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THE COVID-19 CRISIS WAS DIFFERENT: ASSESSING THE ITALIAN FIRMS IN TROUBLE THROUGH A NEW INDICATOR OF FINANCIAL SOLIDITY

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The Covid-19 crisis was different:
Assessing the Italian firms in trouble through a new indicator of financial solidity

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ABSTRACT

We present a new indicator of economic-financial solidity (EFSI) of Italian firms, considering profitability, solidity and firm liquidity, all evaluated in terms of their sustainability over time. On the basis of EFSI values, we classify firms in four classes, according to their degree of exposure to income and financial risks: Healty, Fragiles, At-risk, Highly at-risk. This indicator shows that in 2011-2020 a tightening process of economic and financial structure took place in the Italian business system, a trend that surprisingly continued also during the pandemic year. To investigate this, we consider the entry of firms into the Highly at-risk class ("downgrades") in 2019-20. Through a matching technique, we run two counterfactual exercises, estimating at a sector-firm size level what the downgrade rates would have been during the crisis of 2019-20 had the business system had the same economic-financial structure prevailing in 2011 (i.e. at the eve of 2011-12 crisis) or in 2019 (i.e. the last year of economic growth). By this way, we can evaluate whether, and to what extent, the financial support to firms during 2020 contributed to the resilience of the Italian business system. Our results show that, with respect to pre-Covid year, firm aids limited the negative consequences of the pandemic especially on the smaller firms (those more severely hit by the crisis); with respect the 2011-12 crisis, in several sectors support measures more than fully compensate for the negative effects of the pandemic notwithstanding its stronger economic impact on GDP than the previous crisis episode.

Keywords: Covid-19; Economic-financial solidity; Firm aids; Mahalanobis-metric matching
JEL Classification: G01; H12; H81; H84; L60; L80

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1. Introduction

The Covid-19 pandemic spread rapidly, affected people and economies across the world and pushed countries into the worst recession since World War II. However, the economic effects have been far from uniform: the severity of the impact has been different in timing and intensity across countries, industries, firms, and people (OECD, 2021).

Among European countries, Italy (along with Spain and Greece) suffered the strongest recessionary impact (GDP registered -9.0% in 2020), so much so as to generate deep concerns about the resilience of its business system. These fears were certainly not unfounded, also based on the peculiarities of Italy's business system, which is made up of an extremely high number of small enterprises (in 2019 over 99% of total firms had less than 50 workers; 95% less than 10). Indeed, the literature has shown very clearly that, as events such as the 2008-09 Global Financial Crisis and the Covid-19 pandemic revealed, small and medium-sized enterprises (SMEs) are particularly vulnerable to crises and shocks. Demand and supply-side interruptions, business contraction and economic losses, restricted access to finance and restrictions on physical movement are just some of the consequences firms, and SMEs in particular, face from exogenous shocks (Adian et al., 2020; Chowdhury, 2011; for a survey see Miklian & Hoelsher, 2022).

Nevertheless, the pandemic crisis seems to have barely affected the structure of the Italian business system: with refer to the sub-population of firms with at least one employee (approximately 1.5 million units in 2019), which is of great importance in the Italian economy (in 2019, they accounted for approximately 36% of the total number of firms, 82% of workers and 89% of value added), in 2020 the number of firms compared to 2019 was lower (less than 1.4 million units, accounting for about 31% of total firms), but they still accounted for 81% of workers and 88% of total value added). In other terms, the economic relevance of firms lost during the crisis was very limited. Finally, in 2021 the number of these firms was slightly lower than in 2019, while the number of employees was higher (Istat, 2023a).

This resilience, surprising in light of the strong recessionary impact of the pandemic, may have benefited from two important factors. On the one hand, firms were able to benefit to an exceptionally large extent from support measures – fiscal and monetary – that may have significantly affected their ability to survive and, more generally, their economic-financial solidity.[1] These measures have had a clear impact on firm failures: available data show that the number of bankruptcies in the Italian business system continued on a downward trend both during the 2020 and also in subsequent years (Istat, 2023b). On the other hand, on the eve of the pandemic, Italian firms had a more solid economic and financial structure than at the beginning of the last decade, thanks to the progressive strengthening that characterized the phase of cyclical recovery following the 2011-2013 crisis (Istat, 2017; Bugamelli et al., 2018).

