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THE COVID-19 SHOCK AND EQUITY SHORTFALL: FIRM-LEVEL EVIDENCE FROM ITALY

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Abstract

This paper estimates the drop in profits and the equity shortfall triggered by the COVID-19 shock and the subsequent lockdown, using a representative sample of 80,972 Italian firms. We find that a 3-month lockdown entails an aggregate yearly drop in profits of €170 billion, with an implied equity erosion of €117 billion for the whole sample, and €31 billion for firms that became distressed, i.e., ended up with negative book value after the shock. As a consequence of these losses, about 17% of the sample firms, whose employees account for 8.8% of total employment in the sample (about 800 thousand employees), become distressed. Small and medium-sized enterprises (SMEs) are affected disproportionately, with 18.1% of small firms, and 14.3% of medium-sized ones becoming distressed, against 6.4% of large firms. The equity shortfall and the extent of distress are concentrated in the Manufacturing and Wholesale Trading sectors and in the North of Italy. Since many firms predicted to become distressed due to the shock had fragile balance sheets even prior to the COVID-19 shock, restoring their equity to their pre-crisis levels may not suffice to ensure their long-term solvency.

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The COVID-19 Shock and Equity Shortfall:
Firm-level Evidence from Italy

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Abstract

This paper estimates the drop in profits and the equity shortfall triggered by the COVID-19 shock and the subsequent lockdown, using a representative sample of 80,972 Italian firms. We find that a 3-month lockdown entails an aggregate yearly drop in profits of €170 billion, with an implied equity erosion of €117 billion for the whole sample, and €31 billion for firms that became distressed, i.e., ended up with negative book value after the shock. As a consequence of these losses, about 17% of the sample firms, whose employees account for 8.8% of total employment in the sample (about 800 thousand employees), become distressed. Small and medium-sized enterprises (SMEs) are affected disproportionately, with 18.1% of small firms, and 14.3% of medium-sized ones becoming distressed, against 6.4% of large firms. The equity shortfall and the extent of distress are concentrated in the Manufacturing and Wholesale Trading sectors and in the North of Italy. Since many firms predicted to become distressed due to the shock had fragile balance sheets even prior to the COVID-19 shock, restoring their equity to their pre-crisis levels may not suffice to ensure their long-term solvency.

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"Is giving the already overleveraged corporate sector loans to infinity a good idea? [...] Might we all then be better off if these loans were fast converted into equity — strengthening corporate balance sheets and leaving the government with a portfolio of equity stakes along the way?" (Merryn Somerset Webb, *Financial Times*, 1 May 2020)

"We have a huge opportunity now to replace government lending to companies in the Covid-19 crisis with equity purchases. Indeed, at current ultra-low interest rates, governments could create instantaneous sovereign wealth funds very cheaply." (Martin Wolf, *Financial Times*, 5 May 2020)

1   Introduction

All great economic crises pose two equally important challenges: they drain the liquidity necessary for the functioning of firms, and burn equity capital, or part of it. Of these two, the first poses the most immediate challenge today: due to the COVID-19 shock, and the resulting lockdown, many companies have seen their revenues vanish even while their costs continue to mount and, therefore, find themselves in a liquidity crisis. To limit the recessionary effect of the shock, governments and central banks around the world have enacted policies aimed at providing liquidity to companies, either directly, or through the banking system. For instance, in March 2020, the European Central Bank (ECB) eased the conditions of its Targeted Longer-Term Refinancing Operations (TLTRO III) to support firms' access to bank credit, enlarged the list of corporate collateral eligible assets, and expanded the range of assets eligible for its purchases under the Corporate Sector Purchase Program (CSPP) to include non-financial commercial paper. At the same time, several Eurozone governments offered export guarantees, liquidity assistance, and credit lines to firms, through their respective national development banks, ranging from 38.6% of GDP in Germany and 29.8% of GDP in Italy, to 14% in France and 9.1% in Spain (Anderson et al., 2020).

Such generous liquidity support, however valuable to enable firms to survive in the short term, is far from sufficient in the medium and long term. Indeed, as liquidity reaches companies through loans, it increases their leverage, hence raising their default risk and leaving them vulnerable, with little room to invest and grow. The debt overhang problem arising from excessive debt accumulation is known to deter firm investment (see Myers (1997) and Hennessy et al. (2007)), and to slow down the pace at which corporate

investment and growth recover from crises (Kalemli-Ozcan et al., 2019). Hence, if firms emerge from the COVID-19 crisis overloaded with debt, then investment and growth, which have already been sluggish in most of the Eurozone, will likely slow even further to a snail's pace. In other words, barring an adequate capital injection in its firms, the Eurozone could experience an "L-shaped" recession, with persistently depressed economic activity, rather than a "V-shaped" one, featuring a rapid recovery.

This highlights the urgent need to think about solvency, not just liquidity, and to inject new *equity*, not just liquidity, into viable firms. Some governments are already moving in that direction. The German federal government has already allocated €100 billion to inject equity and buy stakes in (large) companies affected by the COVID-19 shock via the Economic Stabilisation Funds (i.e., Wirtschaftsstabilisierungsfonds - "WSF"), €50 billion in direct grants to distressed one-person businesses and micro-enterprises, and €2 billion to expand venture capital financing to start-ups, new technology companies and small businesses. This federal funding is complemented by €33.5 billion funded by the States of Bavaria, Hesse and Baden-Wuerttemberg. But these seemingly large equity injections, which amount to 5.4% of GDP, are less than 1/7 of the liquidity being provided by the German government in the form of debt (38.6% of GDP). Meanwhile, the equity injections provided to firms by other Eurozone governments pale in comparison to the German figures, in particular due to the existing significant sovereign debt obligations in some of these countries.

Clearly, assessing how much equity capital will eventually be "burnt" in the ongoing crisis is a key pre-requisite to understanding the size of the equity injection that would be required to rebalance the capital structure of Eurozone firms, and get them on their feet again, as the crisis abates. In this paper, we attempt such a detailed exercise for Italy, the first economy in Europe to be seriously affected by the COVID-19 outbreak, and one of the most stressed since then. Our analysis consists of estimating the net income losses due to the lockdown for a large, representative sample of 80,972 Italian firms, which accounts for the substantial proportion of the Italian economy. Our analysis, which is based on 2018 data (the latest available), aims at quantifying the changes in firm leverage and consequent distress due to the lockdown resulting from the COVID-19 outbreak.

We hasten to emphasize from the onset that this is an exercise fraught with difficulties, since the crisis may unfold in a manifold of ways. The main unknown in our

analysis is whether the Italian economy will experience a sharp but short recession, with a fast rebound in 2021, or rather one leading to a depressed economy for years to come, or some intermediate variant. To some extent, this depends on how the pandemic itself develops: while the initial lockdown has already lasted for almost three months, possible subsequent waves of the epidemic may require further lockdown periods in the future, possibly restricted only to some regions. Therefore, we consider a range of possible scenarios, which differ in the duration of the lockdown, so as to allow for a possible resurgence of the disease.

To identify the effects of the COVID-19 shock, we assume that it will induce 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 the lockdown, while taking into account wage subsidies paid to inactive workers and reduced tax payments. This fraction is based on information regarding how essential each sector is to the population as deemed by the government, and how much it depends on close physical contact between workers and with customers. Based on the firms' estimated profit reduction, we can calculate the aggregate profit reduction for the whole sample, and the equity shortfall for all firms, as well as for the subsample of distressed firms, i.e., those ending up with negative book value of equity (net worth), as well as their distribution by firm size, sector, and geographical area.

We find that after a three-month lockdown, the firms in our sample are estimated to face an aggregate annual profit drop of €170 billion (roughly 10% of GDP in 2018). For the subsample of firms predicted to have losses, the aggregate equity erosion is estimated to amount to €117 billion (roughly 7% of Italian GDP in 2018). The shock is estimated to force about 13,500 firms (i.e., 17% of the total) into negative net worth territory; overcoming the equity shortfall of these distressed firms would require an equity injection of €31 billion. The companies predicted to have negative net worth by the end of the year employ slightly over 800,000 workers, that is, 8.8% of the employees of our sample firms.

Of course, if all of these distressed firms were to go bankrupt and be liquidated, the resulting increase in unemployment would be very large. This raises the question of whether our prediction is too pessimistic. On the one hand, our estimates might indeed be regarded as an upper bound, since the liquidity injections and guarantee programs enacted by the Italian government – currently amounting to €530 billion – may enable

many of these firms to avoid bankruptcy and survive at least for some time, even though they may have negative net worth, in book terms. Other firms may be able to raise fresh equity capital, or to restructure their debt so as to return to solvency.

On the other hand, however, our methodology could be questioned for resting on premises that are too optimistic as we do not consider the spillover effects between sectors due to the lockdown, the drop in demand likely to materialize once the lockdown is lifted, nor the increase in firms' costs due to social distancing requirements. In fact, our present calculations assume firms revert to their normal pre-COVID-19 revenue and cost structure *immediately* after the lifting of the lockdown while, in practice, they are most likely to do so only gradually, especially in sectors where social distancing rules are more problematic, such as Retail Trade and Tourism.

Insofar as the sectors most affected by the lockdown were to revert only slowly to their pre-COVID-19 levels after the lockdown is lifted, the estimated equity funding needed to recapitalize Italian firms would rapidly escalate beyond the above-reported figures. This is because the shortfall grows non-linearly due to the convex characteristics of equity, especially for near-distressed companies with thin equity cushions, since equity enjoys limited liability, even if the drop in profits (relative to a no-COVID-19 scenario) is assumed to grow linearly in the duration of the lockdown. Indeed, if the reversion to near-normalcy is not so immediate, then our estimates for the six-months lockdown scenario would be the most appropriate, implying a profit reduction of €321 billions (18% of the GDP in 2018) and a total equity shortfall of €259 billions. This would push more than 30% of firms into distress with a total negative equity equal to €126 billion.

