LOCKDOWN SIMULATIONS AND CATEGORIZATION OF SECTORS BY IMPACT

The COVID19 (coronavirus) pandemic and associated containment measures are expected to cause far-reaching damage to economies around the world. Firms are suffering from reduced demand due to movement restrictions, from reduced labor supply and from constraints to sourcing material inputs. The breakup of otherwise healthy businesses in response to a temporary shock implies large social costs. Governments are therefore intent on designing emergency policies to keep businesses afloat.

We present simulations using firm-level tax records from Ethiopia, which vary the duration of the lockdown[3] and the relative impact across sectors. In these simulated scenarios, demand shocks induce a loss in revenue which triggers a cut in profitability and possibly cuts in employment[4] or even firm closure. We compare these simulations to a baseline (pre-COVID) situation, which corresponds to the last year of available administrative data. Our analysis relies on a few simple assumptions about the structure of firms' revenue and costs: we assume that firms aim to weather the shock such that they can scale their production capacity back up swiftly at the end of the lockdown.[5] In this stylized world, firms can reduce their material costs proportionally to the drop-in demand, are reluc-

tant to reduce their labor costs as re-contracting is costly and cannot adjust their fixed costs. Finally, we assume that credit constraints prevent borrowing beyond existing loans used to cover predictable losses (i.e. losses unrelated to the shock).

We classify sectors into three impact categories - high, medium and low – depending on their expected loss in revenue during the shutdown, displayed in Table 1. This classification is based on a country-specific ad hoc assessment developed with input from government officials. In the high-impact category are sectors which are severely impacted by the lockdown and lose 60% of their revenue. These include tourism, transportation, non-essential retail and entertainment. In the medium impact categories are sectors which are moderately impacted and lose 40% of their revenue. These include manufacturing and education. Finally, the low impact sector only loses 20% of its monthly revenue, in sectors such as essential retail, health, construction and agriculture. Naturally there is still a fair degree of heterogeneity of exposure within the categories, with some sub-sectors experiencing increased revenue. Table 2 shows the number of firms and economic weight of each of the three impact sectors: the high-impact sector contains 9% of the firms and 12% of the wage bill, the medium impact sector contains 38% of the firms and 61% of the wage bill, and the low-impact sector the remaining 54% of the firms and 27% of the wage bill.

Table 1: Sector Categories and Shocks

Categories	**Sectors** (e.g., detailed list of sectors in Appendix Table 4)	**Expected Monthly Revenue Loss**
High Impact	Accommodation and Food Service Activities, Transport, and other highly affected sectors	60%
Medium Impact	Non-essential Retail, Education and other moderately affected sectors	40%
Low Impact	Agriculture, Human Health and Social Work activities and other mildly affected sectors	20%

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[3]We use the term lockdown for ease of reference and to maintain consistency with our other country notes on this topic. However, we do acknowledge that the containment and prevention measures implemented in Ethiopia have been more relaxed than those in other countries, and that in this context there has been no official 'lockdown'.

[4]While the Government of Ethiopia has made it illegal to fire anyone during the State of Emergency, we assume one could still see reductions in employment on the intensive margin (e.g. reductions in hours offered to shift workers, or employees forced to stay at home without pay).

[5]We do, however, plan to extend this note in the future and present simulations in which the economy does not transition to 100% of its previous activities after coming out of lockdown.

**Table 2: Statistics for High, Medium and Low Impact Sectors**

Categories	Aggregates				Averages				
	Number of firms	Share of firms	Revenue share	Wage bill share	Avg. size (LCU, in millions)	Avg. Profit margin	Labor costs (% total cost)	Material costs (% total cost)	Fixed costs (% total cost)
High impact	974	9%	7%	12%	37	13%	32%	39%	29%
Medium impact	4236	38%	69%	61%	79	13%	25%	43%	31%
Low impact	6011	54%	24%	27%	19	11%	31%	39%	30%