The goal of this paper is to investigate whether, and to what extent, the financial support to firms contributed to the resilience of the Italian business system. To do this, we propose a synthetic indicator of the economic-financial solidity of Italian firms; after showing its dynamics over the last decade, through a counterfactual exercise we analyse the extent to which Government aids have contributed to limit the spread of critical financial situations among Italian firms.

There are at least two strands of literature closer to the aim of our work. The first one is related to works studying the structural, behavioral and finance-related factors that can make firms, and therefore economies, more resilient to severe exogenous shocks; the second one is related to the role of financial support to firms in times of economic crisis, in particular during the recent pandemic period.

Many recent papers try to measure the impact of Covid-19 on countries, industries, firms and workers, whose heterogeneous characteristics may amplify or mitigate the direct effects of the crisis and/or determine the resilience of economies to exogenous events. At the firm level, there are several characteristics that seem to be relevant to increase the resilience to an exogenous shock: business dynamics, financial solidity, innovation, and digital technology, among others, are all factors that helped economies be resilient to Covid-19 shock (OECD, 2021). As for the purpose of this work, we are more interested in the first two elements of this list. Considering business dynamics (in terms of firm entry, growth, and survival), the pre-crisis period has been characterized by an increase in the productivity gap between leaders and laggards, declining entry rates, job reallocation, and increasing industry concentration (Bajgar et al., 2019). These trends may be grounded in a lack of capabilities and incentives for younger and smaller firms to innovate and adopt new technologies (Calvino et al., 2020). Furthermore, pre-crisis heterogeneity in firm size and age is likely to affect the

[1] For a detailed list of the Government support measures introduced in Italy in 2020 see Piva and Guerini (2023, Table 7).

vulnerability to the financial shock caused by the crisis. Indeed, smaller and younger firms are often more financially constrained and are not usually equipped with financial cushions to allow them to survive a prolonged period of reduced activity or revenues (OECD, 2020; Bartik et al., 2020; WTO, 2021). This suggests that these firms, which under normal circumstances are an important source of innovation, employment, and productivity growth (Calvino et al., 2015), are particularly sensitive to economic shocks (Adelino et al., 2014). Considering the well-known peculiarities of Italian firms, characterized by a very low average size, this could have penalized Italian business system more than other economies' ones.

As for financial solidity concern, high levels of corporate debt, particularly corporate bonds, emerged in the pre-pandemic period (Çelik et al., 2019). This increase in debt amplified financial pressures during the Covid-19 outbreak (Aramonte & Avalos, 2020), with highly indebted firms predicted to suffer from stronger impacts on leverage ratios and future investment (Demmou et al., 2021). High pre-crisis corporate debt could therefore be considered an aggravating factor for the risk of debt overhang. Furthermore, micro-, small- and medium-sized enterprises have suffered more than larger firms from the effects of the pandemic, owing to their limited access to finance (WTO, 2021). With specific refer to Italy, Costa et al (2022) show that all these factors are important in shaping Italian firm solidity during Covid-19 crisis: their results measure the role of economic size (a broader set of size-related indicators such as firm's workers, capital intensity, age, turnover), past firms' performance, digitalization, innovation, internal and external organization.

Other works analyse the importance of firm liquidity to ease the impact of economic crises. As for the 2008-09 financial crisis, Campello at al. (2011) show how companies substitute between credit lines and internal liquidity (cash and profits) when facing a severe credit shortage. Looking at real-side decisions, they find that credit lines are associated with greater spending when companies are not cash-strapped; firms with limited access to credit lines, in contrast, appear to choose between saving and investing during the crisis. Using a broad sample of international firms from 37 countries, Lang and Muffet (2011) show that firms with greater transparency (based on accounting standards, auditor choice, earnings management, analyst following and forecast accuracy) experience less liquidity volatility. Results are particularly pronounced during crises, when liquidity variances, covariances and extreme illiquidity events increase substantially, but less so for transparent firms.