We also find that the COVID-19 shock would affect different firms with greatly disparate severity. Large companies are predicted to fare better than small and medium-sized enterprises (SMEs) for any assumed duration of the lockdown as they are generally better capitalized to start with: a three-month lockdown is predicted to lead to a 18.1% default rate for small firms, and a 14.4% default rate for medium-size ones, against only 6.4% for large firms. As small firms are under-represented in our sample, this provides an additional reason to suspect that our predictions may well under-estimate the impact of the COVID-19 shock on the frequency of distress and its consequences for employment.

Our results show that the firms that are projected to enter distress are typically not only smaller, but are also characterized by lower profitability and available cash, and to

be far less capitalized than the entire sample. Moreover, such firms are generally much more labor intensive than other firms, as they have far more employees relative to total assets, and a cost structure where labor costs weigh relatively more in total costs. These characteristics of the sample have two important implications. First, an equity injection that would bring these firms back to their pre-COVID-19 level would still not address their inherent financial fragility, and potentially expose them to a second round of external shocks. Second, as these firms are so labor intensive, their demise would imply many redundancies, with severe knock-on effects on demand, and indeed, the whole economy.

Our analysis also highlights that the effects of the lockdown on firms' profits differ vastly across industries. The profit drop is concentrated in Manufacturing and Wholesale Trading, which are respectively the first and third sectors by total assets and number of employees in Italy. Within Manufacturing, the most severely hurt sub-sectors are Fabricated Metal Products, Industrial and Commercial Machinery, Computer Equipment, and Transportation Equipment. Perhaps surprisingly, the profits and equity levels of firms in the Recreation Services and Tourism sectors are relatively lightly affected by the lockdown in our analysis. This may be the case because these sectors are highly labor intensive, so that most of their labor cost, i.e. their wage bill, is currently covered by public wage subsidies, insofar as they are inactive. However, the profitability of these sectors may also be affected by social distancing policies for a longer time than other sectors, due to the lower physical distance between employees and customers in these sectors, and in general, by sluggish consumer demand.

At the geographical level, the losses from the lockdown are more concentrated in the Northern regions, where most of Italian manufacturing firms, especially the largest ones, are headquartered. However, it should be emphasized that our results may underestimate the extent to which profits and equity levels will drop for firms located in Central and Southern Italy. The reason is that in the industrial structure of these regions, the Recreation and Tourism sectors loom larger than in Northern Italy, which, as just explained, may take much longer to recover than the Manufacturing sector, which effect is not accounted for by our estimates.

The paper proceeds as follows. Section 2 describes our dataset. Section 3 describes our methodology, while Section 4 presents our results. Our tentative conclusions are presented in Section 5.

2 Data

We select all the non-financial Italian companies present in the ORBIS database of Bureau van Dijk that were active, employed more than 10 workers, and had at least €2 million of total assets in 2018. Hence, we exclude firms classified as micro-enterprises by the EU, mainly for consistency with the standard international definitions of small, medium and large companies, but also because data quality is typically worse for micro-enterprises.[1] Moreover, we retain in our sample only companies for which accounting data are available for 2017 and 2018. These screens in the construction of our dataset leads to a sample of 83,621 companies, for each of which we have balance sheet data for the period 2017-2018.[2] We focus on accounting data for 2018 because, at the time of writing, 2019 data are available only for a few companies.

We eliminate from our sample all firms with negative equity both in 2017 and 2018, as well as those for which the sum of Net Income in 2018 and Equity at the end of 2017 is negative: the rationale is that we aim to investigate the impact of the COVID-19 shock on solvent firms and, therefore, we exclude from our sample firms that would have been in distress in any case, even absent the COVID-19 shock. Thus, our evaluation provides an assessment of the *incremental* effect of the COVID-19 shock on the financial performance and distress of Italian firms, and *not* its total effect, which would include the normal vicissitudes of firm performance.

In addition to the overall sample, we analyze sub-samples stratified by firm size, by sector, and by geographical area of firm headquarters. Firms are classified by size, based on the EU definitions, into three sub-samples of small, medium-sized and large. Sectors and geographical areas are defined in line with the Italian National Institute of Statistics (ISTAT). Sectors are defined at the first SIC digit level but, for the manufacturing sector, they are further broken down at the two-digit level.

We merge the balance sheet data for our sample firms with data on the forgone fraction of value added in each sector j due the lockdown. This variable, which we denote by

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[1] Small firms are defined as those with less than 50 employees. Medium-sized firms are defined as those with between 50 and 250 employees. Large firms are defined as those with more than 250 employees and balance sheet totals of more than €43 million. See the classification by the EU Commission at https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en.

[2] Specifically, we downloaded the following items: Total Assets, Shareholders' Funds, Operating Revenue, Number of Employees, Net Income, Return on Equity (ROE), Financing Expenses, Employee Costs, Cash and Cash Equivalents, Debt, and Equity (Net Worth).

λ_j for sector j, is computed from national accounting data, firm sectoral data and Labor Force Survey data (ISTAT), as well as the Profession Sample Survey (INAPP), to take into account the fraction of employees in "teleworking" mode in each sector. The fraction of forgone value added in each sector reflects the fraction of non-essential industries in that sector, based on the lists contained in governmental decrees (DPCM of 9, 11 and 22 March, and MISE decree of 25 March 2020).

The values of λ_j for each sector are reported in Table 1. The table shows that the sectors most severely affected by the lockdown are Other Services (80.6%), Recreation Services (74.2%), Restaurants and Tourism (62.1%), Manufacturing (48.7%) and Construction (48.2%). We note the large variance within the Manufacturing and Construction sectors, as reported in the second and third panel of Table 1. In particular, within the Construction sector, we estimate a λ_j of 87.6% for General Contractors and Operations, and 5.2% for Heavy Construction. For Manufacturing, we estimate 84.5% for Furniture and Fixtures, and 5.3% for Chemicals and Allied Products.

Moreover, the distribution of firms differs widely across sectors and sub-sectors, as shown by the second column of Table 1. This aspect has an important bearing on our analysis. For example, the Restaurants and Tourism sector is significantly affected by the lockdown, but only 3,086 firms are in that sector, accounting for less than 4% of our sample. Conversely, the Manufacturing sector, which is on average less affected by the lockdown than the Restaurants and Tourism sector, represents more than 37% of the firms in our sample. As we shall see, the severity of the equity shortfall that we estimate will reflect the combination of these two aspects, i.e., (i) the severity of the lockdown in each sector and (ii) the number and type of firms belonging to that sector.

After merging firm-level data with our measure of the lockdown's severity, and cleaning and filtering the resulting data, we are left with a final sample of 80,972 companies and 9.014 million of employees. The first column in Table 2 provides the summary statistics for the whole sample as of 2018: all data are in millions of euros, except for the number of employees that is stated in units. For completeness, we also provide summary statistics on Total Equity at the end of 2017, because, as we mentioned above, we consider only firms that have a positive book value of equity, at the end of both 2017 and 2018.

Table 1: Fraction of Value Added and Number of Firms Affected by the Lockdown

This table provides data on the fraction of value added lost, λ_J, for sector j, and the number of firms in sector j, computed from national accounting data, firm sectoral data and Labor Force Survey data (ISTAT), as well as data from the Profession Sample Survey (INAPP). These estimates take into account the fraction of employees in "smart-working" mode in each sector. The fraction of forgone value added in each sector reflects the fraction of non-essential industries in that sector, based on the lists contained in governmental decrees (DPCM of 9, 11 and 22 March, and MISE decree of 25 March 2020).

Sector j	Fraction of Sector's Value Added Affected by Lockdown (λ_j)	No. of Firms in Sector j
Sectors		
Agriculture and Food	5.3	4,829
Business services	2	7,972
Communications	.3	239
Construction*	48.2	6,545
Education	2.2	295
Energy and Gas	0	1,796
Extraction	29.4	342
Health	0	1,158
Manufacturing**	48.7	30,457
Other services	80.6	1,758
Real Estate	5.2	811
Recreation Services	74.2	780
Restaurants and Tourism	62.1	3,086
Transportation	0	4,566
Wholesale Trade	42.1	16,338
*Construction		
General Contractors and Operations	87.6	2,566
Special Trade Contractors	44.5	3,072
Heamy Construction, Except Building Construction	5.2	907
**Manufacturing		
Apparel, Finished Products from Fabrics	69.9	1,070
Chemicals and Allied Products	5.3	1,634
Electronic and Other Electrical Equipment	38.7	1,870
Fabricated Metal Products	78.7	6,640
Furniture and Fixtures	84.5	1,070
Industrial and Commercial Machinery	64.2	5,509
Leather and Leather Products	89.4	546
Lumber and Wood Products, Except Furniture	79.6	896
Measuring, Photographic, Medical and Optical	40.4	699
Miscellaneous Manufacturing Industries	27.5	557
Paper and Allied Products	19.2	1,171
Petroleum Refining and Related Industries	29.4	103
Primary Metal Industries	78.7	1,463
Printing, Publishing and Allied Industries	48.7	979
Rubber and Miscellaneous Plastic Products	45.4	2,571
Stone, Clay, Glass, and Concrete Products	70.1	1,461
Textile Mill Products	68.1	1,291
Transportation Equipment	76.7	927

Table 2: Characteristics of All Firms in 2018

This table provides summary financial information for our sample of 80,972 companies. All average values refer to 2018 balance sheet figures. Total Equity is reported both in 2018 and 2017. Column (1) provides summary statistics for the entire sample of firms. Column (2) provides summary statistics for firms that register equity shortfalls after a 3-month lockdown. Column (3) provides summary statistics for firms in distress (defined as negative book equity) after a 3-month lockdown. The source of our data is Orbis (Bureau Van Dijk) and the equity shortfall estimates are based on our computations. All figures in the table are in millions of euros. Number of employees are in units.