EFFECT ON FIRMS' PROFITABILITY

In this section, we ask what share of firms would need government support to "stay afloat" under a three-month and a five-month lockdown scenario. Assuming credit constraints, a rough indication for firms' ability to stay afloat is a non-negative profit rate. We start by simulating scenarios where firms lose a share of their revenue, while all costs remain constant. The results are displayed in Figure 1, and show that in the high and medium impact sectors the vast majority of firms become unprofitable even under the three-month lockdown scenario. In our simulations, as we use annual data, the five-month lockdown scenario could represent: a partial lockdown lasting another two months, the re-imposition of a partial lockdown for two months later in the year, or the implementation of a shorter period of complete lockdown.[6]

Figure 1: Firm Profitability Under a Shock to Revenue, No Adjustment to Costs

| (a) 60% Revenue loss | (b) 40% Revenue loss | (c) 20% Revenue loss |
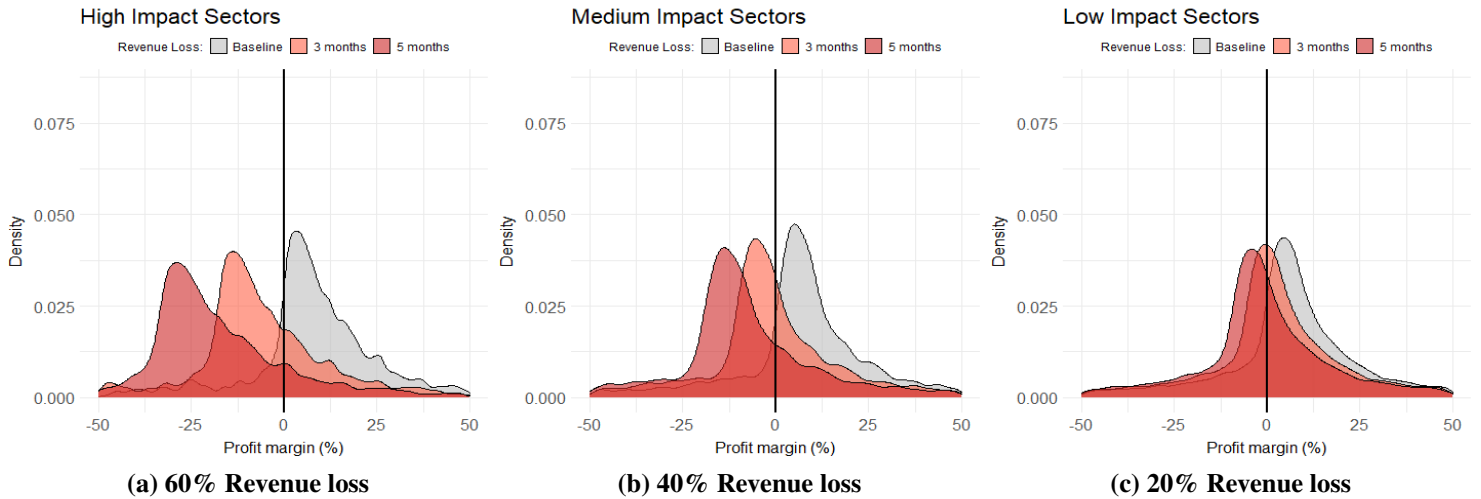
Note: These figures show the distribution of profitability, at baseline, and assuming that firms face a loss in revenue corresponding to either three or five months of loss in yearly revenue. They show the distributions holding all costs constant.

In addition to a pure revenue shock, we simulate a more realistic scenario where firms adjust their material costs proportionally to their revenue loss. The results are displayed in Figure 2: 75% of firms in the high-impact sector are profitable at baseline, a number which drops to 42% for the three-month lockdown scenario and to 27% under a five-month lockdown. The impact is less severe in the medium and low impact sectors, since the shock they face is less severe and since these sectors rely more heavily on material inputs than the high impact sector. On aggregate, only 54% (44%) of all firms remain profitable under a three-month (five-month) lockdown. We also observe that the distribution becomes multi-modal for high impact firms: while firms using mainly material inputs and little labor or capital inputs can adjust to some extent and limit their losses, firms with a small share of material inputs in total cost have little margin to adjust and suffer much larger losses.