Looking more closely at Italian firms in the pre-Covid period, Dottori and Micucci (2018) analyse the evolution over time and the determinants of corporate liquidity in Italy. Using a very large sample of firms for the period 2002-2015 (about 460,000 firms per year on average), they document a substantial increase in cash holdings since 2011, decomposing it into the contributing factors common to all firms, the cash determinants at firm level, and the changing composition of firms' fixed factors. Among firm-specific variables, major contribution was associated to the fall in investments as firms reduced their capital expenditure by a sizeable amount and showed a higher propensity to cumulate cash when they refrain from investing; in 2015, a growing role was played by the improvement in cash flows and the enhanced deleveraging process. Italian firms were also characterized by undercapitalization (i.e., firms that would not at present be able to cover all debt even by selling all assets). Orlando and Rodano (2020) show that the onset of undercapitalization often anticipates business termination: in 2010-2018, on average around 8.5% of Italian companies were undercapitalized. Covid-19 epidemic may have impacted on that share: authors estimate that, also taking into account policy interventions enacted by the government, undercapitalized firms at the end of 2020 may exceed 12%.

As for the financial aid to firms in times of Covid-19 crisis, first available works suggests that the gravity of the Covid-19 crisis was such (Baker et al., 2020) that it could potentially have devastating economic and social consequences. The economic crisis triggered by the spread of the Covid-19 is radically different from past economic and financial crises: this time the shock did not originate in the financial sector and was not the result of financial intermediaries or companies behaving irresponsibly due to ex-ante moral hazard (Kaminsky & Reinhart, 1999, Reinhart & Rogoff, 2009). The uniqueness of the current crisis has led to label it a metaphorical 'Black Swan event' for entrepreneurship (Kuckertz et al., 2020), as it encompasses virtually every sector and every country spanning the entire global economy simultaneously (Goodell, 2020).

In this situation, government aid to firms has been crucial. Several proposal has been advanced about Governments role during the pandemic: among others, they should ensure to absorb losses (Beck, 2020), act as a payer of last resort (Saez & Zucman, 2020), finance shield packages aimed at supporting firms, especially those in financial distress (Bénassy-Quéré et al., 2020; see Didier et al., 2021 for a survey). Furthermore, academic and policy debates discussed firm financing

during the pandemic. At least three points emerged: 1) it is important to support firms to maintain their organizational capital during an exogenous crisis such as the pandemic one; this can allow for a quicker economic recovery once the crisis is over. In other terms, firms' relationships with key stakeholders (e.g., workers, suppliers, customers, and creditors) should be preserved because they are costly and time-consuming to build, maintain, and adjust (Kahn & Wagner, 2021); 2) firms can benefit from "hibernation," incurring the minimum bare expenses necessary to withstand the crisis while using credit to remain alive (Didier et al, 2021); 3) however, concerns have raised as to whether these measures might also have benefited firms that would have probably ceased to exist even without the pandemic (*zombie* firms), by keeping them artificially alive. In this case, the Schumpeterian "creative destruction" may be put into danger by an over generous policy response. First empirical results point out that creative destruction has been partially frozen but not distorted in France (Cros et al., 2021); in Germany, this "cleansing effect" is hampered in the current crisis as the largely indiscriminate granting of liquidity subsidies and the temporary suspension of the duty to file for insolvency have caused an insolvency gap that is driven by firms which were already in a weak financial position before the crisis (Dorr et al., 2021). First results for Italy show that, compared with other firms, zombie firms have exited the market more and had a lower take-up of support measures, concluding that the Government's policies are unlikely to have amplified such a trend (Pelosi et al., 2021).

In this work we are not interested in investigating whether aids to Italian firms during the pandemic have also helped zombie firms. Our view is that in liberal economies, Government's policies have to assist firms in coping with major market disruptions and safeguard their transition to better economic circumstances, especially when the type of the shock is not economic (like in the case of a natural disaster or a pandemic). In these cases, the Schumpeterian view that only the least productive firms are affected by recessionary shocks (i.e. creative destruction) does not necessarily apply because these shocks affect firms regardless of their economic-financial conditions or structural characteristics (size, sector, etc.). We are rather interested in understanding the overall role of aids to Italian firms in avoiding a deterioration of general firms' economic and financial conditions – in terms of profitability, solidity and liquidity as summarized by the synthetic indicator we propose in this paper – which might potentially hamper their survival, possible recover and growth.