	Firms in 2018	Firms with equity shortfalls after a 3-month lockdown	Firms in distress after a 3-month lockdown
	(1)	(2)	(3)
Total Assets	44.31	29.07	13.75
Total Equity	16.61	9.83	1.44
Total Equity (2017)	15.35	9.44	1.29
Operating revenues	36.52	29.98	25.16
Net Income	1.29	0.36	0.11
Total cost net of employees' costs and tax	29.41	25.60	22.69
Cost of employees	4.97	3.67	2.25
Taxation	0.60	0.35	0.11
Number of Employees	111.32	84.26	58.46
ROE	10.66	6.46	9.11
ROA - EBIT over Total assets (%)	6.25	4.34	3.57
Z-score	6.80	6.30	4.43
Total Equity over TA (%)	32.81	29.68	10.46
Net working capital over Total assets (%)	21.24	19.23	8.31
Cash over TA (%)	10.70	9.03	7.18
Observations	80,972	57,248	13,529

Tables 3, 4 and 5 provide the same summary statistics for the three sub-samples of large, medium-sized and small firms. The tables show that, on average, large, medium and small firms employ 1,544, 128 and 23 employees, respectively. Firms differ also in terms of their accounting ratios. In particular, equity capitalization (defined as Equity over Total Assets) is higher for large firms (38.12%) than for medium-sized and small ones (32.51% and 32.6%, respectively). Their lower capitalization makes small and medium firms potentially more fragile than large ones in the face of adverse shocks to their profitability. The Return on Equity (ROE) is higher in small firms (10.94%) and medium ones (10.22%) than in large firms (8.17%), but the difference narrows considering the Return on Assets (ROA, i.e., Earnings Before Interest and Taxes over Total Assets), which is, on average, 6.27% for small firms and 6.19% for large ones. However, Cash over Total Assets ranges from 10.97% for small firms to 8.91% for large ones, so that the former have a larger liquidity buffer.

Table 3: Characteristics of Large Firms in 2018

This table provides summary financial information for our sample of 3,461 large companies. All average values refer to 2018 balance sheet figures. Total Equity is reported both in 2018 and 2017. Column (1) provides summary statistics for the sample of large firms. Column (2) provides summary statistics for firms that register equity shortfalls after a 3-month lockdown. Column (3) provides summary statistics for firms in distress (defined as negative book equity) after a 3-month lockdown. Large firms are defined as those with more than 250 employees and balance sheet total assets of more than €43 million. The source of our data is Orbis (Bureau Van Dijk) and the equity shortfall estimates are based on our computations. All figures in the table are in millions of euros. Number of employees are in units.

	Firms in 2018 (1)	Firms with equity shortfalls after a 3-month lockdown (2)	Firms in distress after a 3-month lockdown (3)
Total Assets	703.64	496.51	279.18
Total Equity	257.16	172.18	30.41
Total Equity (2017)	244.43	168.16	29.98
Operating revenues	521.56	490.57	566.19
Net Income	19.58	5.30	0.08
Total cost net of employees' costs and tax	418.40	419.90	520.19
Cost of employees	72.08	58.77	44.15
Taxation	9.33	6.61	1.77
Number of Employees	1543.65	1287.72	1068.79
ROE	8.17	1.60	-4.41
ROA - EBIT over Total assets (%)	6.19	4.01	2.42
Z-score	6.75	6.20	4.20
Total Equity over TA (%)	38.12	35.13	14.40
Net working capital over Total assets (%)	17.24	15.03	4.06
Cash over TA (%)	8.91	7.42	5.62
Observations	3,416	1,860	219

Table 4: Characteristics of Medium Firms in 2018

This table provides summary financial information for our sample of 18,837 medium companies. All average values refer to 2018 balance sheet figures. Total Equity is reported both in 2018 and 2017. Column (1) provides summary statistics for the sample of medium firms. Column (2) provides summary statistics for firms that register equity shortfalls after a 3-month lockdown. Column (3) provides summary statistics for firms in distress (defined as negative book equity) after a 3-month lockdown. Medium-sized firms are defined as those with between 50 and 250 employees. The source of our data is Orbis (Bureau Van Dijk) and the equity shortfall estimates are based on our computations. All figures in the table are in millions of euros. Number of employees are in units.

	Firms in 2018 (1)	Firms with equity shortfalls after a 3-month lockdown (2)	Firms in distress after a 3-month lockdown (3)
Total Assets	33.80	31.87	22.60
Total Equity	12.91	10.68	2.40
Total Equity (2017)	11.88	9.88	2.08
Operating revenues	35.65	35.63	40.49
Net Income	1.09	0.45	0.21
Total cost net of employees' costs and tax	28.73	29.93	35.89
Cost of employees	5.34	4.92	4.21
Taxation	0.48	0.33	0.18
Number of Employees	128.30	118.93	117.69
ROE	10.22	5.09	6.74
ROA - EBIT over Total assets (%)	6.22	4.33	3.49
Z-score	6.63	6.17	4.25
Total Equity over TA (%)	32.51	30.12	11.31
Net working capital over Total assets (%)	20.14	17.95	5.39
Cash over TA (%)	10.19	9.00	8.27
Observations	18,837	12,287	2,699

Table 5: Characteristics of Small Firms in 2018

This table provides summary financial information for our sample of 58,719 small companies. All average values refer to 2018 balance sheet figures. Total Equity is reported both in 2018 and 2017. Column (1) provides summary statistics for the sample of small firms. Column (2) provides summary statistics for firms that register equity shortfalls after a 3-month lockdown. Column (3) provides summary statistics for firms in distress (defined as negative book equity) after a 3-month lockdown. Medium-sized firms are defined as those with between 50 and 250 employees. The source of our data is Orbis (Bureau Van Dijk) and the equity shortfall estimates are based on our computations. All figures in the table are in millions of euros. Small firms are defined as those with less than 50 employees and balance sheet total assets of more than €2 million. The source of our data is Orbis (Bureau Van Dijk) and the equity shortfall estimates are based on our computations. All figures in the table are in millions of euros. Number of employees are in units.

	Firms in 2018	Firms with equity shortfalls after a 3-month lockdown	Firms in distress after a 3-month lockdown
	(1)	(2)	(3)
Total Assets	9.33	8.10	6.02
Total Equity	3.80	2.57	0.61
Total Equity (2017)	3.14	2.47	0.50
Operating revenues	8.58	8.49	10.09
Net Income	0.28	0.12	0.08
Total cost net of employees' costs and tax	7.18	7.35	9.07
Cost of employees	0.98	0.93	0.89
Taxation	0.13	0.08	0.06
Number of Employees	22.55	22.44	22.54
ROE	10.94	7.06	10.00
ROA - EBIT over Total assets (%)	6.27	4.35	3.62
Z-score	6.86	6.34	4.48
Total Equity over TA (%)	32.60	29.33	10.16
Net working capital over Total assets (%)	21.82	19.78	9.14
Cash over TA (%)	10.97	9.10	6.93
Observations	58,719	43,101	10,611

Labor costs (Employee Cost) range from 0.98 to 72.08 million on average, and corresponds to an average cost per employee of €46,694 for large firms and €43,555 for small firms. Hence the cost per employee does not differ widely across firm sizes, implying that the public labor cost subsidy per employee during lockdown is quite balanced across firm size sub-samples. However, total costs net of employees' cost and tax, scaled by operating revenues are larger for small firms (about 83%) relative to medium-sized and large firms (slightly above 80%), indicating a higher operating leverage (fraction of fixed costs in total costs) for smaller firms in our sample.

To better assess the creditworthiness of these different firms, we employ the Altman Z-score based on the yearly values of four key financial ratios according to the formula proposed by Altman et al. (2014) for firms for which only the book value of equity (as opposed to the market value) is available. This calculation also allows us to assess to what extent firm solvency deteriorates as a result of the COVID-19 shock. For each firm

i in the sample, we measure the Altman Z-score, according to

$$z_{it} = 3.25 + 6.56 \cdot x_{1it} + 3.26 \cdot x_{2it} + 6.72 \cdot x_{3it} + 1.05 \cdot x_{4it}, \tag{1}$$

where x_{1it} is the ratio of the Working Capital of firm i, at time t, to Total Assets, x_{2t} is the ratio of Capital Reserves to Total Assets, x_{3t} is Earnings Before Interest and Taxes scaled by Total Assets, and x_{4t} is the ratio of the Book Value of Equity to Total Liabilities, each measured in accounting year t. Tables 3, 4 and 5 show that the Z-score is very similar across firm size classes, as it ranges from 6.75 for large firms, to 6.63 for the medium, and 6.86 for the small firms. This indicates that, on average, there is no significant difference in terms of creditworthiness among the three types of firms that we investigate prior to the COVID-19 shock.

Comparing the number of firms and employees in our database with those reported by ISTAT for 2017 (the latest available data), it emerges that our sample under-represents small firms, as it does not include those with less that €2 million of Total Assets. ISTAT reports that firms with more than 9 employees (excluding Agriculture) have 7,808,000 employees, of which 40.5% are in small firms, 24.6% in medium firms, and 35% in large firms. In our sample, the share of employees working in small firms is only 15.3%, while the shares of employees in medium and large firms are 27.0% and 57.7% respectively, as illustrated by Figure 1. The figure also reports the allocation of Total Assets in our sample, which largely mirrors that of employees, i.e., 15.1%, 18.3% and 66.5% for small, medium and large firms respectively.

Figure 2 presents the distribution of Total Assets by sector: Manufacturing is the sector with the largest Total Assets (829 billion), followed by Business Services (618 billion), and both these sectors feature one or more large firms, as shown by Figure 3. A similar pattern emerges in Figures 4 and 5, which report the number of employees per sector and their distribution among small, medium and large firms.

