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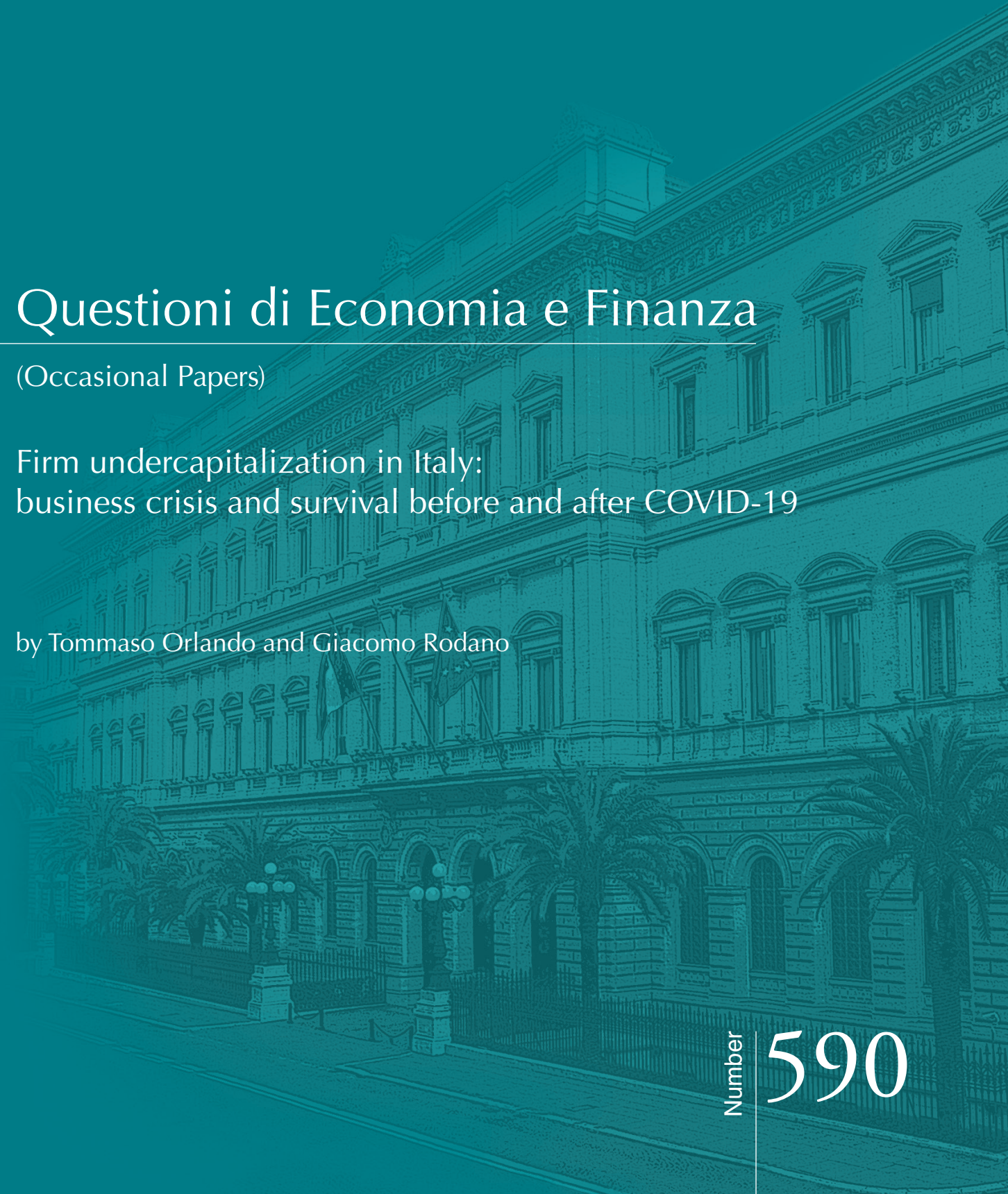

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FIRM UNDERCAPITALIZATION IN ITALY: BUSINESS CRISIS AND SURVIVAL BEFORE AND AFTER COVID-19

by Tommaso Orlando* and Giacomo Rodano*

Abstract

In a context characterized by upcoming regulatory changes and deeply affected by the COVID-19 epidemic, this paper examines the diffusion of firm undercapitalization (i.e., the firm displaying a level of equity below the legal limit) among Italian corporations. In a proposal by the National Board of Accountants, business crisis is substantially identified with undercapitalization. Indeed, our analyses show that the onset of undercapitalization often anticipates business termination: around 60 percent of involved firms go out of business within 3 years. In 2010-18, on average around 8.5 percent of Italian companies were undercapitalized. The impact of the COVID-19 epidemic may be substantial: our predictions indicate that the share of undercapitalized firms at the end of 2020 may exceed 12 percent. This estimate incorporates the powerful mitigating effects of several interventions enacted by the Italian government between March and August 2020 to support firms damaged by the pandemic. The increase in undercapitalization may reverberate onto the functioning of the new 'early warning' system, which will become operational in September 2021: our predictions suggest that the number of firms that could be involved in early warning procedures may be almost twice as large as that foreseeable on the basis of accounting data from 2018.

JEL Classification G32, G33, K29.
Keywords: firm undercapitalization, equity deficit, early warning, impact of COVID-19 on Italian corporations.
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Contents

* Bank of Italy, DG for Economics, Statistics and Research.

1. Introduction[1]

The new Italian regulatory framework for insolvency and bankruptcy, embodied by the Business crisis and Insolvency Code (Legislative Decree no. 14/2019), will enter into force in September 2021. Among several innovations, the Code introduces a formal distinction between corporate insolvency and corporate crisis (Art. 2). A firm is *insolvent* when it can no longer fulfil its obligations towards its creditors. A *state of crisis* emerges, on the other hand, once a situation of distress makes the firm unlikely to be able to repay its short-term debt (and thus likely to become insolvent).

The Code also introduces an 'early warning' system designed to facilitate the swift identification of business crises and the prompt adoption of measures to address them. This system will mostly involve companies that are required by law to have a supervisory body, whose number has been extended by the Code itself (see Section 2). In this context, the Code entrusted an expert panel of accountants (the National Board of Accountants and Auditors) with the task of defining quantitative indicators to provide an objective identification of the state of crisis. The Board's proposal[2] identifies the state of crisis by the hierarchical application of several criteria based on accounting variables.

We document (see Section 2.1) that the quantitatively predominant criterion for the identification of states of crisis is equity lying below the minimum amount indicated by the law (*undercapitalization*). Other criteria down along the hierarchy are quantitatively marginal enough that we can identify firm crisis with undercapitalization alone. While this identification of the state of crisis with undercapitalization was devised specifically for firms subject to the early warning system, in our analyses we extend it to all corporations. Indeed, our results indicate that undercapitalization is in fact a good predictor of negative outcomes in terms of firm survival (see Section 4).

In this paper, we first describe the number and characteristics of undercapitalized firms observed in recent years, in the universe of Italian non-financial corporations (consisting of around 662,000 firms in 2018).[3] For the same sample, we also assess to what extent insufficient equity anticipates the actual occurrence of negative survival outcomes, such as the firm going out of business or being liquidated through a bankruptcy procedure. Then, we evaluate the effects of the COVID-19 events, and of the counteracting policy measures enacted by the Italian government, on the diffusion of undercapitalization among Italian corporations in 2020. Restricting the sample to companies mandated by the law to establish a supervisory body (around 117,000 in 2018), the estimated number of undercapitalized businesses provides an estimate of the magnitude of inflow of firms into early warning procedures, when these are activated in 2021.

Undercapitalization is a rather common occurrence among Italian firms: on average, in each year between 2010 and 2018, 8.5% of all Italian corporations reported equity below the legal threshold. Even though the Italian Civil Code prescribes that equity deficiency, unless promptly resolved, lead to the dissolution of the company, we observe persistent undercapitalization in a significant number of cases. Over one third of firms that become undercapitalized and are still active 3 years after the state of crisis first emerges keep displaying insufficient equity.

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[1] The opinions expressed in this paper are the authors' only and do not necessarily represent those of the Bank of Italy. The analyses on the impact of the COVID-19 epidemics in Sections 5 and 6 are based on a methodology developed in the context of several internal and circulated notes of the Bank of Italy. Special thanks go to all who directly participated to the preparation of these notes: Antonio De Socio, Paolo Finaldi Russo, Simone Narizzano, Fabio Parlapiano, Sabrina Pastorelli, Enrico Sette, Massimiliano Stacchini, Valerio Vacca, Gianluca Viggiano. We also wish to thank Fabrizio Balassone, Marcello Bofondi, Andrea Brandolini, Alessio De Vincenzo, Federico Fornasari, Silvia Giacomelli, Giorgio Gobbi for their comments and suggestions, and Cristina Petrassi for her editorial assistance.

[2] The Board's proposal was made public on October 20, 2019, and is currently awaiting approval by the Ministry of Economic Development. See CNDCEC (2019), "Crisi d'impresa: gli indici di allerta".

[3] In this paper we use the terms 'corporation' and '(limited) company' as synonyms, to indicate businesses known in Italy as *società di capitali*. There mainly include limited liability companies (*società a responsabilità limitata*) and joint-stock companies (*società per azioni*).

Undercapitalization means that the firm would not at present be able to cover all debt even by selling all assets. Insufficient equity does not necessarily imply that the firm is entering a state of insolvency: long-term debt need not be repaid immediately, and over time asset value might be restored to a level sufficient to cover debts. However, continuation of business operations may become unlikely if profitability is not restored and most assets have to be sold in order to fulfill obligations towards creditors. Indeed, about 13% of firms that enter a state of crisis in a given year end up in a formal bankruptcy procedure within 3 years, and almost 50% have either gone out of business with no need for a bankruptcy procedure or are *de facto* inactive.

The economic consequences of the COVID-19 pandemic include a potentially significant rise in the number of firms that meet our definition of state of crisis. Projecting the shock to firm revenues in 2020 based on high-frequency information disaggregated at sectoral level (NACE 2-digit), we estimate that around 82,000 firms may be in a state of crisis at the end of 2020 (over 12% of all operating companies, with a 70% increase over the undercapitalization rate in 2018). This estimate takes into account the main measures adopted by the Italian government to support firms, which are expected to greatly dampen the surge of undercapitalization with respect to a counterfactual scenario without government intervention. Based on actual employment in 2018, around 810,000 workers may be involved in these crises.

These estimates are obtained via a projection of not yet observed revenues growth rates based on the most optimistic value added growth scenario provided the Bank of Italy (estimates obtained using a less optimistic scenario are reported in Table B.4 in Appendix B). Moreover, these numbers refer to one of two methodologies adopted to forecast the levels of equity at the end of 2020 (see Appendix A). The estimates yielded by the alternative methodology (see Table B.3 in Appendix B) are slightly more optimistic in terms of predicted shares of undercapitalized firms, although both methods highlight similar dynamics (also across regions and sectors).[4]

In order to analyse the workload that may concern the new early warning system, we repeat the previous analysis on the subsample of firms that will be obliged to have a supervisory body when the Code becomes operational on September 2021. Because of the COVID-19 shock and taking into account policy interventions enacted by the government, undercapitalization may involve around 13,000 (around 11%) of these firms, employing around 340,000 workers. This is likely to impact on the functioning of the early warning system, which was originally designed to deal with a far smaller number of companies: in the years 2010-18, an average 9,300 firms (almost 8% of those subject to the system) would have faced an early warning procedure in the system's first year of operations, and around 3,700 per year would have entered a procedure had the system been up and running.