The rest of the paper is organized as follows. In Section 2 we briefly describe the data. Section 3 presents a synthetic indicator of the economic-financial sustainability of Italian firms, analysing its trend over the 2011-2020 period; particular attention is paid to the last pre-pandemic growth period (2018-19), the sovereign debt crisis (2011-12) and the Covid-19 pandemic (2020). Section 4 presents the empirical strategy; Section 5 shows and comments on the results; Section 6 provides conclusions.

2. Data sources

The database at the origin of this work is built by integrating the balance sheets of the incorporated companies ("società di capitali")[2] operating in Italy between 2011 and 2020 and the Istat business register "Frame-Sbs". This latter, in particular, is the corner-stone dataset for Italian official structural business statistics. Developed by Istat, it relies on administrative data to provide, on a yearly basis, information on the structure (number of workers, business sector, location, age, belong to a group) and on the main variables from the profit and loss account (value of production, turnover, value added, labour cost) for all of the about 4.4 million of Italian firms (Luzi & Monducci, 2016). In 2019, Italian incorporated companies accounted for 21.5% of the total production units, 61.4% of the workforce, 79.7% of total value added, 86.6% of the total turnover of the business system. While the overall average size is extremely small (the average number of workers in 2019 was 3.9), Italian incorporated enterprises are larger (11,4 workers on average); it follows that these companies are also more productive, with a value added per employee of around 49,000 euros, 54.3% higher than the average. In 2020, the incorporated companies accounted for 22.4% of total firms, 57.2% of workforce, 75.6% of total value added, 81.5% of total turnover, with an average size (9.9 workers) lower than in pre-crisis period and a higher labour productivity (nearly 57,000 euros of value added per worker).

[2] In this work we use the term "incorporated companies" to indicate the Italian business forms known as 'società di capitali', including joint-stock companies ('società per azioni'), limited liabilities companies ('società a responsabilità limitata') and simplified limited liabilities companies ('società a responsabilità limitata semplificata'). All these business have to provide copy of the financial statement to the Register of firms at the local Chamber of Commerce.

The balance sheets of the incorporated companies were suitably reclassified in order to derive a series of indices, on which compliance with the main economic-financial ratios was verified, starting with the breakdown of ROE and ROI. Co-operative firms were excluded from the analysis as their performance is based on criteria of prevalent mutuality.

3. A synthetic indicator of firms economic-financial solidity

In this work, we present a new synthetic indicator related to the degree of economic-financial solidity of Italian firms. Following a consolidated practice and indications from accounting literature (Tirole, 2006; Damodaran, 2010), it is built taking into consideration three areas of economic-financial performance: profitability, solidity and firm liquidity, evaluated in terms of sustainability over time.

In particular: a) by "sustainable profitability" we mean the company's ability to obtain an operating profitability (ROI) higher than the average cost of borrowed capital; b) by "sustainable solidity" we mean the company's ability to resist unfavourable market trends thanks to an adequate level of debt and a good correlation between financing sources and uses; c) by "sustainable liquidity" we mean the company's ability to maintain a level of liquidity that can adequately cover short-term financing sources.

For each of the three performance areas, the practice of financial statement analysis has identified threshold values on the basis of which it becomes possible to formulate a positive or negative judgement on the level of sustainability of profitability, solidity and liquidity of individual firms (see Appendix B for details). On these premises, a synthetic indicator of economic-financial solidity (EFSI) is obtained, combining the judgments of sustainability of each of these three elements; we assign values between -1 and 1 to these combinations (see Table 1), considering an implicit set of weights that gives more relevance to profitability with respect to solidity and more relevance to solidity with respect to liquidity. Then we classify firms in four classes, characterized by a different degree of sustainability of its three components and thus by a different exposure to income and financial risks (Table 1): Healthy, Fragile, At-risk, Highly at-risk.