Figure 1: Shares of Total Assets and Employees in Large, Medium-Sized and Small Firms

The figure shows the proportions of large, medium-sized, and small firms in our sample, as defined by European Commission, in terms of total assets and employees. The source of our data is Orbis (Bureau Van Dijk) and the data are for 2018.
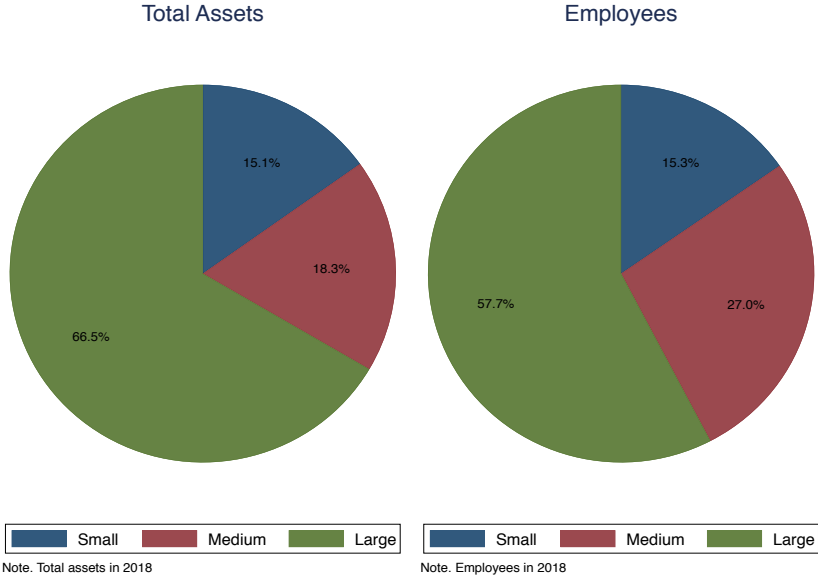

Total Assets
- 15.1%
- 18.3%
- 66.5%

| Small | Medium | Large |

Note. Total assets in 2018

Employees
- 15.3%
- 27.0%
- 57.7%

| Small | Medium | Large |

Note. Employees in 2018

Figure 2: Total Assets by Sector

The figure shows the total assets by sector, in our sample, from national accounting and firm sectoral data as defined by ISTAT. The source of our data is Orbis (Bureau Van Dijk) and the data are for 2018.

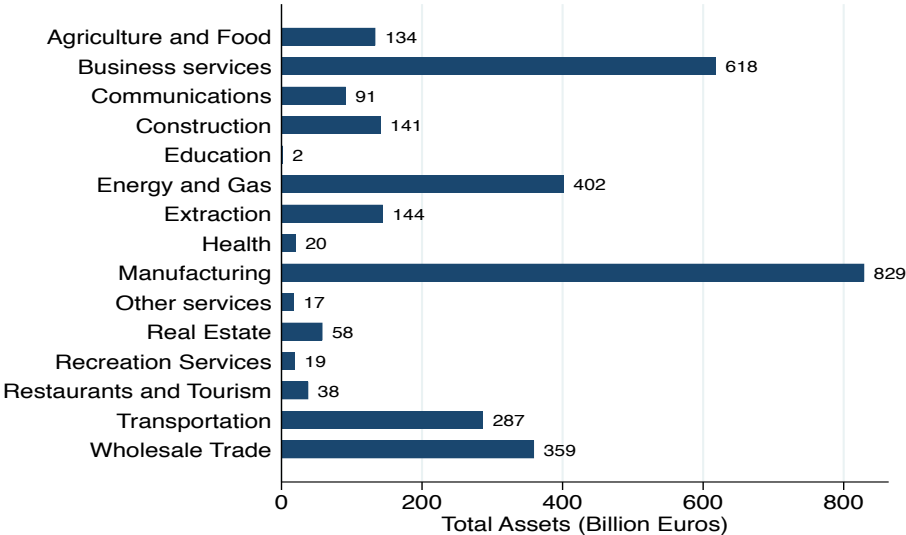| Sector	Total Assets (Billion Euros)
Agriculture and Food	134
Business services	618
Communications	91
Construction	141
Education	2
Energy and Gas	402
Extraction	144
Health	20
Manufacturing	829
Other services	17
Real Estate	58
Recreation Services	19
Restaurants and Tourism	38
Transportation	287
Wholesale Trade	359

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Figure 3: Total Assets by Sector and Firm Size

The figure shows proportions of total assets of large, medium-sized, and small firms in our sample, as defined by European Commission, by sector, in our sample. The sector definitions are from national accounting and firm sectoral data as defined by ISTAT. The source of our data is Orbis (Bureau Van Dijk) and the data are for 2018.
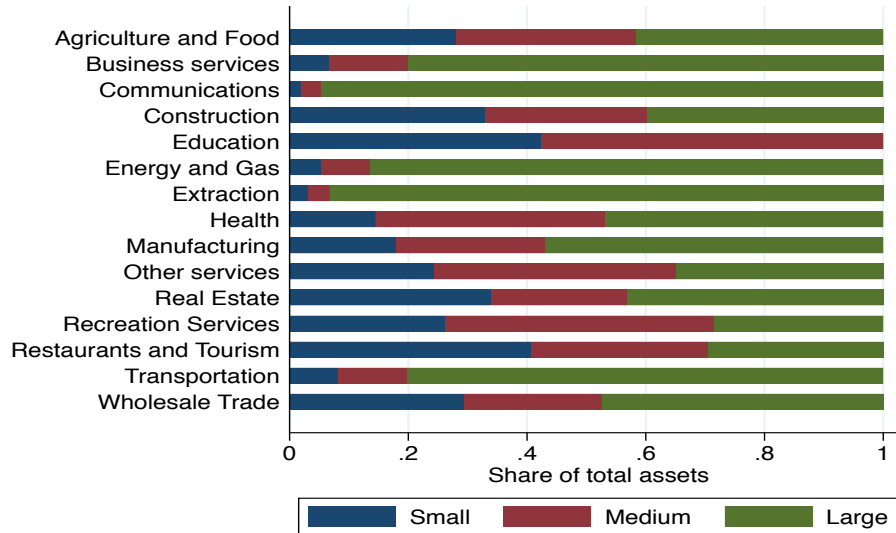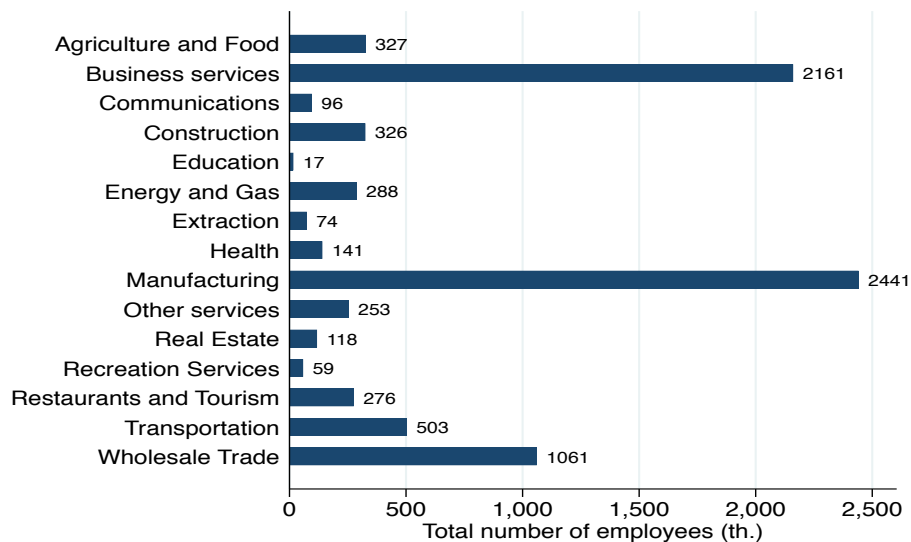

Figure 4: Number of Employees by Sector

The figure shows the number of employees by sector, in our sample, from national accounting and firm sectoral data as defined by ISTAT. The source of our data is Orbis (Bureau Van Dijk) and the data are for 2018.

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Figure 5: Share of Employees by Sector and Firm Size

The figure shows proportions of employees of large, medium-sized, and small firms in our sample, as defined by European Commission, by sector, in our sample. The sector definitions are from national accounting and firm sectoral data as defined by ISTAT. The source of our data is Orbis (Bureau Van Dijk) and the data are for 2018.
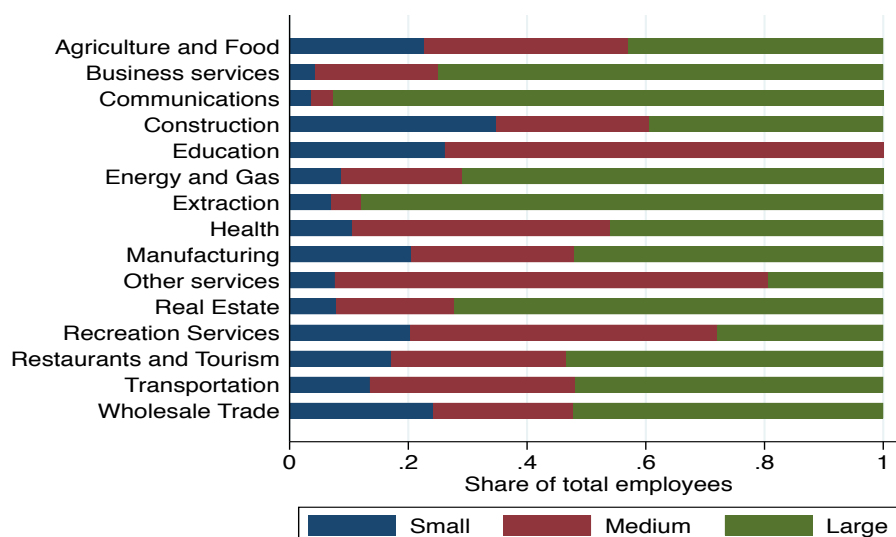
3 Methodology

Based on the above dataset, we estimate the net income losses due to the lockdown for each company in our sample. The key idea is to use 2018 balance sheet data for firms present in the ORBIS database at the end of 2017 and featuring a positive book value, and simulate the impact of the COVID-19 lockdown on their operating revenues, labor and non-labor costs, taxes and profits.[3] This approach has the disadvantage of basing our analysis on the Italian economic conditions in 2018, rather than in 2020, but has several advantages. First, the difference between the economic situation in Italy in 2018, and that at the beginning of 2020 before the COVID-19 shock was rather small due to anemic economic growth. GDP growth was 0.8% in 2018 and 0.3% in 2019, and its 2020 forecast by ISTAT was 0.6%. Therefore, the economic outlook and also the values we observe are roughly similar between 2018 and the projections for 2020. Second, simulating the COVID-19 shock based on actual historical data, rather than forecasts, provides an im-

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[3]Orbis defines Operating Revenues as the sum of Revenues from Goods Sold, Production, Revenues from Sale or Fixed assets and Material Sold, Other Operating Revenues, and Transfer of Operating Revenues.

mediate counterfactual to evaluate the equity injections required to restore Italian firms'
solvency following the COVID-19 shock. This rules out confounding factors due to po-
tential estimation errors that may affect the forecast of balance-sheet variables of firms in
2020, absent the COVID-19 shock. Third, our approach is simple and intuitive: we effec-
tively simulate what would have happened if the 2020 COVID-19 shock had occurred in
an economic situation identical to that of 2018.