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[6]It is worth highlighting that in the five-month scenario, while the majority of the revenue losses would affect collections in the 2019/20 fiscal year, a portion of these might in fact affect the 2020/21 fiscal year - depending on the scenario one has in mind.

Figure 2: Firm Profitability Under a Shock to Revenue, Material Costs Adjust in Proportion

(a) 60% Revenue loss **(b) 40% Revenue loss** **(c) 20% Revenue loss**
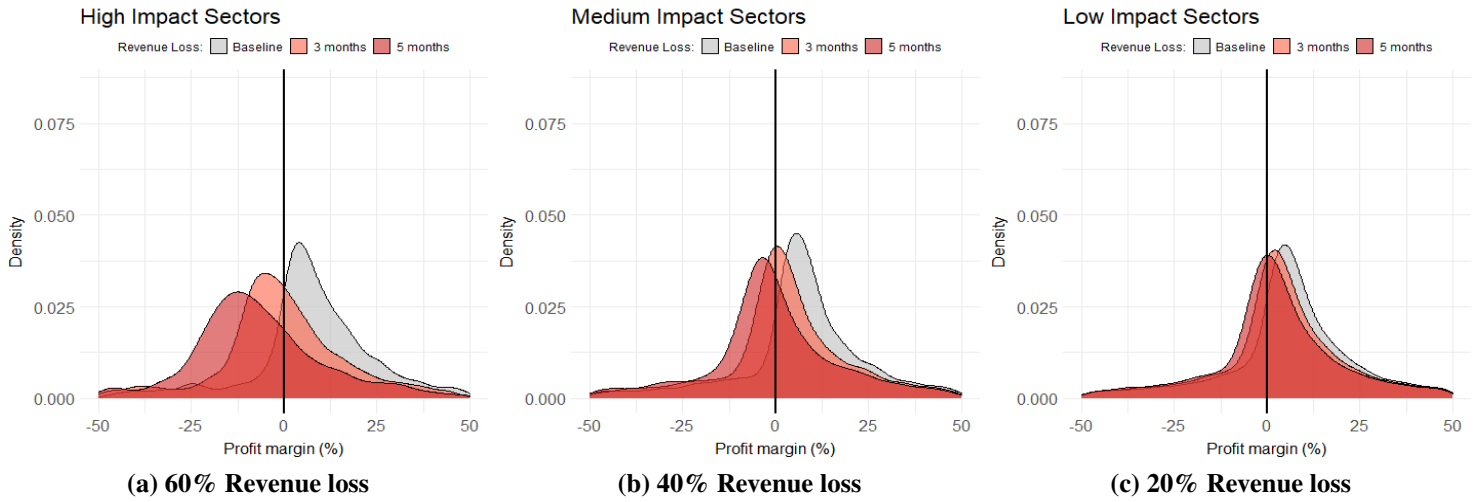
EFFECT ON EMPLOYMENT AND SIMULATIONS OF WAGE SUBSIDIES

In this section, we study by how much employers would need to slash their yearly wage bill in the absence of government support. We continue to assume that material inputs adjust first, and that firms only cut their wage bill if they are still unprofitable after the material inputs adjustment. Figure 3 shows the resulting distributions of the reduction in the yearly wage bill for a three or five month lockdown scenario. The figure is bi-modal: the first spike corresponds to firms which are sufficiently profitable at baseline: they absorb the shock and keep paying their workers. The second spike corresponds to firms which have to cut their wage bill proportionally to the shock in an attempt to stay afloat. In the middle of the distribution, a share of firms reduces their wage bill somewhat (but less than proportionally to the shock) and achieves zero profit (or retains to pre-shock projected losses): providing even modest wage subsidies to these firms has the potential to save jobs. On aggregate, weighting by firms' yearly wage bill, this would lead to a cut in payroll of 3.3% (resp. 6.6%) of the formal economy's total yearly wage bill in the three-month lockdown [resp. five-month]. The payroll loss is of course concentrated in the high-impact sectors which would cut 9.2% (resp. 17.2%) of payroll under the three-month lockdown (resp. five-month).