Table 1. The Economic-Financial Solidity Indicator (EFSI) and its components

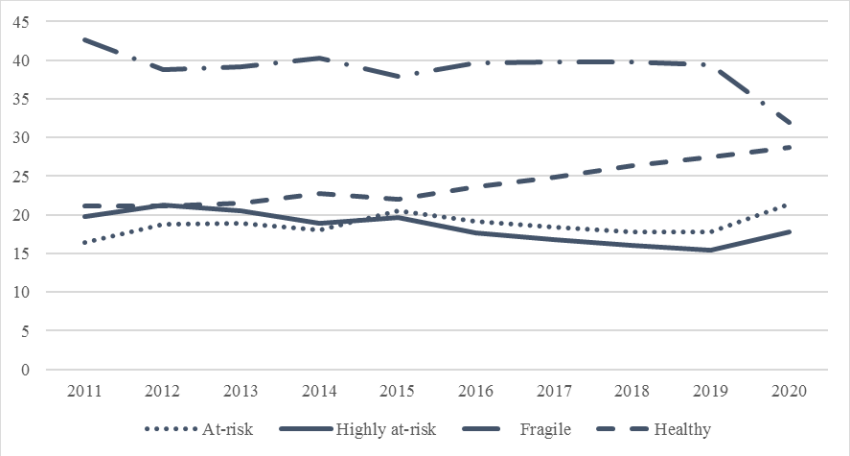
	EFSI values	Profitability	Solidity	Liquidity
Healthy	1.00	Sustainable	Sustainable	Sustainable
Fragile	0.75	Sustainable	Sostenibile	Not sustainable
	0.50	Sustainable	Not sustainable	Sostenibile
	0.25	Sustainable	Not sustainable	Not sustainable
At-risk	-0.25	Not sustainable	Sustainable	Sustainable
	-0.50	Not sustainable	Sustainable	Not sustainable
	-0.75	Not sustainable	Not sustainable	Sustainable
Highly at-risk	-1.00	Not sustainable	Not sustainable	Not sustainable

Source: elaborations on Istat data.

Figure 1 shows the distribution of the four components of EFSI indicator between 2011 and 2020. Firstly, it is worth noticing that this indicator captures the tightening process of economic and financial structure of Italian business system, previously recalled, started after the 2011-2013 crisis. This process is clearly shown by the trend in the four components of the index: the share of Healthy firms constantly increased; on the contrary, Highly at-risk share decreased continuously since 2012. Secondly, in the pandemic year the EFSI dynamic is unexpected: the share of fragile companies declines

drastically; all other classes increase their weight. In a year characterized by a recession of such an extraordinary intensity as 2020, the increase of the shares of At-risk and Highly at-risk firms is not surprising, while it is noteworthy the increase of Healthy units share, which reach a peak over the decade.

Figure 1 - The financial sustainability of Italian firms according to the EFSI, 2011-2020 (composition; %)



Source: Authors' elaborations on Istat data.

However, 2020 dynamic could have been affected by the substantial support measures activated during that year. One example is given by the Government aids for firm liquidity (see e.g. De Mitri et al., 2021), which may have fostered the increase of healthy units and limited the consequences of the turnover losses, allowing for an improvement in the degree of corporate solidity and/or liquidity (Orlando & Rodano, 2022). In this vein, the increase of the share of Highly at-risk firms in 2019-20 could have been much higher without the introduction of financial aids. Another example is provided by the set of measures which eliminated the firm capital depreciation in 2020 and 2021, alleviating the burden of depreciation and increasing the value of the capital.

The empirical strategy of this paper consists in using the EFSI to assess how Government aids to firms during the pandemic helped limit the deterioration of firms' economic and financial conditions. In this respect, the condition of Highly at-risk company deserves special attention, since even in non-recessionary cyclical phases it appears to be closely correlated with the risk of insolvency. Highly at-risk companies, in fact, have a higher probability of entering insolvency proceedings[3] even in years of an expansive business cycle: for example, 5% of firms that were Highly at-risk in 2018 entered insolvency proceedings in the following twelve months, compared to 2.4% of At-risk companies, 0.6% of Fragile companies and 0.8% of Healthy companies[4].

4. Empirical strategy

To our purposes, we define "downgrade" the entry of firms into the Highly at-risk class in a two-year period. The dynamics of the shares of downgrades[5] since 2011-12 is reported in Figure 2. It emerges that during the business cycle