Throughout the paper, we highlight heterogeneities among geographical areas and sectors of economic activity. The share of undercapitalized firms is structurally larger in Central and Southern Italy (8%, versus 6.6% in the North West and 6.2% in the North East), and in sectors related to tourism and leisure (almost 16% in accommodation and food services, almost 12% in arts and entertainment), while it is particularly small in manufacturing, utilities and constructions (around 5%). The COVID-19 pandemic had a particularly hard impact on sectors where undercapitalization was already more frequent: even taking into account the policies enacted by the government, the share of undercapitalized firm in 2020 may reach 42% in accommodation and food services, and 21% in arts and entertainment. Due to sectoral composition and structural firm characteristics, the increase in undercapitalization will be more intense in Central regions, where it is expected to reach almost 14%.

The rest of the paper is structured as follows. Section 2 describes the main characteristics of the regulatory framework, highlighting the innovations brought on by the new Business crisis and Insolvency Code. Section 3 reports the number and characteristics of firms involved in a state of crisis in the period 2010-18, for the universe of Italian corporations. Section 4 contains analyses on the

[4] This methodology is shared with De Socio, A., Narizzano, S., Orlando, T., Parlapiano, F., Rodano, G., Sette, E., and Viggiano, G., "Gli effetti della pandemia sul fabbisogno di liquidità, sul bilancio e sulla rischiosità delle imprese", *Bank of Italy Covid-19 note*, 13 November 2020. See Section 5 and Appendix A for details.

relationship between firm crisis and firm survival outcomes such as the firm ceasing operations or going bankrupt; we also investigate the persistence of states of crisis. Section 5 presents prospective estimates of the effects of the COVID-19 pandemic on the diffusion of undercapitalization in Italy. Section 6 restricts the analysis to firms that are obliged to have a supervisory body, and therefore potentially subject to the early warning system, describing the estimated increase in their number after COVID-19. Section 7 contains concluding remarks.

2. Institutional framework

2.1. Business crises and early warning procedures

A new Business crisis and Insolvency Code was approved in Italy in early 2019. The Code is going to replace the current Italian bankruptcy law. The majority of its provisions were due to enter into force in August 2020. However, the COVID-19 emergency prompted the government to shift to September 2021 the entry into force of the whole Code, except for a restricted set of non-bankruptcy norms already implemented since March 2019. These delays do not reduce the importance of the Code in the current debate, for two reasons.

First, the Code provides new formal definitions of concepts and terms already used, albeit informally, in the realm of distress management and firm liquidation. In particular, the *state of crisis* of a debtor is defined as "a situation of economic and/or financial imbalance which makes debtor insolvency likely" and that, "when the debtor is a firm, manifests itself as inadequacy of predictable cash flows to cover regular financial obligations". Thus, a state of crisis may precede insolvency itself, which arises when there are tangible signs that the firm is no longer able to fulfil its obligations.

The above definition of the state of crisis applies to all debtors. However, for firms (and in particular for companies) an objective quantitative identification of the state of crisis is made necessary in the context of the 'early warning' system, that also constitutes one of the main innovations of the Code with respect to the pre-existing bankruptcy framework. The early warning system is designed as a set of tools aimed at detecting firm distress and directing the debtor to a number of possible ways to resolve it.[5] In this way, the crisis may be addressed before the firm's value is too compromised to either allow for improved chances of business continuation or better satisfy creditors' claims if the firm is eventually liquidated.

Companies may enter the early warning system in three ways: voluntarily, upon being reported by an institutional creditor (the National Institute for Social Security, the Revenue Agency, or a tax collection agency) or by their own supervisory bodies. In what follows, we will restrict our attention to early warning procedures activated by supervisory bodies. Supervisory bodies may include a supervisory board and/or statutory accounting auditors. Not all companies are required to have such bodies. The obligation extends to all joint-stock companies (*società per azioni*), but limited liability companies (*società a responsabilità limitata*) must establish a supervisory body only if they exceed certain size thresholds.[6] Therefore we can identify the set of firms that are potentially subject to early warning procedures *activated by the supervisory body* from firm's legal status and size. In 2018, about 117,000 corporations (approximately 18% of all operating companies) would have been potentially subject to these early warning procedures, had this system been in place.

[5] The system excludes specific categories of businesses, presumed to have internal control mechanisms guaranteeing a prompt reaction to distress situations. These include large companies, large business groups, and companies with listed shares or with a broad shareholder base. A firm is a 'large company' if it exceeds at least two of the three following thresholds: i) total assets: €20mln; ii) net sale and service 'revenues: €40mln; iii) employees: 250.

[6] Recent regulatory interventions (initially the Code itself, then modified by Decree Law No. 32/2019, so-called '*Sblocca Cantieri*') have widened the set of limited liability companies that are subject to this obligation. It now applies to all firms exceeding for two consecutive years at least one of the following thresholds: i) total assets: €4mln; ii) sale and service revenues: €4mln; iii) employees: 20.

Signaling by the supervisory bodies should automatically take place once a possible state of crisis is detected. To make the instrument operational, the Code specifies that the state of crisis must be identified by objective, quantitative indices. The definition of such indices was delegated to the National Board of Accountants and Auditors, hereinafter indicated as 'the Board'.

Following the Code's provisions, the Board's proposal identifies the state of crisis through the following hierarchical procedure. First, the value of equity is assessed with reference to the company's legal form: if this value lies below the minimum required by law for that specific business type, the company is presumed to be in a state of crisis. This choice reflects the indications of the Code on the detection of imbalances – including capital ones – that may jeopardize business continuity. In this paper, minimum equity is set at €50,000 for joint-stock companies and at €0 for limited liability companies.[7] If equity falls below this level, we say that the firm has insufficient equity or, equivalently, that is *undercapitalized*.

As a second step, if equity is larger than the legal minimum the debt service coverage ratio (DSCR) is considered. The DSCR is the ratio between free cash inflows expected within six months and total outflows for debt repayment over the same period. If the DSCR is smaller than one, the firm is in a state of crisis; if the DSCR is larger or equal to one, the firm is presumed *not* to be in crisis. This policy reflects the indications of the Code in terms of debt sustainability for at least six months since the time of assessment.

Finally, if the DSCR is unavailable or unreliable, five capital and financial indices (see Table B.1 in Appendix B) are jointly considered, with specific warning thresholds defined for each index and differentiated across sectors of economic activity. A state of crisis arises when all these indices lie beyond the respective thresholds. This policy reflects the remaining indications of the Code on the detection of economic, financial or capital imbalances, as well as the specific provision of the indices assessing the sustainability of debts by cash flows and the adequacy of own funds compared to third-party funds.

In the rest of this paper we identify the state of crisis with undercapitalization only. We ignore the other criteria proposed by the Board for two reasons. First, we cannot consider the DSCR criterion, because we cannot reliably measure it with the data available to us, as it is based on forward-looking information not reported in balance sheets.[8] We also ignore the additional criterion based on the five capital and financial indices and their warning thresholds because they are quantitatively much less important. On average, in the period 2010-18, 98% of firms in a state of crisis using both the equity and the five indices criteria would have been classified as such by the equity criterion alone.

Upon entering the early warning system, the firm is redirected to the local Chamber of Commerce, where a crisis management committee is formed in order to address the situation. The committee will hear the debtor within 15 days, and may dismiss the case if the distress situation is deemed not too serious. Otherwise, the committee agrees with the debtor to adopt one of the crisis management tools foreseen by the law (certified recovery plan, composition with creditors, debt restructuring agreement, and ultimately judicial liquidation). Alternatively, firms can request a supervised crisis management procedure for an agreed resolution of the crisis with creditors, under the supervision and with the assistance of the committee. In this case, the committee acts as an active arbitrator between the parties in order to identify the best solution. Thus, a substantial burden is imposed on the Chambers of Commerce and the professionals who are called to constitute these committees. Relevant changes in

[7] In fact, limited liability companies may have a minimum capital requirement of €10,000. We cannot make a clear distinction between LLCs that are subject to such requirement and those that are not in our data. However, the availability of LLC types with no capital requirement should make it possible for a 'regular' LLC falling below the lower bound but above €0 to immediately transform into a 'reduced-capital' LLC with no equity deficiency. On the contrary, a joint-stock company cannot in principle continue operations under the same legal form if it does not meet the €50,000 capital requirement.

[8] Moreover, the DSCR is often absent from any accounting record or financial report, to the point that the Board itself explicitly foresees its unavailability or unreliability.

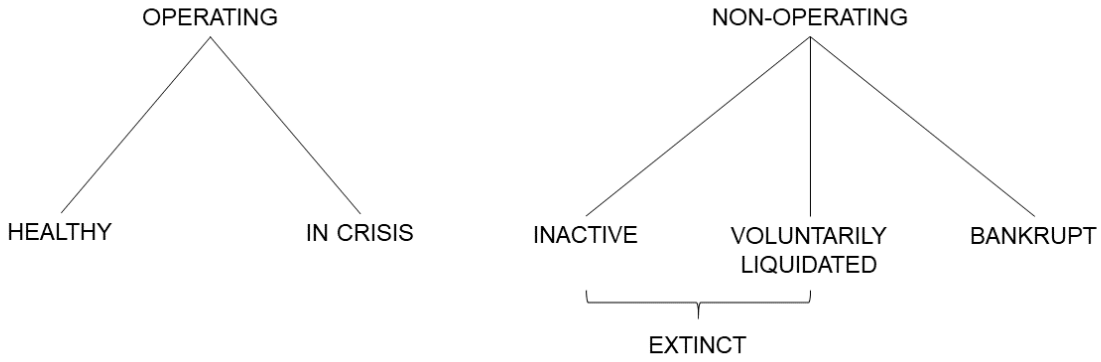
the number of firms needing access to early warning procedures may increase this workload much above what was expected when the system was first designed.

2.2. Firm data and definitions

Besides equity, other variables come into play in characterizing the 'health status' of firms in the following Sections. For the sake of clarity, we introduce a few definitions while describing the data used for firm-level analyses (health status classifications are also represented in Figure 2.1). Balance sheet, income statement and other individual firm data for the years 2010-18 are provided by Cerved Group S.p.A. and refer to all registered companies (*società di capitali*) that produce regular accounting documents in a given year. In addition to balance sheet information, we exploit data from InfoCamere S.c.p.A. containing information on whether the firm is involved in voluntary liquidation, bankruptcy or restructuring procedures,[9] as well as the starting date of each procedure.

To define an activity status for the firm, we combine these two data sources. We say that a firm is *operating* in a given year if (i) it produces positive revenues and displays either non-missing equity or non-missing total assets *and* (ii) it is not involved in any liquidation procedure, including voluntary ones. *Operating* firms are further subdivided according to whether they are undercapitalized (*in crisis*)[10] or have sufficient equity (*healthy*). Firms that do not satisfy point (i) but do satisfy point (ii) are said to be *inactive*. Firms that satisfy point (ii) above are classified according to whether they are undergoing a voluntary liquidation (*voluntarily liquidated*) or a bankruptcy proceeding, including restructuring (*bankrupt*). Inactive and voluntarily liquidated firms are grouped into the category of *extinct* firms. The latter thus contains all non-operating firms that have not gone bankrupt.[11] Operating firms in each year constitute our reference population in the following analyses**.** In 2018, there were around 662,000 operating companies, according to our definition. Among these, around 117,000 (18%) satisfied the new criteria for subjection to the obligation to constitute a supervisory body.