We proceed as follows. For firms in sectors unaffected by the lockdown, we consider
the actual profits (or losses) realized in 2018, corresponding to operating revenues y_i
minus labor costs w_i, non-labor costs z_i and taxes τ_i for 2018:

$$\pi_i = y_i - w_i - z_i - \tau_i, \tag{2}$$

In contrast, in sectors affected by the lockdown, both revenues and costs are assumed
to be lower: on the one hand, the operating revenues of firm i in sector j are assumed
to drop by the fraction of the sector j's value-added affected by the lock-down (i.e., the
fraction λ_j shown in Table 1); on the other hand, the labor costs of firms operating in these
sectors are correspondingly reduced, the wages of inactive employees being covered by
the Italian government under its "Cassa Integrazione Guadagni"(CIG) scheme during
the length of the lockdown. We capture this labor cost subsidy to affected companies by
assuming that in sector j, firms save a fraction λ_j of their wage costs w_i. Non-labor costs,
z_i, are considered fixed costs before taxes, which we assume to be independent of the
COVID-19 shock. Taxes τ_i are instead assumed to drop by the same fraction as operating
revenues for the duration of the lockdown. Hence, the yearly profit (or loss) for firm i in
sector j, as a result of the shock, after X months of lockdown, is assumed to be:

$$\hat{\pi}_i(X) = (y_i - w_i - \tau_i)\left(1 - \frac{X}{12}\lambda_j\right) - z_i, \tag{3}$$

where the operating revenues y_i, the cost of employees w_i and taxes τ_i of firm i, are
calculated by re-scaling each firm's revenues and variable costs in 2018 by the fraction of
lockdown months $X/12$, multiplied by sector j's lockdown severity λ_j.

The annual profits of each company are simulated for six hypothetical scenarios fea-
turing different lockdown durations – from 1 to 6 months. For each duration, the an-
nual simulated profits of each firm are the sum of its profits during the lockdown period

and those in the "normal" (i.e., non-lockdown) regime as defined by equation (2), each weighted by their respective fractional duration $X/12$ and $1 - X/12$.[4] Based on the simulated profits obtained as described above, we calculate the year-end equity shortfall for each company in the sample, defined as the difference between its equity at the end of 2017 and its profit shortfall associated with a hypothetical lock-down of X months in 2018. Hence, a firm is assumed to be distressed only if it is estimated to have negative net worth by the end of 2018, not by the end of the assumed lockdown period of X months. This implies that firms affected by the lockdown are assumed to go back to their normal level of revenues (and to lose eligibility for wage subsidies as well as tax reductions) as soon as the lockdown is lifted. Hence, assuming say a three-month lockdown, firms are predicted to have nine months of normal (i.e., no-COVID-19-affected) profits.

Reliance on end-of-2017 book values and on 2018 profit data may lead to overestimating the incidence of distress, as we neglect that profits in 2019 and 2020 may have allowed firms to achieve somewhat higher equity, if not distributed as dividends. Conversely, these assumptions may lead to an underestimate of the incidence of distress insofar as we ignore losses that firms may have experienced in 2019. Sticking to 2018 realized data enables us to avoid making assumptions (or producing predictions) about the dynamics of profit and losses of these firms in 2019 and 2020.

We also calculate the percentage of companies that are forced into distress by the lockdown, i.e. those whose year-end cumulative losses exceeds their entire initial equity, assuming a lockdown of X months. These are firms that, absent a re-capitalisation, are predicted to have year-end negative book value. Of course, these companies need not necessarily go bankrupt if they have access to liquidity in the form of bank loans or bond issuance, for instance as a result of government guarantees or if they can persuade their creditors to restructure their debt liabilities, or if they can raise fresh equity via new share issuance. It should also be noted that all our calculations are based on book values, and to the extent that market values deviate from the book values, it is possible that a firm may have a negative net worth on a book basis, and yet be viable in the eyes of the market (or the opposite).

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[4]This assumes a uniform distribution of profits over the year and, therefore, neglects their seasonality, which may be important in some sectors such as Tourism. Of course, since the definition of the lockdown parameters themselves are estimates, this is not likely to be of any consequence for the first order calculations that we are attempting.

Finally, it is worth highlighting two other possible limitations of our methodology. For simplicity, we assume (i) the lockdown to be lifted simultaneously in all sectors and (ii) the profits of each firm to go back to "normal" as soon as the lockdown is lifted. In practice, the lockdown period may differ somewhat across sectors, being shorter in productive sectors where social distancing is less problematic, such as Manufacturing, and longer in other sectors, such as Retail Trade, Entertainment and Tourism. Moreover, in most sectors, revenues and profits are likely to revert to the pre-lockdown level only gradually, and at different speeds: in sectors such as Tourism they are expected to take much longer to recover than in others, again because social distancing requirements pose greater challenges. On the whole, the fact that the post-lockdown recovery is going to be gradual in most sectors suggests that the 3-month lockdown scenario that we present as our baseline should really be considered as a lower bound: predicted losses, equity shortfall and defaults may well be more accurately approximated by those that we report for a longer lockdown period.

4 Results

The main objective of this paper is to assess the extent to which the lockdown due to the COVID-19 pandemic has eroded the equity of Italian firms by inflicting losses on them. As described above, data availability constraints force us to estimate the changes in firms' equity based on 2018 data, as if the lockdown had occurred in 2018. Figure 6 presents our estimates of the change in profits and the resulting equity shortfall for our entire sample of firms, for alternative scenarios regarding the duration of the lockdown. The green bars show the aggregate lockdown-induced change in profits for the whole sample relative to the no-lockdown case (which coincide with the actual profits and losses realized by these firms in 2018 – the counterfactual for our analysis). The red bars measure the aggregate equity shortfall, i.e., the total losses for the subsample of firms that, according to our simulation ,experience lockdown-induced losses and, thus, a reduction in the book value of equity relative to its initial level (as of the end of 2017). Finally, the blue bars measure the equity shortfall for the subsample of firms that due to the lockdown end up with negative year-end net worth, calculated as the sum of the initial equity (as of the end of 2017) and lockdown-induced negative profits (losses, simulated for 2018).

### Figure 6: Equity and Profit Shortfall: All Firms

The figure shows the annual financial projections for all firms, based on data from Orbis (Bureau Van Dijk). Profit shortfall is defined as the difference between all firms' end-of-the-year profits after X months of lockdown and annual net income in 2018. Equity shortfalls is defined as the sum of all firms' end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined by the sum of all firms' end-of-the-year negative profits (losses) after X months of lockdown and the total equity at the end of 2017. Data source: Orbis (Bureau Van Dijk).
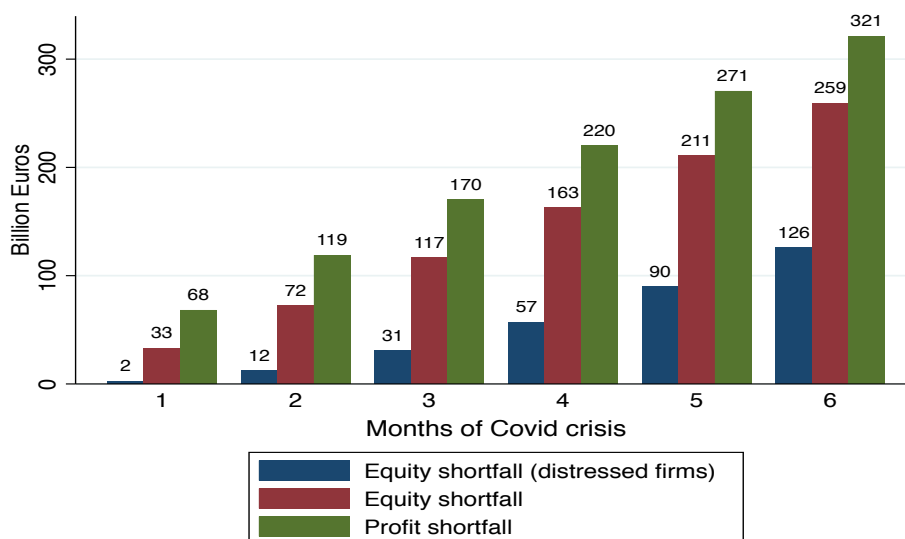
The figure shows that, after a three-month lockdown, the firms in our sample are projected to experience an annual drop in profits of €170 billion. Such a lockdown is sufficient to trigger aggregate losses (equity shortfall) of €117 billion, €86 billion of which arises in firms facing losses but retaining a positive year-end book value, and €31 billion in distressed firms. As shown in Table 2, a 3-month lockdown would erode the equity of 57,248 firms, i.e., 71% of firms in our sample. Moreover, it would force as many as 13,529 firms into distress out of 80,972 (see column 3), implying approximately a 17% default rate in the absence of any debt restructuring or equity injection, as shown also by the upper panel of Figure 7. Since these firms employ 790,905 employees, i.e. about 9% of the 9,013,803 employees in our sample, the employment drop resulting from their bankruptcy and liquidation would be of significant macroeconomic relevance.