Figure 3: Wage Bill Reduction from a Revenue Shock, Material Costs Adjust Proportionally

(a) 60% Revenue loss **(b) 40% Revenue loss** **(c) 20% Revenue loss**
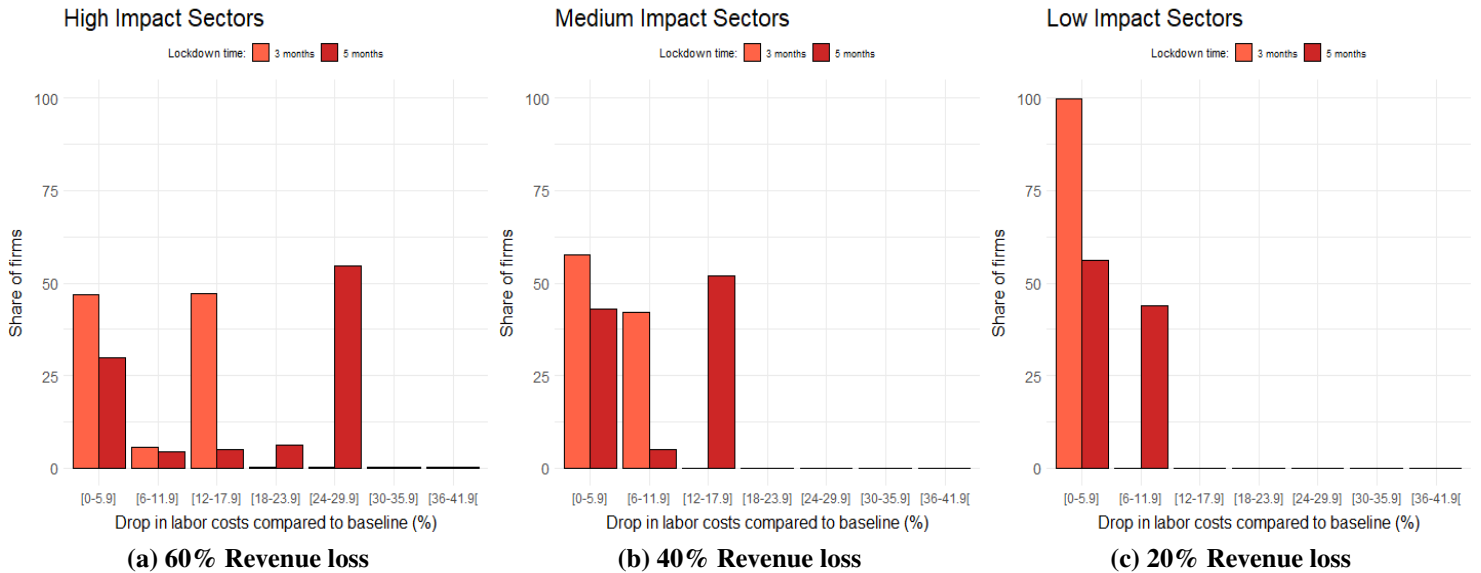
To counteract these payroll losses, the government might consider offering wage subsidies to firms in order

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[7]As noted above, while the government has made it illegal to fire anyone during the State of Emergency, one could still see reductions in employment on the intensive margin (e.g. reductions in hours offered to shift workers, or employees forced to stay at home without pay).