Figure 2.1. Health status of firms



[9] The available information does not allow us to distinguish liquidatory restructuring from restructuring aimed at business continuity. However, in InfoCamere data the most common form of restructuring are compositions with creditors, most of which are liquidatory procedures (see Danovi, A., Giacomelli, S., Riva, P., and Rodano, G., "Strumenti negoziali per la soluzione delle crisi d'impresa: il concordato preventivo", *Bank of Italy Occasional papers no. 430*, 2018).

[10] Recall from the Introduction that we extend the identification of crisis and undercapitalization from the sub-population of firms subject to the early warning system to the whole population of corporations.

[11] It is important to notice that not all firms can go bankrupt. Indeed, formal insolvency procedures do not apply to firms exercising a non-commercial (e.g., agricultural) activity or that do not trespass any of these thresholds: (i) total assets: €300,000, in each of the previous three years; (ii) sale and service revenues: €200,000, in each of the previous three years; (iii) total debt: €500,000.

3. Undercapitalization among Italian firms

In this Section, using balance sheet data produced by Cerved Group S.p.A, we provide an estimate of the number of firms that were in a state of crisis in the period 2010-18. In the rest of the paper, the state of crisis is identified with the firm's equity lying below the minimum required by law, and the definition is applied to all firms, independently of them being subject to the early warning system. In Sections 3-5, we present results for the full sample of operating companies. In Section 6, devoted to the effects of undercapitalization and COVID-19 on the early warning system, we restrict the analysis to the subsample of firms that are potentially subject to such procedures (see Section 2).

Table 3.1. Number of undercapitalized firms (2010-18)

year	operating firms	in a state of crisis	%
2010	627,043	54,635	*8.71*
2011	634,788	56,356	*8.88*
2012	630,584	58,671	*9.30*
2013	626,749	57,312	*9.14*
2014	628,711	55,601	*8.84*
2015	644,602	53,151	*8.25*
2016	656,920	52,882	*8.05*
2017	661,727	51,412	*7.77*
2018	662,465	48,042	*7.25*
avg. 2010-18	*641,510*	*54,229*	*8.45*

Table 3.1 presents the number of firms that would have been in a state of crisis in the period 2010-18 according to our definition. Over the period 2011-2018, on average about 54,000 companies would be in crisis each year, equal to about 8.5% of all the companies in the full sample.

The measure reported in Table 3.1 is the average yearly *stock* of companies signaled in crisis, regardless of their state in previous years. However, it is also important to understand what would be the *flow* of firms expected to transition from a state of regular activity to a state of crisis on average each year. Thus, in Table 3.2 we report the number of firms in a state of crisis but in regular activity in the previous year. On average, almost 20,000 firms (about 3.7% of all firms not in crisis in the previous year) would become undercapitalized every year. Both the stock of firms in a state of crisis and the flow into the state of crisis appear to be affected by the business cycle. In 2012-13, the share of companies in a state of crisis exceeded 9%, and the rate at which companies entered a state of crisis was over 4%. On the other hand, in 2017-18 these figures amounted to less than 8% and less than 3%, respectively.

Table 3.2. Number of firms entering a state of crisis (2018 and 2010-18 average)

year	operating firms[1]	entering a state of crisis	%
2010	516,740	19,625	3.80
2011	529,726	22,371	4.22
2012	531,652	24,373	4.58
2013	527,613	22,162	4.20
2014	526,144	20,045	3.81
2015	535,312	17,552	3.28
2016	547,974	17,828	3.25
2017	553,479	16,748	3.03
2018	548,891	15,585	2.84
avg. 2010-18	*535,281*	*19,588*	*3.66*

(1) Operating firms include only firms that were not undercapitalized in the previous year.

Table 3.3 reports some characteristics of firms in a state of crisis as opposed to all other operating companies (*healthy*). On average firms in crisis are smaller, in terms of both total assets and workforce, and younger: based on median values, undercapitalized firms have about 1/3 of the assets of healthy ones, 2/3 of the workforce and their age is half that of healthy firms. As expected, firms in crisis have negative median returns on assets and higher indebtedness. Virtually all companies in crisis are classified as high-risk firms, against 13% of the healthy ones. State of crisis would concern each year assets valued €45bln (1.5% of total value of assets in the sample) and around 330,000 employees (3.6% of total workforce in the sample).[12]

Table 3.3. Characteristics of undercapitalized firms (2018)

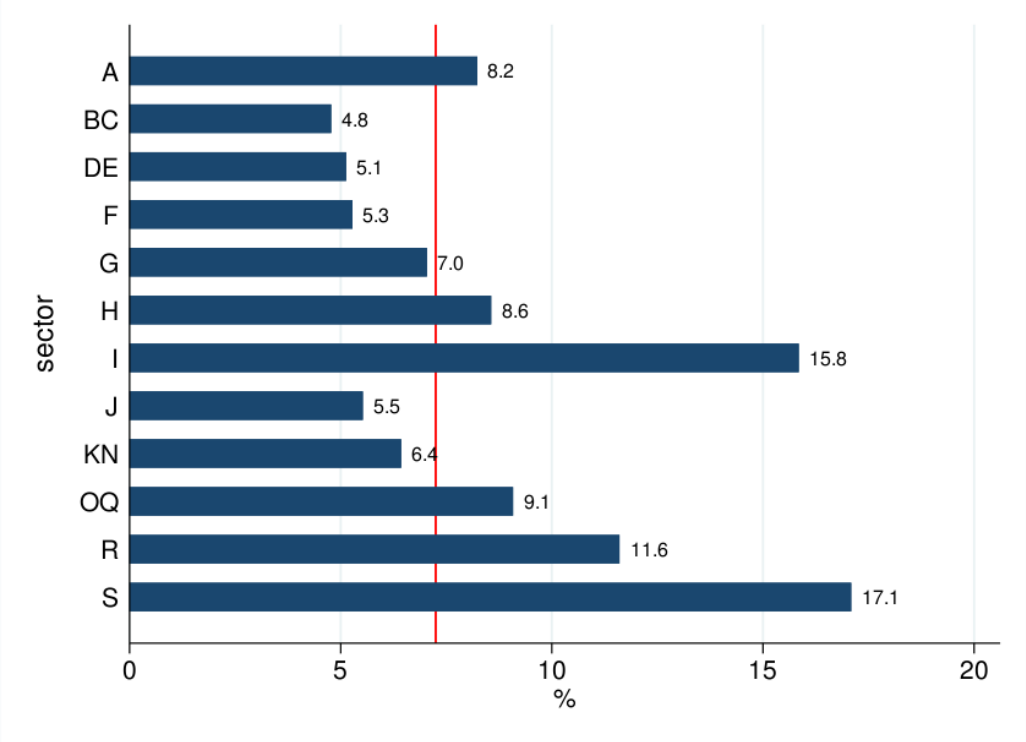
	median, in crisis	median, healthy	total, in crisis	total, healthy	%
total assets	0.14	0.46	45,290	2,879,918	*1.55*
workforce	2.00	3.00	334,154	8,913,446	*3.61*
age	5.00	10.00			
ROA	-0.07	0.09			
leverage	0.60	0.37			
total exposure	0.14	0.28	17,947	721,197	*2.43*
riskiness	1.00*	0.13*			

(*) Population averages. – *Total assets* and *total exposure* are measured in €mln. *Total exposure* refers to debts towards financial intermediaries reported in the Credit Registry. *ROA* is the ratio of EBITDA to total assets. *Leverage* is the ratio of total debts to total assets. *Riskiness* is a binary indicator of whether the firm's Cerved score above 6.

[12] The characteristics of the flow firms that *entered* in a state of crisis in 2018 are similar to those of all firms that *were* in crisis in the same year (see Table B.2 in Appendix B). Firms entering in the crisis are smaller, younger, less profitable, and more leveraged and less profitable. They employ about 1.9% of the workforce and account for 0.7% of the assets of all operating firms that were not undercapitalized in 2017.

As shown in Figure 3.1, the stock of undercapitalized firms, as a share of all operating firms, varies across sectors of economic activity. It is particularly high in industries related to leisure activities: accommodation and food services (15.8%), arts, entertainment, and recreational activities (11.6%), and other services (e.g., personal care; 17.1%). On the other hand, undercapitalization is less frequent in manufacturing (4.8%), utilities (5.1%), constructions (5.3%), and information and communication services (5.5%).

Figure 3.1. Share of undercapitalized firms by sector of economic activity (2018)

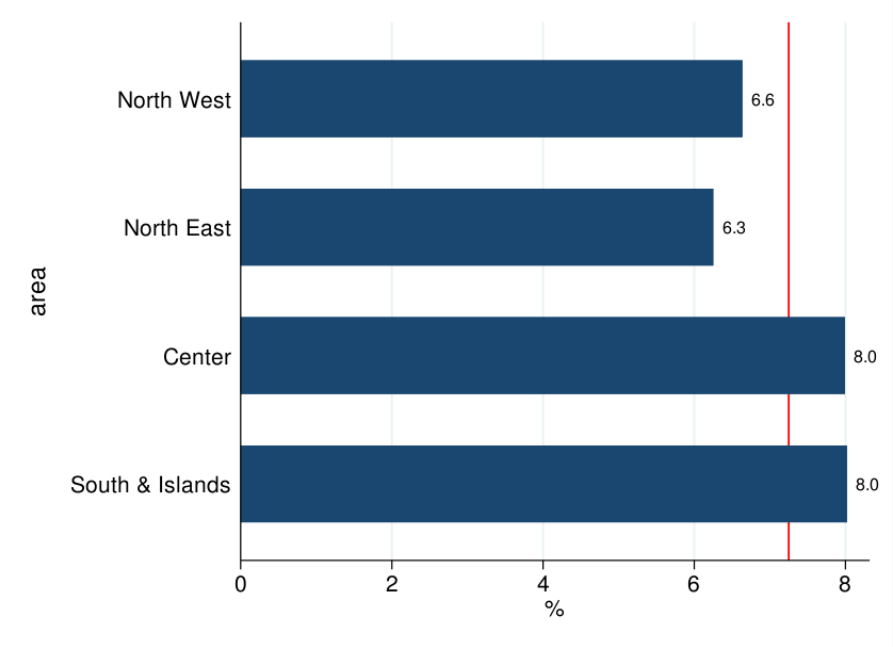


The figure reports, for each sector of economic activity, the share of undercapitalized firms (with respect to all firms that were operating in 2018). The red line indicates the overall share of undercapitalized firms. – A: agriculture, forestry, and fishing; BC: manufacturing, including mining; DE: utilities; F: construction; G: wholesale and retail trade; H: transportation and storage; I: accommodation and food services; J: information and communication; KN: professional services (including finance and insurance, real estate, professional, scientific and technical activities, support services); OQ: education, health, and social security; R: arts, entertainment, and recreation; S: other services.