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Figure 7: Distress Rate by Lockdown Duration

The figure shows the distress rates for all firms, based on data from Orbis (Bureau Van Dijk). Distress rate is defined for each firm in our sample when the annual losses after X months of lockdown exceed total year-end equity (taken to be equal to its book value at the end of 2017). The upper panel shows the number of firms predicted to be in distress divided by the total number of firms in the sample. The lower panel shows the same ratio for the sub-samples of large, medium-sized and small firms. Data source: Orbis (Bureau Van Dijk).
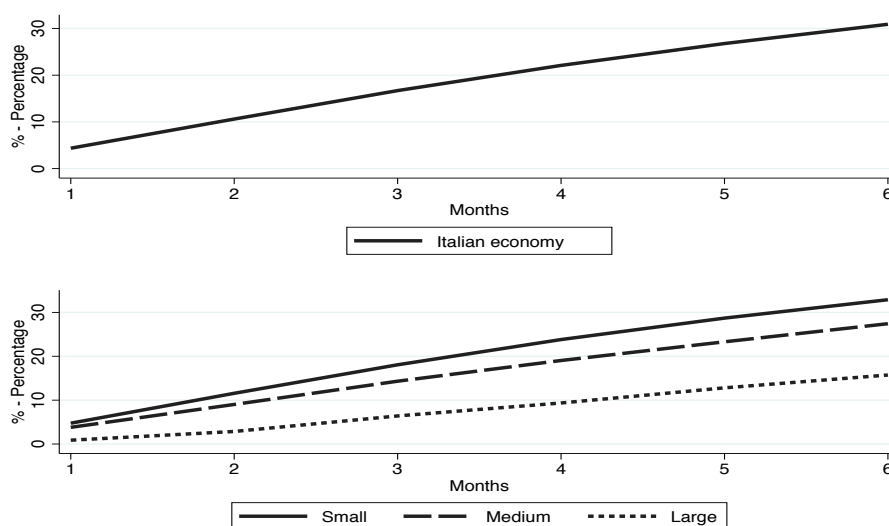
The firms facing an equity shortfall, and especially the subset of those that are also in distress, are mostly of small size, as shown by the second and third columns of Table 2. There is, however, a significant difference between the overall sample of firms facing a reduction in equity and the sub-sample of them ending in distress: the former are mostly well-capitalized firms. Indeed, their average Equity over Total Assets is 29.68% (i.e., Total Assets that are 3.36 times the level of Equity), quite comparable to the 32.81% average for the whole sample.

In contrast, the sub-sample of firms that end up in distress were already highly in-debted even in the absence of the COVID-19 shock, with an Equity-Total Assets ratio of 10.46%. Being highly leveraged to begin with, distressed firms earn an average ROE of 9.11% but an average ROA equal to only 3.57%, i.e., about half the whole sample average. Moreover, also their Cash to Total Assets ratio is about 30% less than the average ratio for the whole sample. Finally, these firms also have a Z-score of 4.43, corresponding to 65% of the average Z-score in the whole sample. Hence, according to our simulation the virus outbreak mostly affected distressed firms that were already significantly less cred-

itworthy, irrespective of their sector and of the severity of the lockdown. This finding implies that an equity injection bringing these firms back to their pre-COVID-19 shock equity level would still leave them with a low Equity-Total Assets ratio relative to other firms, and hence vulnerable to external shocks. [5] Another important observation is that distressed firms are much more labor intensive than other firms: they have far more employees relative to total assets, and a cost structure where labor costs weigh relatively more in total costs (net of employees' costs). As these are highly labor intensive firms, their demise would imply erosion of economic value and massive redundancies.

Figure 6 also shows that a six-month lockdown would entail a €321 billion drop in aggregate yearly profits, a €259 billion equity shortfall for the whole sample, and a €126 equity shortfall for distressed firms. As shown by the upper panel of Figure 7, a six-month lockdown would force about 33% of firms into financial distress (i.e., more than 26,000 companies in our sample). While such a long lockdown period may be considered unrealistic, a full immediate recovery of economic activity after *three months* (as is assumed in our 3-month lock-down scenario) is also quite unrealistic. As underscored for example by Philip Lane, the ECB's chief economist, "it is likely to take at least *three years* for the Eurozone economy to fully recover from the extraordinary and severe shock of the coronavirus crisis" (emphasis added).[6] In line with this possibility, one could also interpret a longer period of lock-down as capturing a more prolonged period of stress in terms of weaker demand, and thus lower revenues. Note, however, that once the lockdown is lifted, firms may no longer benefit from the same advantages as during the crisis, in terms of reduced workers' payments or lower taxes. From this perspective, the losses produced by our simulations for a six-month lockdown may be underestimated, in particular for highly labor-intensive firms.

Recall that the distress rates shown in Figure 7 are *exclusively* due to the lockdown associated with the COVID-19 shock; absent this shock, no firm would be distressed according to the construction of our sample, which only includes firms with positive book equity. Thus, the results indicate, on the one hand, the presence of a significant

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[5]This finding is not unique to Italian firms: the average U.S. firm going into distress after the COVID-19 outbreak already had a junk bond rating (B+) before the outbreak, to be compared with an A rating for the average firm, while those that only experienced only some equity erosion have an A rating. These figures are based on 94 Chapter 11 bankruptcy filings, 2010-2013. Sources: Compustat, Company Filings and S&P. We thank E.Altman for providing us these data.

[6]"Eurozone recovery to take three years, warns ECB's chief economist", Financial Times, 1 May 2020.

fraction of firms that were fragile even before the COVID-19 shock. On the other hand, the COVID-19 shock would have an increasing impact on firms' equity if the lockdown were protracted for several months. In fact, as shown by Figure 6, the equity short-fall grows non-linearly in lockdown duration, especially for distressed companies, even though profits decrease linearly by construction, given our assumption that the impact of the lockdown on profits is uniformly distributed across months. This is especially pro-nounced for distressed companies: after four months, the predicted equity shortfall for distressed companies is 84 % larger than that required after three months, but it becomes 190 % larger after five months, and 306% larger after six. This is entirely due to the op-tionality of the equity contract as a consequence of the limited-liability option enjoyed by shareholders.

The equity erosion due to the lockdown can also be gauged by its predicted impact on the leverage distribution of Italian firms. Figure 8 shows the distribution of leverage of all the firms in our sample, at the end of 2018, based on our simulations for a 3-month and a 6-month lockdown scenarios. In the baseline no-shock scenario, based on actual 2018 data, all firms have positive equity (by construction), so that leverage (calculated as Equity over Total assets) ranges from almost zero to 100%, with the median firm featur-ing a 29% leverage, and firms at the 25th and the 75th featuring 15% and 48%, respectively. In the 3-month lockdown scenario, a significant fraction of firms enters into distress, as shown also by Figure 6. Median leverage drops to 20% and for firms at the 25th and at 75th percentile leverage becomes 4.6% and 40%, respectively. In 6-month lockdown scenario, more than 25% of firms would be in distress, the median firm would become highly indebted with a leverage ratio of 11%, and 75% of firms have a leverage below 27%. Therefore, Figure 8 underscores that there may be a greater fragility of the capi-tal structure of Italian firms following the COVID-19 shock, if public support is given entirely in the form of debt financing or loan guarantees.

The impact of the lockdown is not the same for large, medium and small firms, as illustrated by the lower panel of Figure 7. Small firms appear to be the most fragile, given that in all the lockdown scenarios considered, their distress rate exceeds that for other firms, ranging from 4.7% for a one month lockdown to 33% for six months. The second most affected firms are medium ones, with a distress rate between 3.8% and 27%, while the least affected are large firms, with a distress rate ranging from 0.9% to 15.7%.

Figure 8: Firms leverage distribution

The figure shows the leverage distribution without the COVID-19 shock, in the 3-months lockdown scenario and in the 6-months lockdown scenario. Leverage is defined as Equity over Total asset ratio. Extreme values have been trimmed. Data source: Orbis (Bureau Van Dijk).
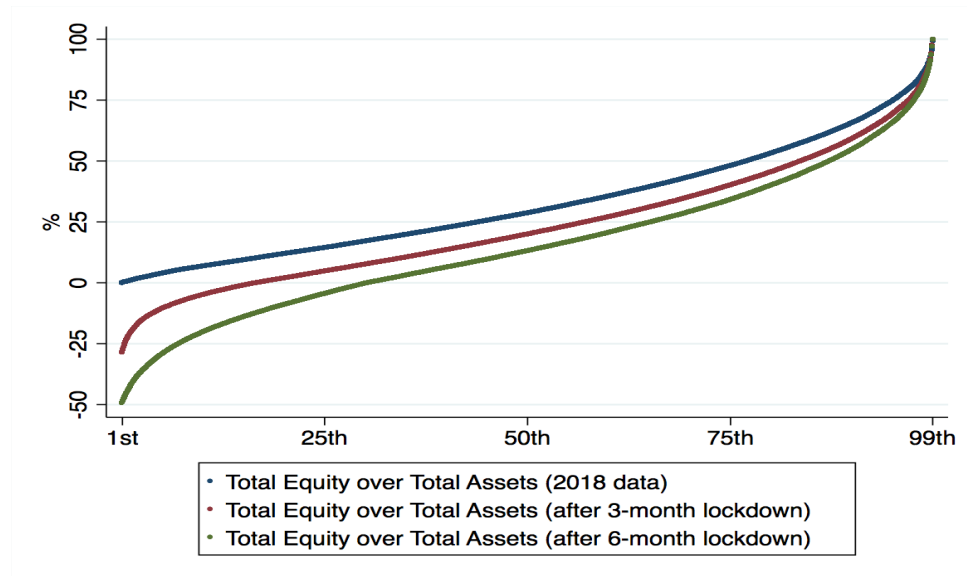
Firm size is not only associated with widely different lockdown-induced default rates, but also with different equity shortfalls, as illustrated by Figures 9, 10 and 11, which respectively refer to large, medium and small firms. Clearly, large companies fare better than medium and small companies, being initially better capitalized. The amount required to recapitalize large distressed companies after a 3-month lockdown is €10 billion, against €10 billion required for medium firms, and €11 billion for small companies, even though the latter two size classes account for a considerably smaller fraction of total assets and employees than large companies, as seen above. This large difference in the equity shortfall across firm size categories partly reflects the fact that the fraction of companies predicted to become distressed (i.e., have negative net worth) in response to the lockdown is larger for small and medium enterprises (SMEs) than for large companies, as shown by the lower panel of Figure 7. In particular, after a three-month lockdown, the default rate is 6.4% for large firms, while it equals 14.3% for medium firms and 18.1% for small firms; after a 6-month lockdown, it is predicted to triple for large firms, and approximately double for SMEs.