[8]It is worth noting that the four-month waiver of employment income tax for particular workers (those required to stay at home) may have assisted in this respect.

to protect wage levels and formal employment.[78] Figure 4 shows each sector's aggregate payroll losses when varying the size of the wage subsidy, measured as the share of firms' payroll paid by the government. In the case of a zero-wage subsidy the loss in payroll corresponds to the numbers mentioned above. As the wage subsidy increases the loss in payroll decreases, as some firms now return to zero profits (or to their baseline losses). The impact on payroll loss is however very different across the three impact sectors: On the one hand, for the high impact sectors (Figure 3a), the loss in revenue is too severe to be compensated by wage subsidies and these firms are forced to cut employment, even for large wage subsidies. To understand this, note that we assume that these firms still

have to pay their fixed costs (e.g. rent) and a reduction in labor costs is not sufficient to counteract the revenue loss. On the other hand, wage subsidies can save payroll for the low, and especially the medium-impact sector: in the latter sector, a 60% wage subsidy over the lockdown period would roughly halve the sector's payroll loss. On aggregate, applying a 50% wage subsidy across all sectors would reduce the yearly payroll loss from 3.3% to 2.7% (three-month lockdown) or from 6.6% to 5.0% (five-month lockdown). It would take a substantial subsidy to save more payrolls: even with a 90% wage subsidy the loss in yearly payroll would be reduced only to 2.4% (three-month lockdown) or to 4.2% (five-month lockdown).

Figure 4: Aggregate Sector Loss in Payroll as a function of the Size of the Wage Subsidy

| (a) 60% Revenue loss | (b) 40% Revenue loss | (c) 20% Revenue loss |
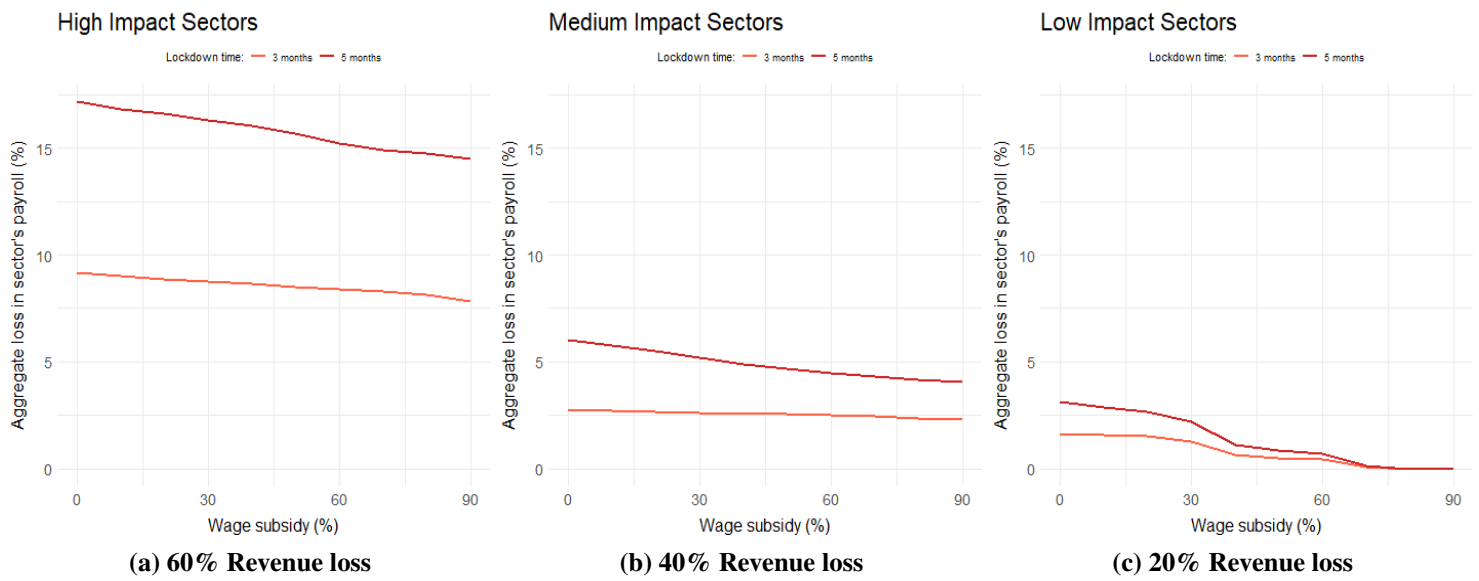
Note: These figures show to what extent a government wage subsidy for the retained labor force can absorb the aggregate loss in payroll, if the lockdown lasts three or five months. Firms readjust their decision after receiving a wage subsidy: they first adjust their material costs, and then their wage bill. It is still assumed that the drop-in wage bill can't be more than proportional to the revenue fall and that due to re-contracting costs, firms keep paying wages as long as they remain profitable.