Figure 3.2 shows that states of crisis are relatively more common in the Central and Southern regions of Italy (8% in 2018, against a national average of 7.2%). The highest value (9%) is recorded in the major islands. This is consistent with both the different distribution in the size of firms (that are on average smaller in the Center and South) and with the heterogeneous sectoral composition. Indeed, Central and Southern regions have a larger share of firms active in some of the sectors with above-average incidence of firms in crises. For instance, the accommodation and food sector accounts for 9.6% of firms in Central Italy, and only 5.4% in the North West. On the other hand, Central and Southern regions display a smaller weight of the manufacturing sector (12% of firms in Southern Italy, versus 22% in the North), which scores the lowest in terms of undercapitalization.

All sectors and all macro-regions display the same time trend, following the business cycle closely. The relative incidence of firms in crisis across regions and sectors does not appear to have changed in the period under observation.

Figure 3.2. Share of undercapitalized firms by macro-region (2018)



The figure reports, for each sector of economic activity, the share of undercapitalized firms (with respect to all firms that were operating in 2018). The red line indicates the overall share of undercapitalized firms. – North West: Piemonte, Valle d'Aosta, Lombardia, Liguria; North East: Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna; Center: Toscana, Umbria, Marche, Lazio; South & Islands: Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna.

Table 3.4 reports equity deficit at the country level (Panel A) as well as disaggregated for macro-regions and industries (Panel B). We define equity deficit as the difference between the minimum capital required by law and the firm's equity, when such difference is positive. The total equity deficit of Italian undercapitalized firms amounted in 2018 to around €12bln, corresponding to 0.4% of the assets owned by all operating firms. The median equity deficit is about €29,000, while the median ratio of equity deficit to total assets is 22%.

Slightly more than half of the total equity deficit is concentrated in Northern Italy (Panel B, col. 1). This reflects the uneven distribution of economic activity across macro-regions. Companies in our sample located in the North hold 62% of all assets, and account for 54% of the overall equity deficit, while companies in the South weigh at around 20% in terms of equity deficit, but own only 10% of all available assets. Indeed, the ratio of equity deficit to assets lies below 0.4% in the Center-North, while it reaches 0.8% in Southern Italy (Panel B, col. 2). Similarly, at the firm level, the median deficit is relatively larger in the North of the country (Panel B, col. 3). However, this is due to Northern firms being larger on average: dividing the equity deficit by the firm's asset, no significant difference between macro-regions emerges (Panel B, col. 4).

4. Undercapitalization and survival outcomes

This Section illustrates the relationship between undercapitalization and firm survival outcomes. In particular, we compare firms that enter a state of *crisis* in a reference year with firms that remain *healthy*. We show that these two groups display very different frequencies of negative survival outcomes such as firm extinction (*extinct*) and liquidation through bankruptcy (*bankrupt*), as defined in Section 2. This evidence, corroborated by regression analysis, suggests that undercapitalization is indeed a good predictor of insolvency and of the dissolution of the company, supporting the proposal by the Board of Accountants to include it as the main identifier of firm crisis in the early warning system.

Table 3.4. Equity deficit by region (2018)

Panel A

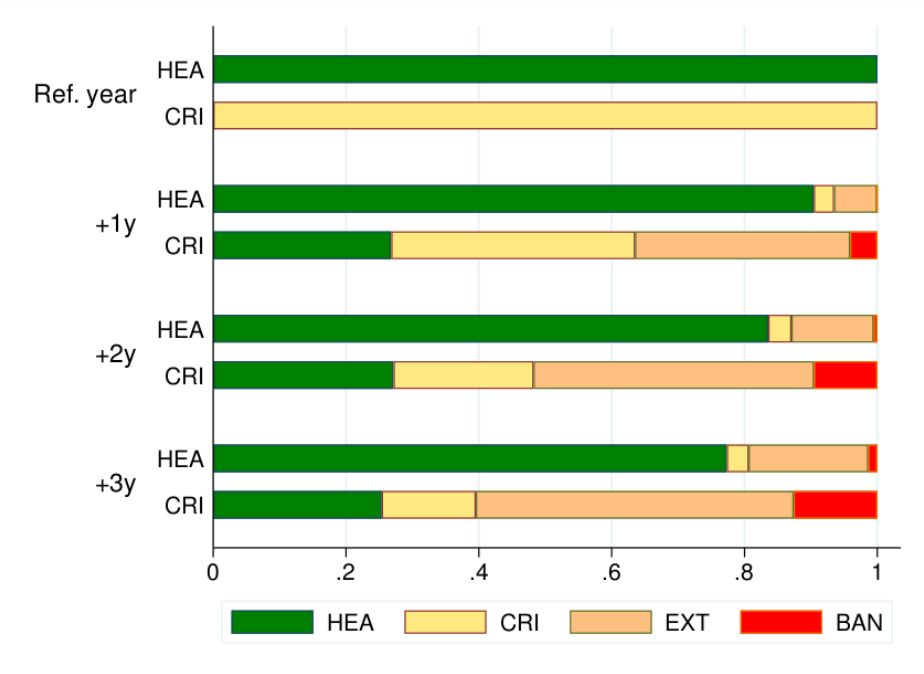
	(1)	(2)	(3)	(4)
	total deficit (€mln)	**total deficit / total assets (%)**	**median deficit (€1,000s)**	**median deficit / assets**
Italy	12,075	0.41	29	0.22

Panel B

	total deficit (% of country total)	**total deficit / total assets (%)**	**median deficit (ratio to country median)**	**median deficit / assets**
North West	31.8	0.33	1.4	0.22
North East	21.8	0.42	1.2	0.21
Center	26.5	0.39	0.9	0.22
South & Islands	19.8	0.81	0.8	0.23

Figure 4.1 displays the evolution of the health status of firms that enter a state of crisis in a reference year, compared to those of healthy firms that do not enter a state of crisis in the same year. The starting sample includes firms that are operating in the reference year and that were *not* undercapitalized in the previous year. Firms are observed over a three-year horizon. For this reason, the analysis is limited to the period 2010-15.

Figure 4.1. Survival outcomes for operating firms entering a state of crisis



The diagrams report the share of firms in each health status, separately for firms entering and not entering a state of crisis in the reference year. The starting sample is made of firms that were operating in the reference year and not undercapitalized in the previous year. The reference period is 2010-15. – HEA: healthy firms; CRI: operating firms in a state of crisis; EXT: firms exiting the market without a bankruptcy procedure (*extinct*); BAN: firms exiting the market through a bankruptcy procedure (*bankrupt*).

Within one year since entering a state of crisis, 36% of firms cease operations: about 4% go bankrupt and 32% become extinct without a formal insolvency procedure. As a comparison, only about 6% of the firms that are healthy in the reference year go out of business within one year, and less than 0.1% do so through a bankruptcy procedure. Over a three years horizon, 61% of firms entering in a crisis in the reference year go out of business: about 13% undergo a bankruptcy procedure, and 48% leave the market in other ways. As a comparison, only 1.4% of previously healthy firms face insolvency procedures over a three-year horizon.[13] Around 39% of firms entering the state of crisis in the reference are still active after three years. Approximately 36% of these (14% of the total) remain in a state of crisis. Overall, only 25% of firms that enter a state of crisis in a given year go back to a healthy status within three years.

A strong relationship between states of crisis and negative survival outcomes is not surprising. The presence of negative equity is likely to be correlated with other variables that are in turn associated with poor business performance (such as low profitability, high indebtedness, and the presence of net losses in the previous years) or with an overall larger likelihood to leave the market (due to location, industry, business cycle downturns). However, even when controlling for such factors, the conditional correlation of undercapitalization with firm extinction and bankruptcy remains statistically significant. This is shown in Table 4.1, which reports estimates from a regression analysis of different survival outcomes on several firm characteristics.

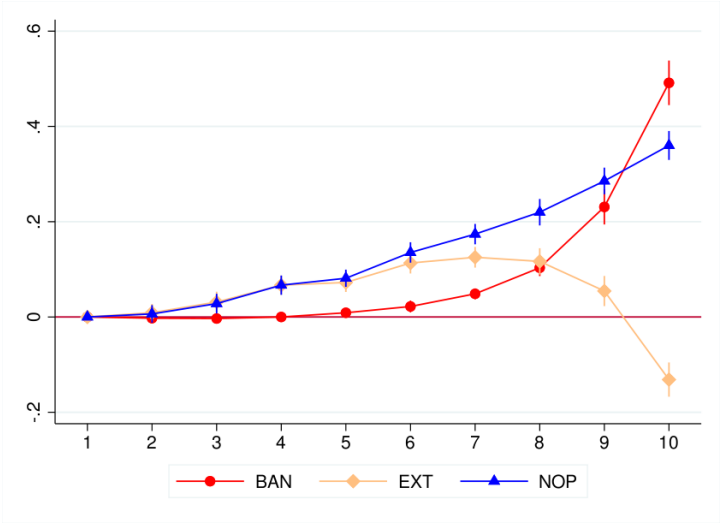
When only basic controls are included (e.g., assets and workforce: columns 1, 4 and 7), entering a state of crisis is associated with a 29pp increase in the likelihood of extinction, an 11pp increase in the probability of going bankrupt and a 40pp increase in the chance that either event occurs within three years.[14] The five indices devised by the Board of Accountants as an additional criterion for the detection of firm crises cover many aspects of firm performance such as profitability, indebtedness, and financial coverage. Including these five indices, as well as age and losses in the current or previous year (columns 2, 5 and 8), still results in a significant association between undercapitalization and extinction, bankruptcy or the union of the two events although, as expected, the magnitude of the conditional correlation coefficients is reduced. Even the inclusion of firm fixed effects (columns 3, 6 and 9), that substantially decreases the variability of our variable of interest by effectively restricting the analysis to firms transitioning to or from the state of crisis, does not annihilate the significance of this correlation.

Table 4.1 illustrates the relationship between the 'extensive margin' of entering a state of crisis and survival outcomes. Figure 4.2 shows that the probability of a negative outcome changes with the magnitude of the equity deficit ('intensive margin'), keeping all other firm characteristics constant. Undercapitalized firms are classified into deciles of equity deficit. Binary indicators of survival outcomes (bankruptcy, extinction, either of the two events) are then regressed – for the sample of undercapitalized firms only – on quantile indicators and all the controls used in columns 2, 5, and 8 of Table 4.1. Firms in the first decile of the equity deficit distribution constitute the reference group. The diagram shows that the probability of bankruptcy increases with the magnitude of the firm's equity deficit, being almost 50pp larger for firms in the last quantile than for firms in the 1st decile. However, the probability of bankruptcy diverges from baseline only from the 5th quantile onwards. Interestingly, over the 6th decile bankruptcy substitutes non-bankruptcy extinction, whose probability for firms in the last decile is even lower than that for firms in the first decile. The union of the two events is almost linearly increasing over equity deficit deciles.

[13] Subjection to bankruptcy depends on size criteria. Around 20% of firms in our sample cannot undergo a bankruptcy procedure according to our definition. If these firms were excluded from the sample, the rate of bankruptcy after three years would be around 16% for undercapitalized firms and 1.7% for healthy firms.

[14] The population averages of these variables are 21.9%, 1.9%, and 23.8% respectively.

Figure 4.2. Equity deficit magnitude and survival outcomes



Linear regression coefficients for indicators of equity deficit deciles. The excluded category (1) contains firms in the 1st decile of the distribution. BAN: firms exiting the market through a bankruptcy procedure (*bankrupt*); EXT: firms exiting the market without a bankruptcy procedure (*extinct*); NOP: non-operating firms, the union of BAN and EXT.