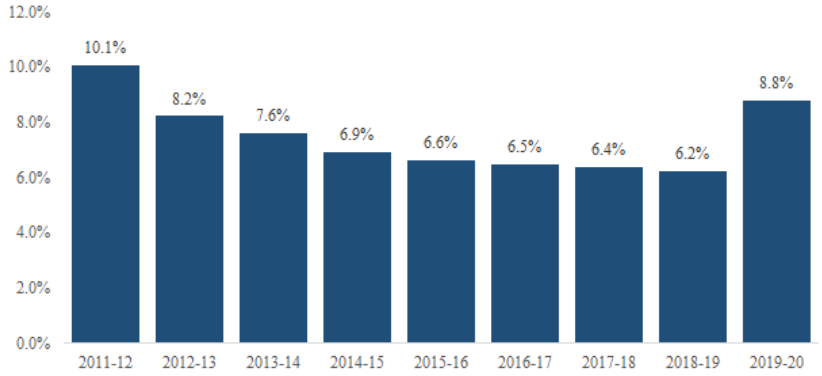
[3] Insolvency procedures are instruments for managing business crises, which are triggered when a company is unable to meet its obligations with the means of payment normally used. The main instruments are bankruptcy, compulsory administrative liquidation, extraordinary administration, composition with creditors, debt restructuring agreements, and receivership. The data reported in the text are based on the information contained in the Movimprese - information on insolvency proceedings archive, source CCIIA (Italian Chambers of Commerce).

[4] The higher share of entries into insolvency proceedings recorded among Healthy enterprises compared to Fragile ones is due to the greater prevalence of the former among small enterprises (in 2019, the share of healthy enterprises was 33.7% for micro enterprises and 30.4% for units with at least 10 employees).

[5] The share of downgrade is as follows: $down_{t_0,t_1} = \frac{\sum_i^n trans_{i,t_0,t_1}}{N_{t_0,}}$, where $trans_{i,t_0,t_1}$ is the transition of firm *i* to the "Highly at-risk" class between year t_0 and year t_1; $N_{t_0,}$ is the total number of firms in t_0.

recovery of the last decade, the share of downgrades has been decreasing, as a result of the strengthening process mentioned in Section 1. In 2019-20, due to the pandemic outbreak, the share increased again. However, notwithstanding the much deeper GDP fall due the pandemic crisis (-9.0% in GDP growth rate with respect to -3.0% in 2012), the share of downgrade was lower than in 2011-12 crisis (8.8% *vs.* 10.1%). At least two factors may have helped the resilience of enterprises, explaining this results: first, the improvement of firms' financial conditions during the decade; second, the far-reaching aid scheme put in force by Italian Government in order to support firms.

Figure 2 – Share of downgrades (entries into the Highly at-risk class) (a)



(a) Percentage of firms entering the Highly at-risk class between year *t* and year *t+1* on the total of firms of year *t*.
Source: Authors' calculations on Istat data.

As mentioned before, this latter aspect is the focus of this work. In particular, in order to assess the effectiveness of financial support measures, we compare the share of downgrades observed during the first pandemic year (2019-20) with those recorded during the previous crisis (the public debt-related one in 2011-12) and during the most recent growth period (2018-19).

Furthermore, to take into account the wide heterogeneity existing in the Italian business system and the peculiarities of the pandemic crisis (e.g. administrative lockdowns, which had very different effects among sectors and type of enterprises), it is necessary to carry out the analysis by sector and firm size classes. In doing so, we also classify sectors to reflect the heterogeneity observed in the effects of Covid-19 on Italian firms (see e.g. Costa et al., 2023; Orlando & Rodano, 2022). Groups of sectors are based on EU's NACE Revision 2 classification scheme (European Union, 2006) as reported in Table 2.

Table 2 – The sectors groups generated from the EU Nace Revision 2 divisions

	Sectors	Nace rev. 2 Divisions
1	Business-related services	58–63, 68–82
2	Other Industry	5–9, 13–19, 23–25, 31-33, 35-39, 41-43
3	Wholesale and retail trade	45–47
4	Education, health and social services	85-88, 94-96
5	Accommodation & catering	55, 56
6	Logistics and transport	49–53
7	Creative industry and entertainment	90–93
8	Mechanical engineering	28–30
9	Food production	10, 11
10	Chemicals and pharmaceuticals	20–22
11	Electronics and electrical equipments	26, 27

The shares of downgrades for each of these sector groups are showed in Table 3. There emerges that the trends in downgrades observed for the business system as a whole (Figure 2) generally applies also to the sector-size class combinations: with few exceptions, a decrease in the shares of downgrades between 2011-12 and 2018-19 is followed by an increase during the pandemic year, with shares remaining below the 2011-12 crisis levels. This does not occur in three sectors – Education, health and social services, Accommodation and catering, Creative industry and entertainment – where the percentages of downgrades in 2019-20 were higher (and for the latter two sectors much higher) than in 2011-12. This result is consistent with the evidences showing that these activities are those which suffered the most from the consequences of the pandemic crisis.