FIRMS' EXIT RATES INDUCED BY THE REVENUE SHOCK

Here we predict the increase in firms' exit under the different lockdown scenarios. We use the panel dimension of the data to measure the excess exit rate in pre-crisis years separately for negative and positive profit firms (and in each of the three impact sectors). Figure 5 (a) shows these exit rates in regular times: on average 13% of firms exit in any given year; however firms which had losses in the previous year have an exit rate which is at least 8 percentage points higher than firms which had positive profits. In our previous analysis, we

estimated the share of firms which have negative profits due to the crisis, for each impact sector. We thus combine these results to measure the percentage increase in exits induced by the crisis, by multiplying the share of newly loss-making firm with their excess exit rate. We show the results for the three and five month lockdown scenario in 5 (b): under a three (five) month lockdown scenario, firms' exits from the formal economy increase by 47% (77%). This loss of firms is of course particularly acute for the high impact sector where the percentage increase in firms' exits is 115% (168%) compared to the average pre-crisis year.

Figure 5: Firms' Exit Rate

(a) Pre-Crisis Average Exit Rate

(b) Crisis Induced Exits
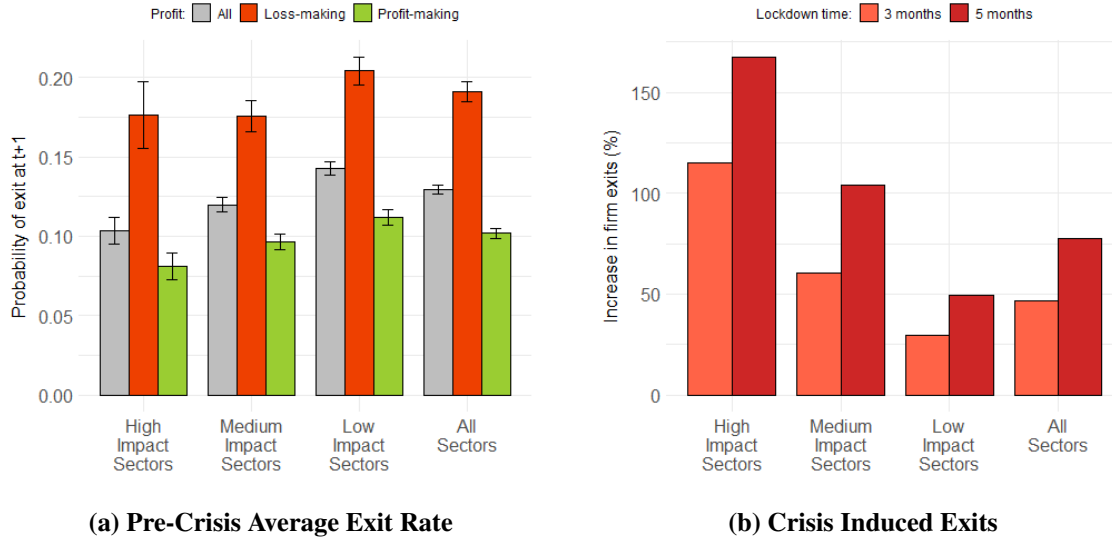
Note: Panel (a) shows the average exit probability for all firms, and then for loss-making and profit-making firms, using panel data before the crisis. Panel (b) shows the percentage increase of firms' exit induced by a three or five month output loss, compared to baseline levels.