Figure 4.1 shows that a significant share of firms that enter in a state of crisis and remain operational, persist in a state of undercapitalization after three years. In principle, the persistence of undercapitalization may be due to firms exiting the state of crises and re-entering it in successive years. However, around two thirds of these firms never leave the state of crisis for three consecutive years. This is somewhat striking, as persisting undercapitalization should not occur so commonly within the Italian legal framework. Indeed, the Civil Code contains provisions aimed at inducing companies' administrators to take actions in many instances of equity deficit. Our data allow us to observe that continuing undercapitalization is more prevalent among limited liability companies, which are smaller and potentially subject to less tight supervision than joint-stock companies.

Table 4.1 Survival outcomes for operating firms entering a state of crisis

	extinct			bankrupt			non operating (extinct *or* bankrupt)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
entering crisis	0.286***	0.125***	0.023***	0.115***	0.104***	0.049***	0.401***	0.228***	0.072***
	(0.006)	(0.006)	(0.002)	(0.010)	(0.009)	(0.001)	(0.011)	(0.008)	(0.002)
total assets (€mln)	0.000	0.000*	-0.000	-0.000***	-0.000**	-0.000*	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
workforce size	-0.000***	-0.000***	-0.000***	0.000	-0.000	-0.000**	-0.000***	-0.000***	-0.000***
(hundreds of employees)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
subject to bankruptcy	-0.126***	-0.102***	-0.037***	0.014***	0.014***	0.003***	-0.112***	-0.088***	-0.034***
	(0.004)	(0.004)	(0.002)	(0.001)	(0.001)	(0.000)	(0.004)	(0.003)	(0.002)
supervisory body	-0.055***	-0.042***	-0.022***	0.018***	0.018***	-0.006***	-0.037***	-0.024***	-0.028***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
large	-0.022***	0.006*	-0.023***	-0.013***	-0.010***	-0.013***	-0.035***	-0.005	-0.037***
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.005)
coverage		0.199***	0.056***		0.022***	0.021***		0.221***	0.076***
		(0.019)	(0.004)		(0.005)	(0.001)		(0.023)	(0.004)
leverage		0.000***	0.000***		0.000***	0.000***		0.000***	0.000***
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
profitability		-0.196***	-0.020***		-0.051***	-0.012***		-0.247***	-0.033***
		(0.004)	(0.002)		(0.007)	(0.001)		(0.007)	(0.002)
short-term liquidity		0.003***	0.001***		-0.001***	-0.000***		0.002***	0.001***
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
debt inst. creditors		0.351***	0.121***		0.060***	0.051***		0.411***	0.172***
		(0.012)	(0.004)		(0.005)	(0.002)		(0.016)	(0.004)
age		-0.001***	0.050***		0.000	0.009**		-0.001***	0.059***
		(0.000)	(0.005)		(0.000)	(0.004)		(0.000)	(0.008)
losses current year		0.066***	0.013***		0.010***	0.003***		0.075***	0.016***
		(0.002)	(0.001)		(0.001)	(0.000)		(0.002)	(0.001)
losses previous year		-0.000	0.014***		-0.001	0.002***		-0.001	0.015***
		(0.002)	(0.001)		(0.001)	(0.000)		(0.002)	(0.001)
year x sector FE	x	x	x	x	x	x	x	x	x
region FE	x	x	x	x	x	x	x	x	x
firm FE			x			x			x
obs.	3,130,555	2,266,203	2,174,702	3,130,555	2,266,203	2,174,702	3,130,555	2,266,203	2,174,702
adj. R2	0.06	0.09	0.64	0.04	0.06	0.62	0.07	0.12	0.67

Linear regressions. The dependent variable is a dummy for the corresponding survival outcomes. Variables *Coverage* to *Debt inst. creditors* are defined in Table B.1 in Appendix B.

5. The effects of the COVID-19 pandemic on firm undercapitalization

In this Section, we analyze the effects of the economic crisis induced by the COVID-19 epidemic on firm undercapitalization in Italy. In particular, we estimate the number of firms that would be in a state of a crisis after COVID-19. We also take into account the effects of a set of policies implemented by the Italian government between March and August 2020, with the aim to counteract its economic impacts. In particular, we focus on measures directed at sustaining firms through the first lockdown period and the subsequent return to regular operations.

Here we provide a brief summary of the methodology used to perform this estimation exercise. The details are presented in Appendix A.[15] The main element of the exercise is an equation that describes the evolution of equity from one year to the next, containing only income statement variables. From an accounting point of view, end-of-year equity is equity at the beginning of the year plus profits (or losses). We call this an *accounting method* to describe the evolution of equity. Profits are the sum of variables that may or may not correspond to cash flows. For instance, direct and labor costs as written in income statements by and large correspond to cash outflows, while depreciations and amortizations do not. An alternative to the accounting method is to include in the dynamics of equity only income statement items with corresponding cash flows. We call this an *economic method* for the evolution of equity.

Each of these methods has advantages and drawbacks. Especially in a moment of crisis, the response of income statement items to which no cash flow corresponds may be more volatile and harder to interpret. If this is the case, the *economic method* may better represent the actual soundness of the firm, which is especially useful when evaluating its medium-to-long-term profitability. However, in the short run, the value of equity that will be observed at the end of the year by external agents (customers, suppliers, current and potential creditors, …) is the one resulting from balance sheets, which is better approximated by a prediction obtained through the accounting method. Given the unpredictability of the evolution of the pandemic, in our main analyses we focus on the short-term prospects of firms in terms of undercapitalization, and therefore adopt the *accounting method*. However, results obtained through the *economic method* are presented in Table B.3 in Appendix B.

We model the economic consequences of COVID-19 as a shock to firm revenues. Variation in firm revenues are available, at a disaggregated sectoral level (NACE 2-digit), for each month from January to July 2020. We project the series up to December 2020 using a calibration that imposes the variations in value added implicit in the projection to match the annual growth rate of private sector value added predicted by Bank of Italy (see Figure A.1 in Appendix A). We consider two scenarios: the most optimistic used in the main analysis, and the most pessimistic presented in Table B.4 in Appendix B.

Shocks to revenues propagate to other income statement variables, namely direct costs (i.e., materials, goods, and services) and labor costs. The magnitude of such propagation is determined by estimates of the elasticities of these variables to changes in revenues. Such estimates are carried out on our Cerved 2010-18 sample, at industry level (see Table A.1 in Appendix A for details). The average values of these elasticities are around 0.9 for direct costs and 0.55 for labor costs.

This allows us to obtain predictions on firms' equity at the end of 2020 in presence of the COVID-19 shock. On top of this, we model the impact of government interventions on individual income statement items, so to quantify the mitigating effect of the individual measures and their combination.

[15] Although with several important points of difference, this methodology is ultimately based on Schivardi, F., and Romano, G., "A simple method to estimate firms liquidity needs during the COVID-19 crisis with an application to Italy", *CEPR Covid Economics*, 2020. It first appeared in the current form in De Socio *et al.*, "Gli effetti della pandemia sul fabbisogno di liquidità, sul bilancio e sulla rischiosità delle imprese".

The possibility to resort to short-time work schemes ('CIG') was repeatedly extended since the beginning of the pandemic. Short-time work schemes allow firms to reduce hours work shifting the burden of paying wages onto the public sector. The progressive availability of these instruments is modeled by imposing, for each covered month, a change on the elasticity of labor costs, increasing it to 0.8 unless the natural elasticity of labor already exceeds this value. The elasticity is set below 1 as not all employees can benefit from these instruments.

A debt moratorium was also progressively extended in the past months. This measure allows firms to suspend the payment of interests for a specified period of time. However, the moratorium has no effect on equity when using the accounting method, since financial expenditures are written in the current income statement even if the payment is delayed to next year. In the economic method, the moratorium reduces financial expenditure for eligible firms, proportional to the share of long-term debts, to which the moratorium applies.

Other measures are taken into account, such as a waiver on the first instalment of production taxes ('IRAP'), as well as a refund of rents and a direct grant directed at firms suffering a large drop in revenues (further details can be found in Appendix A). The impact of these measures is incorporated by adding the amounts accruing to each firm to the income statement result.

Before showing the results of our exercise, it is important to clarify that our analysis does not consider possible counter-actions by firms such as recapitalization or coverage of the equity deficit by new debt. Consequently, we also do not consider the impact of policy measures that do not involve income statement variables, but may help firms to restore sufficient equity levels through recapitalizations or new debt contracts. Interventions of this kind are, for instance, foreseen by the '*Rilancio*' decree passed in May 2020.

Table 5.1 reports our main results, using the accounting method to predict equity at the end of 2020.[16] In 2018, about 48,000 firms were in a state of crisis, amounting to 7.25% of all operating firms and employing 3.6% of the workforce in our sample (about 334,000 employees). The aggregate equity deficit in 2018 amounted to little more than €12bln. Without considering the measures enacted by the Italian government, the economic crisis induced by the COVID-19 pandemic would have increased the number of undercapitalized firms to about 94,000 (over 14% of those active in 2018). The crisis would have involved slightly less than 1.2 million workers, about 13% of the 2018 total workforce of firms in our sample. The aggregate equity deficit would have exceeded €24bln.

The measures adopted by the Italian government as a support to firms since the beginning of the pandemic will greatly contribute to dampening this surge in undercapitalization. We estimate that the main interventions enacted so far may reduce the number of firms in a state of crisis to less than 82,000 (12.4% of those active in 2018) and the number of workers involved to 812,000. The contributions of specific measures are described below.

The main measure included in the first two decrees passed by the Italian government (DL 18/2020, '*Cura Italia*', and DL 23/2020, '*Liquidità*'), namely the extended possibility of using short-time work schemes,[17] may have reduced the number of firms in a state of crisis to about 92,000. Of the approximately 2,200 firms 'rescued' by these interventions, less than 6% would have been undercapitalized in 2020 even in the absence of the pandemic. Firms rescued by these initial measures employ around 80,000 workers.

[16] Although they are based on the same methodology, the figures presented here may slightly differ from the corresponding ones that appear in De Socio *et al.*, "Gli effetti della pandemia sul fabbisogno di liquidità, sul bilancio e sulla rischiosità delle imprese". The main reason behind this difference is that we do not include in this paper real estate and property management companies, that constitute over 11% of firms in the sample used by De Socio *et al.*. Furthermore, undercapitalization shares in this paper are computed over all companies operating in 2018, while De Socio *et al.* report shares over companies operating in 2018 *and* still operating at the beginning of 2020.

[17] Recall that debt moratoria have no impact on equity when the latter is computed with the accounting method.

The measures included in Decree Law 34/2020 ('*Rilancio*') are estimated to have further reduced the number of firms in crisis by almost 10,000, to about 82,500, the number of workers involved to about 900,000, and equity deficit to less than €23bln. Among the several interventions foreseen by DL 34/2020 (a further extension of short-time work schemes, tax rebates, rents refunds, and direct grants), direct grants predominate both in terms of rescuing power and in intervention 'precision', as measured by the ability to rescue firms that would have been undercapitalized only because of the COVID-19 shock. Overall, the cumulative extension of short-time scheme will account for the majority of firm rescues from states of crisis.