Figure 9: Equity and Profit Shortfall: Large Firms

The figure shows the annual financial projections for large firms, defined as those with more than 250 employees and balance sheet total of more than €43 million. Profit shortfall is defined as the difference between end-of-the-year profits after X months of lockdown and annual net income in 2018. Equity shortfall is defined as the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined as the sum of the firms' negative profits (losses) after X months of lockdown and their initial equity (as of the end of 2017). Data source: Orbis (Bureau Van Dijk).
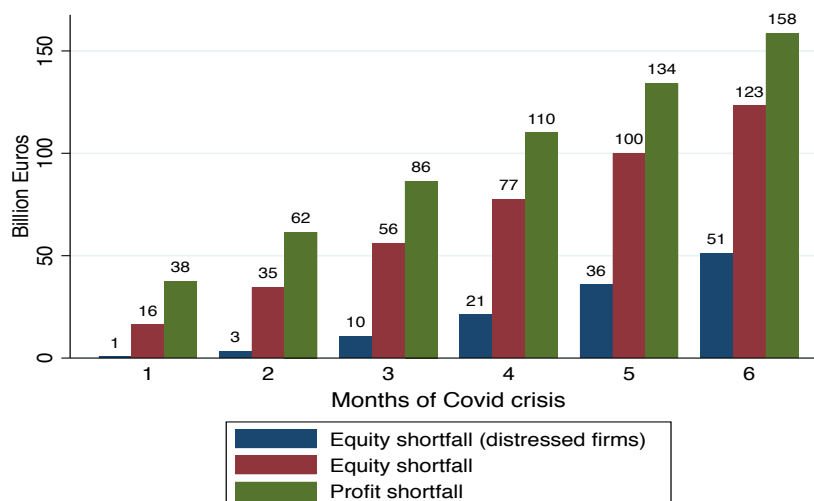

Figure 10: Equity and Profit Shortfall: Medium-Sized Firms

The figure shows the annual financial projections for medium-sized firms, defined as those with between 50 and 250 employees. Profit shortfall is defined as the difference between end-of-the-year profits after X months of lockdown and annual net income in 2018. Equity shortfall is defined as the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall is defined as the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined as the sum of the firms' negative profits (losses) after X months of lockdown and their initial equity (as of the end of 2017). Data source: Orbis (Bureau Van Dijk).
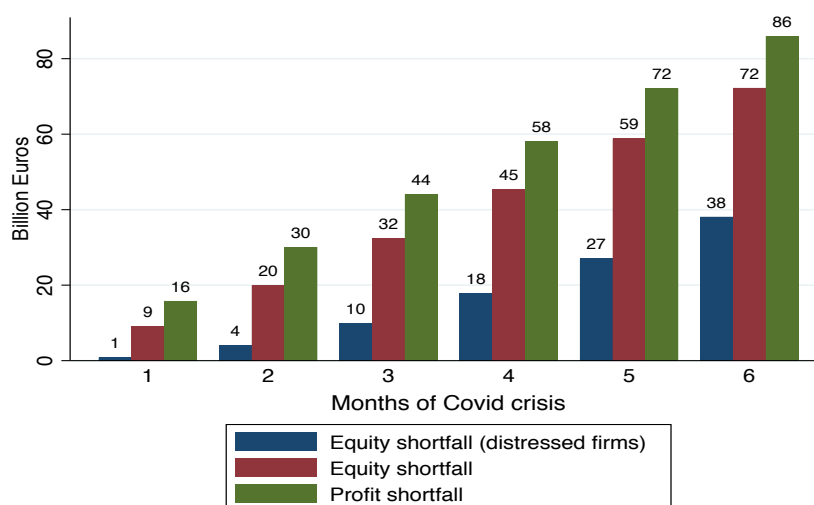
Figure 11: Equity and Profit Shortfall: Small Firms

The figure shows the annual financial projections for small firms, defined as those with less than 50 employees and balance sheet total of more than €2 million. Profit shortfall is defined as the difference between end-of-the-year profits after X months of lockdown and annual net income in 2018. Equity shortfall is defined by the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall is defined as the sum of all firms' end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined as the sum of the firms' negative profits (losses) after X months of lockdown and their initial equity (as of the end of 2017). Data source: Orbis (Bureau Van Dijk).
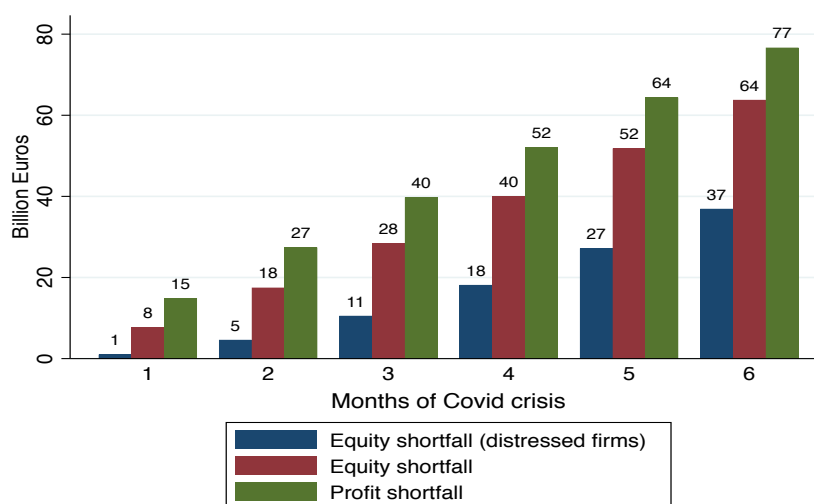

The characteristics of the firms predicted to enter distress after a three-month lockdown can be inferred from Column 3 of Tables 3, 4 and 5: these firms are much smaller than the others, less profitable, far less capitalized, and closer to insolvency than other firms, even within their respective size class and even relative to all firms projected to make losses (Column 2). In terms of Z-scores, instead, there are no significant differences between firms that suffer an equity shortfall and those that end up in distress. As for the employment consequences of the lockdown, of the 790,905 employees employed by firms that would be in distress, 29% belong to large firms, 40% to medium size firms, and 31% to small firms, suggesting a very different distribution relative to the whole sample shown in Figure 1.

The subsequent figures break down the drop in profits and the equity shortfall by sector and geographical region. Figure 12 shows that the profit drop is concentrated in Manufacturing, Wholesale Trading, and, to a far smaller extent, Construction and Business Services. Importantly, these sectors also happen to be the top four sectors by number of employees.

Figure 12: Profit and Equity Shortfall by Sector with a 3-Month Lockdown

The figure shows the annual projections for equity and profit shortfalls by sector. The sector definitions are from national accounting and firm sectoral data as defined by ISTAT. Profit shortfall is defined as the difference between end-of-the-year profits after X months of lockdown and annual net income in 2018. Equity shortfalls is defined by the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall is defined as the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined as the sum of firms' negative profits (losses) after X months of lockdown and their initial equity (as of the end of 2017). Data source: Orbis (Bureau Van Dijk).
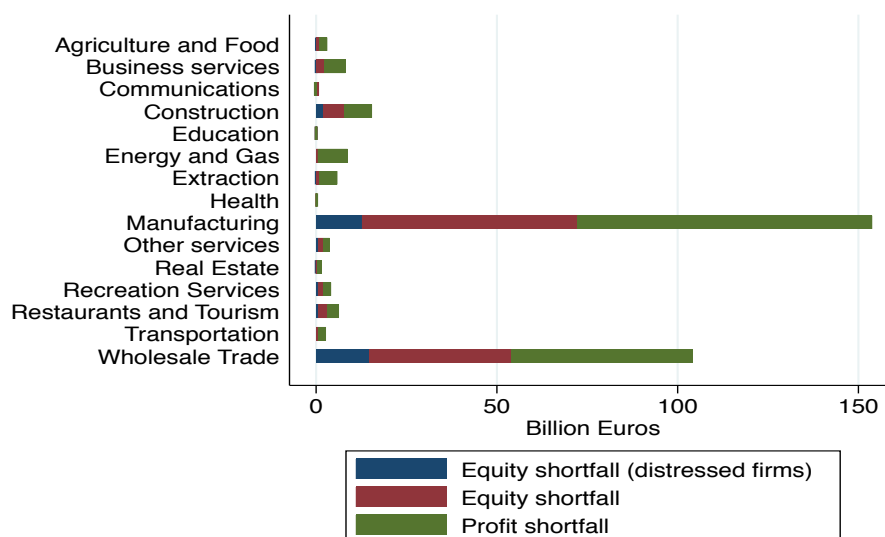

Surprisingly, the drop in profits and the equity shortfall in the Recreation Services and Tourism sectors are comparatively small. This is probably because these are labor-intensive sectors with low fixed costs and hence, though severely hit by the lockdown, most of their labor costs during the lockdown are covered by the wage subsidy paid to inactive workers. However, going forward, these sectors may be more affected by social distancing than others and thus be subject to an longer effective lockdown than others. This may outweigh the less severe impact on their profits early in the lockdown months. Moreover, as stressed above, even if the lockdown is severe for the Recreation Services and Restaurant and Tourism sectors (respectively, 74.2% and 62.1%), relatively few firms in our sample belong to these sectors (4.8%), probably due to the prevalence of micro-firms (namely, those with less than 10 employees), which are not included in our sample.