AGGREGATE NUMBERS AND IMPACTS ON THE ECONOMY

The impact on the overall economy is severe, with large falls in tax revenue, increases in debt, and reductions in wages and employment.[9] Table 3 summarizes the key numbers for the 3 and 5 months lockdown scenarios and the aggregate impact on the economy. 54% or less of firms remain profitable after the shock, and almost all firms in the highly impacted sectors register losses. The Corporate income tax revenue loss is severe, reaching 24% overall in the three-month shock scenario and 38% in the five-month shock scenario. In the high-impact sectors, almost all CIT revenue is lost. This is because, despite the temporary nature of the shock, the shock generates large losses which are counted against the profits made during the remainder of the year. The absolute increase in losses is 0.6% [1.1%] with the three-month shock [five-

month shock], suggesting that firms will need to substantially increase borrowing. Payroll losses are also substantial, ranging between 3.3% and 6.6% of the annual wage bill - wage subsidies can safeguard some employment, especially in the medium-impact sectors: a 50% wage subsidy would reduce the payroll losses from 3.3 to 2.7% [6.6 to 5.0%] in the three [five] month lockdown scenario. Increases in firm exit are relatively small, meaning that associated output and payroll losses are also small, but this is likely an under-estimate: Our panel data features only a smaller number of firms that experience large revenue losses and hence allow us to estimate the effect, presumably because most such firms exit the panel. Our estimates mean that the size of government rescue packages for firms and workers needs to be large, and the budget support from donors to lower-income countries even larger, to compensate for the massive loss in tax revenue.

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[9]As noted above, while it is illegal to fire anyone during the declared State of Emergency, there could still be reductions in employment on the intensive margin (e.g. reductions in hours offered to shift workers; or employees forced to stay at home without pay).

Table 3: Aggregate Impacts by Lockdown Duration and by Impact sectors

			High Impact		Medium Impact		Low Impact		All Sectors	
			3 months	5 months	3 months	5 months	3 months	5 months	3 months	5 months
1	Share of firms profitable at baseline		74.8		70.4		67.1		**69.0**	
2	Share of firms still profitable (material adj.)		42.3	27.4	52.1	39.0	57.1	50.3	**53.9**	**44.0**
3	CIT revenue loss relative to baseline (%)		52.3	74.9	24.4	38.1	15.3	24.6	**24.1**	**37.5**
4	Absolute losses increase (% GDP)		0.2	0.3	0.3	0.7	0.1	0.1	**0.6**	**1.1**
5	Payroll Loss	No wage subsidy	9.2	17.2	2.8	6.0	1.6	3.1	**3.3**	**6.6**
		50% wage subsidy	8.5	15.7	2.5	4.7	0.5	0.9	**2.7**	**5.0**
		90% wage subsidy	7.9	14.5	2.3	4.1	0.0	0.0	**2.4**	**4.2**
6	Percentage increase in exit relative to baseline		115.0	167.6	60.7	104.1	29.7	49.3	**46.9**	**77.4**
7	Permanent output loss from firm exit (% GDP)		0.0	0.1	0.1	0.2	0.0	0.1	**0.2**	**0.4**
8	Permanent payroll loss from firm exit (% GDP)		0.2	0.3	1.0	1.7	0.2	0.4	**1.4**	**2.3**

Table 4: Sectors and Impact Categories

SECTORS (ISIC Rev 4 code)	High - Medium - Low Impact	
A AGRICULTURE, FORESTRY AND FISHING	Low Impact	
B MINING AND QUARRYING	Low Impact	
C MANUFACTURING	Low Impact	Medium Impact
	Food products; Beverages; Tobacco products; Basic pharmaceutical products and pharmaceutical preparations	Textiles; Wearing apparel; Leather and related products; Wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; Paper and paper products; Printing and reproduction of recorded media; Coke and refined petroleum products; Chemicals and chemical products; Rubber and plastic products; Other non-metallic mineral products; Basic metals; Fabricated metal products, except machinery and equipment; Computer, electronic and optical products; Electrical equipment; Manufacture of machinery and equipment n.e.c.; Motor vehicles, trailers and semi-trailers; Other transport equipment; Furniture; Other manufacturing; Repair and installation of machinery and equipment
D ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	Medium Impact	
E WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	Medium Impact	
F CONSTRUCTION	Medium Impact	