The most recent of all interventions considered here, DL 104/2020 ('*Agosto*') extended short-time work schemes to the end of 2020. According to our estimates, its impact on the number of firms would be relatively small, and mainly concentrated on medium-to-large size firms. However, this is due to our projection of revenue shocks in the last semester of the year implying a recovery, and therefore less firms resorting to the available support tools (see Appendix A).

Table 5.1. COVID-19 and undercapitalization (accounting method)

	undercapitalized firms	**% operating firms in 2018[1]**	**workforce (1,000s)**	**% workforce in 2018[1]**	**equity deficit[2] (€bln)**	**rescued firms (wrt to previous decree)**	**COVID rescues[3] (% of recovered firms)**
in 2018[4]	47,977	7.2	334	3.6	12.1		
in 2020 w/out COVID	63,942	9.7	545	5.9	18.7		
in 2020 with COVID, no govt. measures	94,252	14.2	1,164	12.6	24.3		
CIG 9 weeks (DL 18 and 23/2020)	**92,069**	**13.9**	**1,085**	**11.7**	**24.0**	**2,183**	**94.6**
CIG 18 weeks	89,423	13.5	950	10.3	23.5	2,646	91.4
IRAP	91,478	13.8	1,079	11.7	24.0	591	89.9
rents refund	90,007	13.6	1,064	11.5	23.6	2,062	95.1
direct grants	87,445	13.2	1,062	11.5	23.8	4,624	97.6
DL 34/2020	**82,443**	**12.5**	**902**	**9.8**	**22.9**	**9,626**	**87.2**
CIG end of 2020 (DL 104/2020)	**81,795**	**12.4**	**812**	**8.8**	**22.7**	**648**	**94.3**

(1) The numbers from row 'in 2020 w/out COVID' onwards are computed excluding from the sample all firms that were active in 2018 and that we know to have gone out of business in 2019. However, percentages refer to the grand total as observed in 2018 (see Appendix A). (2) 'Equity deficit' is the amount needed to bring equity back to the minimum required by the law. – (3) 'COVID rescue' refers to firms rescued by the policy measures that were not already in a state of crisis in 2018. – (4) The numbers referring to 2018 do not exactly coincide with the ones reported in Table 3.1: shocks to revenues are defined at sector level, but some firms in the reference population are not associated to any sector and are therefore excluded from this exercise.

Table 5.2 reports the effects of COVID-19 on the share of undercapitalized firms by sector of economic activity. The impact of COVID-19 on the number of firms in a state of crisis, before the implementation of policy measures, mirrors the intensity of the fall in revenues across industries. The pandemic hit the accommodation and food services sector particularly hard. Before the shock, this sector already had the largest share of undercapitalized firms (almost 16%). Without government interventions, the share of firms in a state of crisis in this sector would have increased to almost 50%. The supporting measures are expected to reduce this share to around 42%, which is however much higher than the post-COVID analogous values of other sectors. Arts, recreations, and entertainment displayed the second highest share of firms in crisis in 2018 (11.6%), and is also subject to the second largest increase in undercapitalization due to COVID-19. Considering the effects of government interventions, the least affected sectors – in terms of increase in the share of undercapitalized firms – at the end of 2020 will be transportations, constructions, and trade.

Table 5.2. COVID-19 and undercapitalized firms by sector of economic activity

	in 2018	in 2020 w/ COVID, no govt. measures	in 2020 w/ COVID, all measures
Agriculture	8.2	14.2	13.4
Manufacturing	4.8	9.5	7.4
Utilities	5.1	11.2	10.7
Construction	5.3	9.0	6.8
Trade	7.0	9.8	9.1
Transportation & storage	8.6	13.4	10.4
Accommodation & food	15.8	48.5	42.2
Info & communication	5.5	8.6	8.3
Professional services	6.4	14.2	12.8
Health & education	9.1	15.9	14.8
Arts & entertainment	11.6	28.6	21.4
Other services	17.1	23.2	22.9

Percentage shares over to the total number of firms operating in each sector in 2018.

Table 5.3 reports the effects of COVID-19 and of the policy measures implemented by the government on the share of firms in a state of crisis in each macro-region. As discussed in Section 3, the share of firms in a state in crisis in 2018 was slightly lower in the North (between 6% and 7%) than in the Center-South (8%). Both with and without policy interventions, the largest increase in undercapitalization would be observed in Central regions (+5.9pp).

These areas are penalized by the structural sectoral composition of their local economy, rather than by differences in how COVID-19 impacted each sector across different regions. The hardest hit-sectors, heavily related to leisure and tourism (accommodation and food, and arts, recreation and entertainment), weigh more in Central Italy than in other areas. Moreover, sectoral weights in Central regions typically lie in between those of Northern and Southern Italy. Some large sectors are less affected by COVID-19. Thus, for instance, Central Italy has too small a share of manufacturing firms relative to the North, and too small a share of trade firms relative to the South, to enjoy the relatively small increase in undercapitalization in these sectors, generating worse prospects than for other regions.

Table 5.3. COVID-19 and undercapitalized firms by macro-region

	in 2018	in 2020 w/ COVID, no govt. measures	in 2020 w/ COVID, all measures
North West	6.6	13.3	11.8
North East	6.2	12.7	11.0
Center	8.0	16.2	13.9
South & Islands	8.0	14.6	12.7

Percentage shares over to the total number of firms operating in each macro-region in 2018.

6. Undercapitalization and the early warning system

As discussed in Section 2, early warning and supervised crisis management proceedings are among the main innovations of the new Business crisis and Insolvency Code. As a consequence of the COVID-19 pandemic, the Code and its early warning system will become effective in September 2021. We first look backwards to the period 2010-18 in order to understand what the number of firms involved by these procedures would be in times of 'normal' economic activity. However, when the system becomes operational in 2021, it will have to deal with corporate crises due to the economic shock that followed the COVID-19 pandemic. Therefore, we repeat the analysis carried out in Section 5 for the subsample of firms subject to early warning procedures, in order to understand the workload the new system may face right after it begins to operate.

Early warning procedures activated through reporting of the state of crisis by supervisory bodies involve only companies required by law to have such bodies. Moreover, other categories are excluded from its scope of application (see Section 2). In the rest of the analysis, we restrict our reference population to operating firms that are subject to the early warning system. As previously remarked, in 2018 these accounted for 18% of all operating companies.

Table 6.1 reports the results of the backward-looking exercise. It presents the *hypothetical* number of crisis reports by supervisory bodies in the period 2010-18. The first four columns report the stock of operating firms identified as in a state of crisis. On average, about 9,300 companies would be in a state of crisis each year, slightly less than 8% of the companies within the scope of application of the early warning system and about 1.5% of all operating firms. This number gives an estimate of how many firms would – in 'normal' times – possibly face early warning procedures *in the year in which the system enters into force*.[18]

Notice that, with respect to the general population of companies, undercapitalization appears to be slightly less common among early-warning companies. However, this distance was larger in recent times: in 2018, the state of crisis involved 7.25% of all firms, but only 6% of companies subject to the early warning system. The difference in characteristics between early-warning companies in crisis and healthy ones mirrors that observed for the general population of Italian companies (see Table 3.3).

[18] The stock of firms would also be an upper bound of the number of cases the whole early warning system would be dealing with at a given point in time, under normal circumstances.

The last four columns report the hypothetical estimated yearly flow of firms *entering* a state of crisis from a state of regular activity, based on 2010-18 accounting information. This is the number of firms that would be subject to a new early warning procedure each year, *with the exception of the year in which the system is first activated*. The flow of firms towards the state of crisis (and, therefore, potentially entering an early warning procedure) would amount to 3,700 firms on average, equal to 3.5% of all companies with a supervisory body (and 0.7% of all companies) not in crisis in the previous year.

Table 6.1. Number of undercapitalized firms subject to EW (2010-18)

	Stock				Flow[1]			
year	**firms subject to EW**	**in a state of crisis**	**% of subject to EW**	**% of all firms**	**firms subject to EW**	**entering a state of crisis**	**% of subject to EW**	**% of all firms**
2010	117,046	9,537	*8.15*	*1.52*	104,375	3,474	*3.33*	*0.65*
2011	120,191	10,218	*8.50*	*1.61*	107,874	4,201	*3.89*	*0.76*
2012	120,353	10,782	*8.96*	*1.71*	108,202	4,802	*4.44*	*0.86*
2013	118,568	10,438	*8.80*	*1.67*	106,147	4,271	*4.02*	*0.78*
2014	117,155	9,742	*8.32*	*1.55*	105,032	3,770	*3.59*	*0.69*
2015	118,245	9,164	*7.75*	*1.42*	105,504	3,305	*3.13*	*0.60*
2016	120,086	8,845	*7.37*	*1.35*	108,426	3,428	*3.16*	*0.61*
2017	119,662	8,230	*6.88*	*1.24*	109,194	3,221	*2.95*	*0.56*
2018	117,441	7,010	*5.97*	*1.06*	107,884	2,798	*2.59*	*0.50*
avg. 2010-18	*118,750*	*9,330*	*7.86*	*1.45*	*106,960*	*3,697*	*3.46*	*0.67*

(1) The reference sample used for the analysis of the flow of firms that *enter* in a state of crisis differs from the one for the stock of firms in a state of crisis. It excludes the firms that were already in a crisis in the previous year.

As explained above, the estimated flow of firms entering a state of crisis suggests what the likely number of firms starting an early warning procedure every year would be in 'normal' times. The stock of firms in a state of crisis would have provided an estimate of the number of firms involved facing early warning procedures at the beginning of the system's implementation. However, the COVID-19 shock will greatly affect the number of firms that could possibly face such procedures when the system is introduced in September 2021: the number of firms initially involved in early warning procedures depends on the number of undercapitalized firms based on 2020 balance sheets.

To provide a quantification of the potential impact of COVID-19 on the early warning system, we repeat the exercise in Section 5 for the subsample of firms that are subject to this system. Table 6.2 reports the results of this exercise. Overall, about 13,000 firms – 11% of all firms operating in 2018 and subject to the early warning system – would be in state of crisis after COVID-19. This estimate takes into account the mitigating effect of the policy measures implemented by the Italian government described in Section 5. As a comparison, this number is slightly larger than that of all bankruptcy proceedings started in 2019 (almost 11,500). The involved workers would be more than 340,000, almost 10% of those in the sample.

As in the general population of operating firms, also in the subsample of firms subject to the early warning procedures the share of firms in crisis in 2018 was smaller in the North (around 4.4% on average) than in other areas. However, in this restricted subpopulation, undercapitalization is significantly more widespread in the South (8.7%) than in the Center (6.5%). Unlike all other regions, Southern Italy has a larger share of undercapitalized firms in this subsample than in the general population (8.0%).

Similarly to what observed for the general population of firms, early-warning companies located in Central regions were most hardly hit by the COVID-19 events. The share of undercapitalized firms among them increased by 6pp, to 12.5%. Nonetheless, post-COVID estimates still indicate Southern regions as the ones with larger rates of undercapitalization (14.5%).