Figure 13 shows that, within Manufacturing, the sub-sectors that suffer the largest drop in profits are Fabricated Metal Products, Industrial and Commercial Machinery and Computer Equipment, and Transportation Equipment. These sub-sectors are also those with the largest equity shortfalls and funding need to revive their distressed firms.

Figure 13: Profit Shortfall by Manufacturing sub-sectors with a 3-Month Lockdown

The figure shows the annual projections for equity and profit shortfalls by sub-sectors of the manufacturing sector. The sector and sub-sector definitions are from national accounting and firm sectoral data as defined by ISTAT. Profit shortfall is defined as the difference between all firms' end-of-the-year profits after 3 months of lockdown and annual net income in 2018. Equity shortfalls is defined by the sum of end-of-the-year negative profits (losses) after 3 months of lockdown. Equity shortfall is defined as the sum of end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined as the sum of firms' negative profits (losses) after X months of lockdown and their initial equity (as of the end of 2017). Data source: Orbis (Bureau Van Dijk).
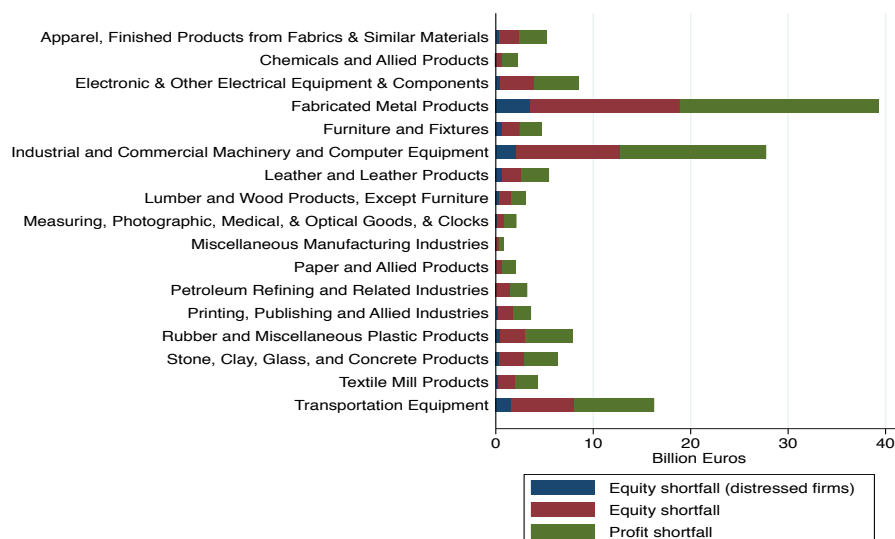
Finally, Figure 14 shows that most of the profit and equity shortfalls refer to firms located in Northern Italy, in contrast to firms in the South being the lowest. This reflects the geographic distribution of economic activity within the country, rather than the impact of the COVID-19 shock itself, since we model the impact of the lockdown as geographically homogeneous, as it has actually been at least until early May 2020 (the time of this writing). However, the effects of social distancing policies may persist much longer for economic activity in Southern (and to some extent Central) regions, where Tourism and Retail Trade are proportionately more important than Manufacturing and Business Services, and are likely to revert to the pre-crisis activity level much more slowly. Hence, the persistence of the COVID-19 shock may eventually turn out to be greater in the South, and to some extent in the Center, than in the North of the country relative to the current forecast. Our estimates fail to account for this, being predicated on the assumptions that the lockdown will be lifted simultaneously in all sectors and geographical areas, and that economic activity will immediately revert to pre-crisis levels in all of them.

Figure 14: Profit Shortfall by Geographic Area with a 3-Month Lockdown

The figure shows the annual projections for equity and profit shortfalls by geographic area. The geographic area definitions are from national accounting and firm sectoral data as defined by ISTAT. Profit shortfall is defined as the difference between all firms' end-of-the-year profits after 3 months of lockdown and annual net income in 2018. Equity shortfalls is defined by the sum of all firms' end-of-the-year negative profits (losses) after 3 months of lockdown. Equity shortfall is defined as the sum of all firms' end-of-the-year negative profits (losses) after X months of lockdown. Equity shortfall (distressed firms) is defined as the sum of the firms' negative profits (losses) after X months of lockdown and their initial equity (as of the end of 2017), i.e., those firms that end up with negative equity value in 2018, due to the lockdown. Data source: Orbis (Bureau Van Dijk).
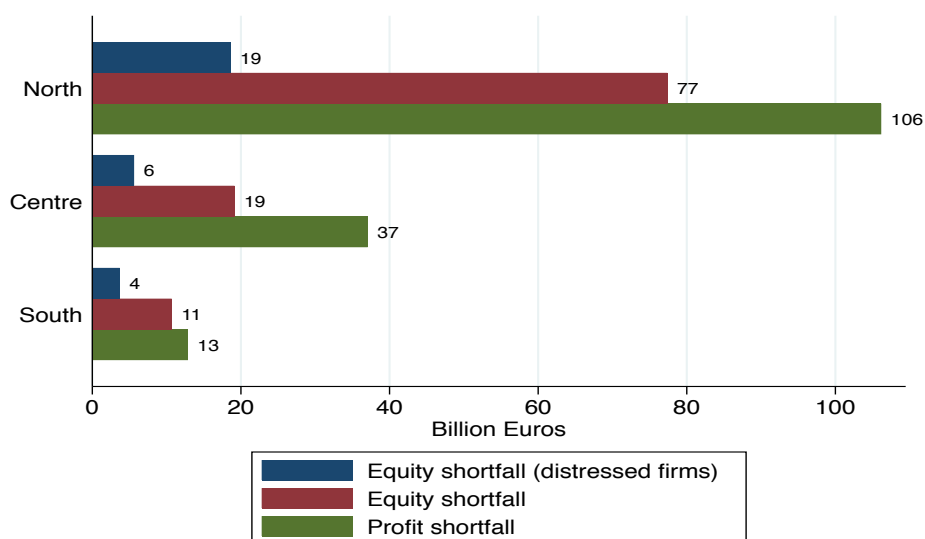
As mentioned above, our simulations also ignore spillover effects among sectors, and the effects of the COVID-19 shock on the demand side, that is, the substantial impact that it is likely to have on consumption, investment and exports.

5 Conclusions

The evidence in this paper shows that the losses inflicted by the COVID-19 shock on Italian firms are likely to produce a sizeable erosion of their equity, to the point that, absent any recapitalization or debt restructuring, 17% of the firms in our representative sample of Italian industry would end up with negative 2020 year-end net worth after a three-month lockdown, based on 2018 data. Importantly, this number represents the distress rate exclusively due to COVID-19. From this perspective, our analysis suggests substantial effects of the virus outbreak in terms of widespread bankruptcies and layoffs and,

consequently, potential long-term damage to the economic fabric of the country. Public liquidity provisions via debt financing, currently encouraged by the loan guarantees provided by the Italian government, will simply not do: providing more debt to already highly indebted firms is throwing good money after bad, as it will temporarily keep them alive without restoring their solvency.

Addressing the plight of these companies calls for a robust equity injection. To some extent, the most promising of these firms, especially the larger ones, might be able to raise new equity funding on the capital market, and/or bargain with their creditors so as to restructure their debt obligations, and thus rebalance their capital structure, and start to invest again, once the crisis abates. For many others, as underscored by Somerset Webb's and Martin Wolf's quotes at the start of this paper, the government could step in, providing much-needed equity rather than debt finance, as it is currently doing. However, this public intervention raises several additional questions. First, which firms should the government target with its equity injections? Second, how much equity should it provide to each sector, and each firm? Third, what specific contractual form should the equity funding take (voting common equity, non-voting common equity, hybrid instruments such as convertible debt, debt with warrants attached, etc.,)? Fourth, should this equity participation have a predefined time span, and what exit strategies should be envisaged for the government as a shareholder?

The evidence presented in this brief study does not address any of these all-important policy questions, but does hint at a dilemma that the government is likely to face in answering the first two questions in the context of Italy–and possibly also in other countries. The objective of supporting employment begs for equity injections being directed mainly at the companies in distress, not only because these are at the highest risk of ending up in bankruptcy but also because they are the most labor-intensive, so that their liquidation would lead to a greater impact on employment, and the social fabric, generally. However, our data indicate that these are also the firms that already had, by far, the most fragile balance sheets even prior to, and in the absence of, the COVID-19 crisis. Hence, on the one hand, returning them to the equity levels prior to the crisis would not necessarily restore them to good health: such an equity injection risks leaving them still vulnerable to external shocks. On the other hand, providing them with a more generous equity injection would clearly require escalating the funding well beyond the sums implied by our

projections. One would then have to ask whether such large sums would not be better invested in firms that hold greater promise of growth, profitability, and job creation, even if they may have borne significant losses during the current crisis.

While our analysis presents broad-brush evidence of the impact of the crisis at the levels of sector, firm size, and geographical region, concrete policy interventions would call for a more granular analysis, drilling down to the sub-sector, provincial, or at least regional levels, hence requiring more detailed data. They would also call for more up-to-date firm-level data, at least referring to 2019. Of equal importance, they would require detailed modelling and measurement of supply-chain effects across sectors and demand-side feedback effects. Given how important the resolution of the crisis is for the Italian corporate sector, and indeed the Italian economy, such an effort would be worthwhile.

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