G WHOLESALE AND RETAIL TRADE other than food, pharamacies, gas stations	High Impact	Low Impact
	Automobile Dealers; Other Motor Vehicle Dealers; Furniture Stores; Home Furnishings Stores; Clothing Stores; Shoe Stores; Jewelry, Luggage, and Leather Goods Stores; Sporting Goods, Hobby, and Musical Instrument Stores; Book Stores and News Dealers; Department Stores; Florists; Office Supplies, Stationery, and Gift Stores; Other Miscellaneous Store Retailers; Consumer Goods Rental; General Rental Centers; Apparel, Piece Goods, and Notions Merchant Wholesalers; Automotive Parts, Accessories, and Tire Stores; Direct Selling Establishments	Remaining sub-categories

H TRANSPORTATION AND STORAGE	High Impact	Medium Impact
	Scheduled Air Transportation; Nonscheduled Air Transportation; Taxi and Limousine Service; School and Employee Bus Transportation; Other Transit and Ground Passenger Transportation; Support Activities for Air Transportation; Support Activities for Water Transportation; Traveler Accommodation	

I ACCOMMODATION AND FOOD SERVICE ACTIVITIES	High Impact	Medium Impact
	Special Food Services; Drinking Places (Alcoholic Beverages); Restaurants and Other Eating Places	Remaining sub-categories

J INFORMATION AND COMMUNI-CATION	Low Impact	
K FINANCIAL AND INSURANCE AC-TIVITIES	Medium Impact	
L REAL ESTATE ACTIVITIES	Medium Impact	
M PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES	Low Impact	
N ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	Low Impact	
O PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY	Low Impact	
P EDUCATION	Medium Impact	
Q HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	Low Impact	
R ARTS, ENTERTAINMENT AND RECREATION	High Impact	Medium Impact
	Performing Arts Companies; Spectator Sports; Independent Artists, Writers, and Performers; Amusement Parks and Arcades; Gambling Industries; Other Amusement and Recreation Industries	Remaining sub-categories
S OTHER SERVICE ACTIVITIES	High Impact	Medium Impact
	Offices of Dentists; Personal Care Services; Other Personal Services	Remaining sub-categories

CALCULATION DETAILS FOR TABLE 3

Each figure is calculated for a specific Impact category (High, Medium, Low impact and All sectors) and for a specific lockdown scenario (three and five months):

1. Share of firms profitable at baseline: (1) number of firms with positive profit margin before output shock, divided by (2) total number of firms, expressed as percentage.

2. Share of firms still profitable (material adj.): (1) number of firms with positive profit margin, after material costs adjustment proportional to the shock, divided by (2) total number of firms, expressed as percentage.

3. CIT revenue loss relative to baseline: (1) sum of all firms' profits at baseline multiplied by the corporate income tax rate minus (2) sum of all firms' profits after lockdown multiplied by the corporate income tax rate, divided by (1) and expressed as percentage.

4. Absolute losses increase (% GDP): (1) absolute value of the sum of all firms' losses after lockdown minus (2) absolute value of the sum of all firms' losses at baseline, divided by (3) GDP (current LCU of the same year), expressed as percentage.

5. Payroll Loss, at different wage subsidy rate: (1) sum of all firms' new labor costs under lockdown, divided by (2) the sum of all firms' labor costs at baseline, expressed as percentage.

6. Percentage increase in exit rate relative to baseline: (1) exit rate of firms after lockdown minus (2) exit rate of firms at baseline, divided by (2) and expressed as percentage.

7. Permanent output loss from firm exit (% GDP): (1) additional exit rate relative to baseline multiplied by (2) the sum of all firms' turnover at baseline, divided by (3) GDP (current LCU of the same year), expressed as percentage.

8. Permanent payroll loss from firm exit (% GDP): (1) additional exit rate relative to baseline multiplied by (2) the sum of all firms' labor costs at baseline, divided by (3) GDP (current LCU of the same year), expressed as percentage.