Table 6.2. COVID-19 and the early warning system

	subject to EW in 2018		in crisis in 2018			in crisis in 2020, with COVID and govt. interventions		
	firms	workforce (1,000s)	firms	%	workforce (1,000s)	firms	%	workforce (1,000s)
Italy[1]	117,401	3,478	7,003	6.0	152	13,034	11.1	343
North West	35,951	1,234	1,623	4.5	51	3,232	9.0	124
North East	27,689	869	1,188	4.3	27	2,460	8.9	69
Center	23,443	687	1,534	6.5	37	2,927	12.5	77
South & Islands	30,218	683	2,643	8.7	37	4,395	14.5	72

(1) The total number for Italy does not correspond to the sum of different macro-regions because of missing geographical information for some firms.

This sharp increase in the first inflow of firms actually involved in early warning procedures may reflect on the functioning of the crisis resolution system that can be activated after early warning reports. The conduction of this process is partly delegated to a crisis management committee whose activity is in turn managed by and takes place within the Chambers of Commerce. When envisioned by the legislator, this system was – based on 2018 data – may have faced around 7,000 incoming procedures in the first year, and less than 3,000 at steady state (Table 6.1). However, given the COVID-19 and by rules currently due to enter into force in September 2021, it may now face around 13,000 incoming procedures in the first year (Table 6.2). This can put the newly operating system under serious strain.

7. Concluding remarks

The latest bankruptcy law reform in Italy – due to enter into force in September 2021 – introduced the so-called 'early warning' system. This prompted the definition of criteria to identify firms in a 'state of crisis'. According to the proposal by the Italian Board of Accountants, the state of crisis is substantially identified with the presence of equity below the legal limits (undercapitalization).

Our analyses show that undercapitalization is widespread among Italian companies. In 2010-18, on average over 8% of firms were undercapitalized each year. There are significant differences in the incidence of undercapitalization across macro-regions and sectors of economic activity: the phenomenon is more common in the Center and South of the country, and in sectors related to tourism and entertainment.

Undercapitalization is associated with a large increase in the probability of the firm going out of business (with or without a formal bankruptcy procedure), even when controlling for a rich set of other firm-level structural characteristics and accounting variables. Moreover, in spite of legal

prescriptions aimed at a quick resolution of these situations, undercapitalization persists in many cases for several years.

The COVID-19 pandemic has caused a shock to the economy that will in turn translate into a significant increase in the number of undercapitalized firms in 2020. Policy measures enacted by the Italian government to counteract the economic impact of COVID-19 are expected to greatly dampen such increase. Nonetheless, our analysis predicts that the incidence of undercapitalization may increase to over 12%, from 7.25% in 2018. The COVID-19 shock will also reverberate over the early warning system, on which the surge in undercapitalization induced by COVID-19 will impose a much larger workload than initially foreseen.

Appendix A – Methodology of the COVID-19 forecasting exercise

1. The evolution of liquidity and equity[19]

The estimates provided in Sections 5 and 6 of the paper are based on a simple model of the evolution of firm equity in the presence of revenue shocks. We adopt the simplest evolution equations for our variable of interest, exclusively based on accounting variables that can be observed in annual income statements.

Profits (or losses if negative) in year t are given by

$$\pi_t = r_t - c_t - \ell_t - \iota_t - \tau_t + x_t \,,$$

where r_t are revenues, c_t are direct costs,[20] ℓ_t are labor costs, ι_t are financial expenditures, τ_t are taxes and x_t are other elements of income statements that are linked to cash inflows or outflows (such as additional proceedings/costs). The evolution of equity according to the *accounting method* is given by $E_{t+1} = E_t + \pi_t$.

According to the *economic method*, the evolution of equity is given by $E_{t+1} = E_t + CF_t$, where CF stands for cash flow. The difference between profits used in the accounting method and cash flow used in the economic method is that the latter only includes income statement items insofar as a corresponding cash in- or outflow exists. Most notably in our case, ι_t will not be affected by a debt moratorium in the accounting method, as the whole amount of payments due remains written the 2020 income statement even if a fraction of payments are delayed to the following year. Denoting by z_t all income statement voices to which no cash flow corresponds (e.g., depreciation and amortization), one has $\pi_t = CF_t + z_t$, so that

$$E_{t+1}^{acc} = E_t + CF_t + z_t = E_{t+1}^{eco} + z_t \,.$$

Notice that z_t can be either positive or negative, so that there is no ex-ante ordering between E_{t+1}^{acc} and E_{t+1}^{eco}. From now on, we will illustrate the methodology using the economic method, and drop the indication in superscript. Even though the accounting method is used in the main analysis, the economic method is chosen for ease of exposition since it allows to do without the z_t term, which is not affected by revenue shocks (see below). All considerations extend to the accounting method.

To estimate firms' equity after the COVID-19 shock, we first model the impact of the pandemic on individual components of the income statement. In particular, we assume that COVID-19 had a *direct* impact only on revenues, and that this shock to revenues transmits to other components of CF_t. Specifically, we assume the shock to revenues only transmits to direct costs and labor costs, while all other variables can only be affected by government interventions after the shock has occurred.[21]

Our last accounting data refer to 2018,[22] and revenue shocks are specified on a monthly basis (see Section 2 of this Appendix). Thus, in the absence of the COVID-19 shock, the projected value of

[19] The methodology described in this paragraph is based on Schivardi and Romano (2020). It was first developed in its current form in De Socio *et al.* (2020). Full references in the main text.

[20] We call 'direct' costs all those related to the use of factors except labor (e.g., materials and services).

[21] The tax component (τ_t) represents taxes on profits due in the current year, which depend on previous year's profits only, and are therefore not affected by current revenues. VAT and labor taxes, that do depend on current revenues, are included in direct costs c and labor costs ℓ respectively. The simplifying assumption of zero elasticity of interest expenditures (ι_t) to revenues is not far from the elasticity estimated by the same methodology used for direct and labor costs (see below), which is equal to 0.19 on average.

[22] While 2018 is the most recent year for which balance sheet data are available, we have information on firms that went out of business in 2019. These firms are excluded from computation in the predictive exercises. However, as no balance sheet data are available for firms entering the market in 2019, in our analyses we express shares of undercapitalized firms with respect to the whole population of operating firms in 2018.

equity at the end of 2020 is $E_{2020} = E_{2018} + CF_{2018}$. The COVID-19 shock modifies revenues in month m from r_{2018m} to $r_{2020m} = (1 + g_m)r_{2018m}$.[23] To a shock g_m to revenues, there corresponds a change $g_{c,m} = \eta_c g_m$ of direct costs and $g_{\ell,m} = \eta_\ell g_m$ of labor costs. Thus, in presence of the COVID-19 shock, the cash flow for 2020 is modified to

$$CF_{2020} = \sum_m (1 + g_m)r_{2018m} - (1 + \eta_c g_m)c_{2018m} - (1 + \eta_\ell g_m)\ell_{2018m} - \iota_{2018m} - \tau_{2018m} + x_{2018m} .$$

Estimates of the elasticities η_c and η_ℓ are obtained at the level of a coarse disaggregation of (macro) sectors.[24] For each sector s, we use balance sheet data for the period 2010-2018 to estimate the elasticity of direct costs and labor to revenues ($\eta_{y,s}$ for $y \in \{c, \ell\}$), using the following equation

$$\log y_{i,t} = \eta_{y,s(i)} \log r_{i,t} + \gamma X_{i,t-1} + \theta_t + \zeta_i + \varepsilon_{i,t} ,$$

where $s(i)$ is firm i's sector; $X_{i,t-1}$ is total assets in year $t-1$; and θ_t and ζ_i are year and firm fixed effects respectively. The observations are weighted by size of the firm (measured by total assets). Table A.1 illustrates the estimated elasticities.

Table A.1. Estimated elasticities by sector of economic activity

Sector[1]	Direct Costs	Labor Costs
A	0.81	0.37
BC	0.88	0.56
DE	1.11	0.32
F	1.04	0.28
G	0.93	0.55
H	1.39	0.26
I	0.71	0.90
J	0.92	0.66
KN	0.69	0.51
OQ	0.79	0.97
R	0.87	0.46
S	0.71	0.84

(1) Sector labels are defined in footnote 24.

The next paragraph illustrates how the annual shock g_r is obtained from monthly data on firm revenues that are observed only up to July 2020.

[23] All non-shocked monthly variables are simply equal to the original variable divided by 12.

[24] These sectors are: agriculture, forestry and fishing (A); mining, quarrying and manufacturing (BC); utilities (DE); construction (F); wholesale and retail trade (G); transportation and storage (H); accommodation and food service activities (I); information and communication (J); finance and insurance, real estate, professional, scientific and technical activities, support services (KN); public administration, social security, education and health (OQ); arts, entertainment and recreation (R); other services (S).

2. Shocks to firms' revenues

Our analysis rests on the identification of shocks to firm revenues induced by the COVID-19 pandemic. Actual data on the variations of revenues at the level of 2-digit NACE sector classification are currently available up to July 2020.

This information allows us to compute, for each month $m \in \{1, \dots, 7\}$ and sector j,[25] the growth rate $g_{m,j}$ of firm revenues with respect to the corresponding months of 2019. However, due to issues in the data, we do not deem the information concerning total revenues in January and February 2019 entirely reliable. For this reason, we impose a zero growth rate of revenues for the corresponding months of 2020 ($g_{1,\cdot} = g_{2,\cdot} = 0$). The data on actual variations of revenues is thus used for months going from March to July 2020.

For remaining months (August to December 2020), variations in revenues must be forecast. In our model, the growth rates with respect to the corresponding month of 2019 ($g_{m,j}, m \in \{8, \dots, 12\}$) are set equal to

$$g_{m,j} = \alpha_j + \beta \log m \,,$$

where α_j and β are calibrated so that[26]

(i) the growth rate in July matches the one observed in the data (i.e., $g_{7,j} = \alpha_j + \beta \log 7$) and
(ii) the aggregate growth of *value added* for the firms in our sample matches the aggregate growth in private sector value added estimated by the Bank of Italy for the Italian economy in July 2020.[27]

Given that the Bank of Italy provides two growth rates of value added, corresponding respectively to an optimistic and pessimistic outlook, we will also obtain two different scenarios for the growth rates of net revenues, which will differ only in months starting from August 2020.

In firms' income statements, value added is the difference between revenues (r_t) and direct costs (c_t). In order to calibrate revenue shocks with a reference value added growth rate, we use our estimate of the elasticity of direct costs to variations in revenue. Through this, we transfer shocks to revenues to (monthly) direct costs, to obtain a (monthly) shocked value added. While these values are derived from the data for the months up to July, the remaining ones depend on our choice of β which in turn affects $g_{m,s}$ for $m \in \{8, \dots, 12\}$. Summing over all months, this provides a growth rate of aggregate value added which depends on β. We then choose the exact β, and therefore $g_{m,s}$ for $m \in \{8, , 12\}$, so that the growth rate of value added coincides with the reference aggregate forecast.

[25] Notice that this sectoral partition ($\{j\}$) is a refinement of the one used to compute elasticities ($\{s\}$).
[26] Thus, by choosing this specification, we impose that the time trend of revenue shocks is common across sectors, but that levels may differ.
[27] Bank of Italy, *Economic Bulletin no. 3*, 2020.

Figure A.1. Growth rate of revenues and value added

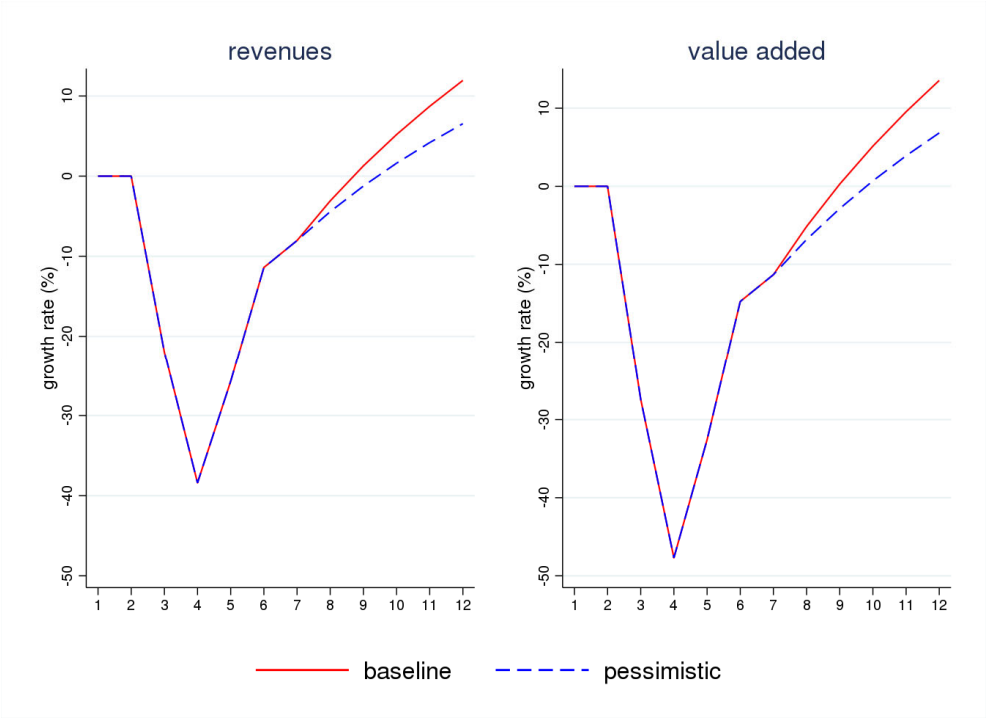


Figure A.1 reports the *aggregate* monthly growth rates of revenues and value added resulting from our calibration, both in the baseline and in the pessimistic scenario. Notice that our specification leads to forecasting a positive growth rate for 2020Q4. Because of differences in how accounting value added and macroeconomic value added are computed, and of the restrictions imposed by our elasticity-based model of transferring shocks from revenues to value added, in our setting observed revenues data would lead to a larger decline of value added in 2020Q2 with respect to the Bank of Italy macroeconomic forecast. Since we calibrate our unobserved shocks on the corresponding yearly forecast, our model must compensate the difference in value added decline by imposing positive results in the last quarter.

3. The effects of government measures

Our analysis provides predictions of end-of-2020 equity under the COVID-19 shock. Furthermore, we also quantify the potential effects of several measures enacted by the Italian government to counteract the pandemic's impact on the economy. In what follows, we illustrate our choices of modeling how these policies affect firms' accounting variables.

Short-time work schemes. The Italian government repeatedly extended the possibility for firms to reduce hours worked under the protection of short-time work schemes (labeled 'CIG' in this analysis, standing for *cassa integrazione guadagni*, even though the extension also involved other wage-supporting tools). These instruments allow firms facing a decline in revenues to reduce labor costs at a rate larger than they can through ordinary channels (e.g., layoffs or non-renewal of temporary contracts). We chose to model the presence of short-time work schemes by increasing the elasticity of labor costs to *negative* variations in revenues. However, since such tools cannot be used for all workers, we limited the value of this modified elasticity to 0.8. If a sector already has a 'natural' labor cost elasticity larger than 0.8, that value is retained even in the presence of the CIG. Hence the growth rate of labor costs for firms in sector a in any month m in which the CIG is available is

$$d\ell = \begin{cases} \eta_{\ell,s(a)} g_{m,a}, & \text{if} \quad g_{m,a} \geq 0 \\ \max\{0.8, \eta_{\ell,s(a)}\}\, g_{m,a}, & \text{if} \quad g_{m,a} < 0 \end{cases}$$

where $s(a)$ is the macro-sector (corresponding to the level of disaggregation at which elasticities are estimated) containing 2-digit sector a.

Three policy interventions allowed for an increasingly extensive use of the CIG:

- DL 18/2020 ('*Cura Italia*') and DL 23/2020 ('*Liquidità*') allowed for the use of the CIG throughout the months of March, April and May 2020.
- DL 34/2020 ('*Rilancio*') extended the possibility to use the CIG to June and July.
- DL 104/2020 ('*Agosto*') extended this possibility to the end of 2020.

Debt moratorium. Debt moratoria allow to postpone the payment of interests and capital instalments for a period of time. We assume that when the moratorium ends firms revert to their regular payments schemes, and do not have to pay additional amounts on top of their regular instalments. Thus, a moratorium that extends for *n* months will reduce the total amount paid in the year by a proportion of *n*/12.

However, debt moratoria introduced by the Italian government have the following characteristics:

- they only apply to interest and capital payments *on long-term debt*;
- they only apply to SMEs that did not have non-performing loans as of 28 February 2020.

We assume that the proportion of financial expenses relating to long-term debt over total financial expenditure is equal to the proportion of the size of long-term debt over total debt (δ_{long}). If a moratorium is introduced for n months, the yearly amount of financial expenses is

$$\iota_t^{\text{mor}} = \left(1 - \frac{n}{12}\right)\iota_t + \frac{n}{12}\left(1 - \delta_{\text{long}}\right)\iota_t = \left(1 - \frac{n}{12}\delta_{\text{long}}\right)\iota_t$$

for eligible firms.

As it happened with the CIG, debt moratoria were also progressively extended:

- DL 18/2020 ('*Cura Italia*') introduced a debt moratorium to last until the end of September 2020 ($n = 7$).
- DL 104/2020 ('*Agosto*') extended the moratorium to the end of 2020 ($n = 10$).

Recall that, ι_t will not be affected by the debt moratorium in the accounting method, as the whole amount of payments due remains written the 2020 income statement even if a fraction of payments are delayed to the following year.

Other measures. DL 34/2020 ('*Rilancio*') contained several measures besides the extension of the CIG. First, firms whose revenues in the previous year lay below €250mln obtain a refund on 40 per cent of production taxes ('IRAP'). Second, for the months of March, April and May 2020, firms that were subject to a decrease in revenues[28] above 50 per cent in a month receive a direct contribution of 60 per cent the amount of *rents* due that month. Third, firms whose revenues in the previous year lay below €5mln and were subject to a decrease in revenues above 1/3 in April 2020[29] receive a direct grant in proportion to the loss of revenues

- 20 per cent of the loss if previous-year revenues lay below €400,000;
- 15 per cent of the loss if previous-year revenues lay above €400,000 up to €1mln;
- 10 per cent of the loss if previous-year revenues lay above €1mln up to €5mln

These refunds, contributions, and grants are added directly to firms' cash flow.

[28] With respect to the corresponding month in 2019.
[29] With respect to April 2019.

Appendix B – Additional tables and figures

Table B.1. Early warning indices proposed by the Board of Accountants

Performance area	Index
Financial expense sustainability (coverage)	$\frac{\text{financial expense}}{\text{revenues}}$
Capital adequacy (leverage)	$\frac{\text{equity}}{\text{total debts}}$
Return on assets (profitability)	$\frac{\text{cash flow}}{\text{total assets}}$
Short-term liquidity	$\frac{\text{current assets}}{\text{short-term debt}}$
Incidence of social security and tax payables (debt towards institutional creditors)	$\frac{\text{social security and tax payables}}{\text{total assets}}$

Table B.2. Characteristics of firms entering a state of crisis (2018)

	median, in crisis	median, healthy	total, in crisis	total, healthy	%
total assets	0.20	0.53	20,408	2,766,551	*0.73*
workforce	2.42	3.00	161,553	8,422,075	*1.88*
ROA	-0.13	0.08			
leverage	0.68	0.39			
total exposure	0.16	0.29	7,925	703,173	*1.11*
age	7.00	11.00			
riskiness	1.00*	0.12*			

(*) Population averages. – *Total assets* and *total exposure* are measured in €mln. *Total exposure* refers to debts towards financial intermediaries reported in the Credit Registry. *ROA* is the ratio of EBITDA to total assets. *Leverage* is the ratio of total debts to total assets. *Riskiness* is a binary indicator of whether the firm's Cerved score above 6.

Table B.3. COVID-19 and undercapitalization (economic method)

	undercapitalized firms	% operating firms in 2018[1]	workforce (1,000s)	% workforce in 2018[1]	equity deficit[2] (€bln)	rescued firms (wrt to previous decree)	COVID rescues[3] (% of recovered firms)
in 2018[4]	47,977	7.2	334	3.6	12.1		
in 2020 w/out COVID	64,333	9.7	559	6.0	19.9		
in 2020 with COVID, no govt. measures	83,907	12.7	1,049	11.4	22.6		
CIG 9 weeks	82,342	12.4	993	10.7	22.3	1,565	89.4
Moratorium Sep 2020	83,045	12.5	1,044	11.3	22.5	862	62.4
DL 18 and 23/2020	**81,508**	**12.3**	**988**	**10.7**	**22.1**	**2,399**	**79.0**
CIG 18 weeks	79,737	12.0	853	9.2	21.7	1,771	84.4
IRAP	81,307	12.3	985	10.7	22.1	201	97.0
rents refund	79,305	12.0	958	10.4	21.8	2,203	96.9
direct grants	77,968	11.8	970	10.5	21.9	3,540	81.5
DL 34/2020	**74,015**	**11.2**	**800**	**8.7**	**21.2**	**7,493**	**82.8**
CIG end of 2020	73,483	11.1	717	7.8	21.0	532	90.2
Moratorium end of 2020	73,718	11.1	799	8.6	21.1	297	34.7
DL 104/2020	**73,176**	**11.1**	**716**	**7.7**	**20.9**	**839**	**70.1**

(1) The numbers from row 'in 2020 w/out COVID' onwards are computed excluding from the sample all firms that were active in 2018 and that we know to have gone out of business in 2019. However, percentages refer to the grand total as observed in 2018 (see Appendix A). (2) 'Equity deficit' is the amount needed to bring equity back to the minimum required by the law. – (3) 'COVID rescue' refers to firms rescued by the policy measures that were not already in a state of crisis in 2018. – (4) The numbers referring to 2018 do not exactly coincide with the ones reported in Table 3.1: shocks to revenues are defined at sector level, but some firms in the reference population are not associated to any sector and are therefore excluded from this exercise.

Table B.4. COVID-19 and undercapitalization (different scenarios)

	baseline			pessimistic		
	undercapitalized firms	**% operating firms in 2018**	**workforce (1,000s)**	**undercapitalized firms**	**% operating firms in 2018**	**workforce (1,000s)**
in 2020 with COVID, no govt. measures	94,252	14.2	1,164	97,503	15.1	1,232
CIG 9 weeks (DL 18 and 23/2020)	92,069	13.9	1,085	95,100	14.7	1,161
DL 34/2020	82,443	12.5	902	85,076	13.2	1,003
CIG end of 2020 (DL 104/2020)	81,795	12.4	812	84,255	13.1	856