Table 3 – Share of downgrades, by size class and sectors

Sectors	Time	Size class			
		Micro	Small	Medium/large	Total
Business services	2011-2012	8.5	9.7	10.8	8.7
	2018-2019	5.1	4.9	5.7	5.1
	2019-2020	6.2	7.3	8.5	6.4
Other Industry	2011-2012	10.2	12.9	14.1	11.2
	2018-2019	5.1	4.8	6.7	5.1
	2019-2020	7.2	7.8	9.7	7.5
Trade	2011-2012	10.5	12.4	12.1	10.9
	2018-2019	5.6	4.8	4.9	5.4
	2019-2020	8.7	8.5	8.8	8.7
Education, health and social services	2011-2012	10.5	9.9	9.8	10.3
	2018-2019	11.2	9.4	6.6	10.6
	2019-2020	11.1	10.7	12.4	11.1
Accommodation and catering	2011-2012	13.6	15.4	11.5	14.1
	2018-2019	7.5	7.5	9.3	7.7
	2019-2020	21.4	26.9	30.5	23.2
Logistic and transport	2011-2012	12.1	13.4	14.0	12.7
	2018-2019	10.2	8.9	6.7	9.9
	2019-2020	9.8	9.7	12.4	10.0
Creative industry and entertainment	2011-2012	13.3	14.2	14.9	13.5
	2018-2019	10.2	8.9	6.7	9.9
	2019-2020	17.0	22.5	25.3	18.0
Mechanical engineering	2011-2012	10.2	10.1	9.3	10.1
	2018-2019	5.5	4.2	5.2	4.9
	2019-2020	7.6	7.6	6.7	7.5
Food and beverage	2011-2012	10.0	12.0	10.2	10.8
	2018-2019	8.1	6.6	8.0	7.5
	2019-2020	11.1	9.8	8.0	10.3
Chemicals, pharmaceuticals, Rubber/plastics	2011-2012	11.9	11.5	9.2	11.3
	2018-2019	6.8	4.3	4.5	5.4
	2019-2020	7.2	5.3	6.5	6.3
Electronics and electrical equipments	2011-2012	9.1	11.9	9.4	10.3
	2018-2019	5.7	3.8	4.5	4.8
	2019-2020	8.5	6.6	6.5	7.5
Total	2011-2012	10.1	12.2	11.9	10.7
	2018-2019	6.1	5.5	6.3	6.0
	2019-2020	8.8	10.1	10.3	9.2

Source: Authors' calculations on Istat data

Finally, the analysis is limited to only those firms survived each of the two years considered. In other words, the exercise here proposed does not take into account the effect related to business demography. Since we are comparing very different two-year periods – in terms of business cycle conditions and, with refer to 2011-12, distance in time – we need to adopt an empirical strategy able to make the firms operating in the two couples of periods as more homogeneous as possible. This is obtained by applying a matching procedure.

In doing so, we propose two counterfactual exercises, estimating what the downgrade rates would have been during the crisis of 2019-20 had the business system had the same economic-financial structure prevailing in 2011 (i.e. at the eve of 2011-12 crisis) or in 2019 (i.e. the last year of economic growth). In this way we are able to compare, on homogeneous bases, the 2019-20 shares of downgrades with those of 2011-12 and 2018-19. This double exercise allows to assess the

effectiveness of Government aids during the pandemic year in limiting the negative effects of the crisis on downgrades, both with respect another crisis and a growth two-year period. However, we are not able to separate the (positive) effect of Government aid on downgrades from the (negative) effect of the crisis on downgrades: for this reason, we call the net effect measured in this exercise "crisis-aid" effect.

To calculate this latter, we use the matching technique; the basic idea of this procedure is to find firms as similar as possible in terms of economic and structural characteristics. Once controlled for these characteristics, possible differences in downgrade rates should be explained by the different extent and nature of recessions and aids to firms in the two periods considered.

As already mentioned, we run our empirical analysis at a sector-size level to control for the heterogeneous impact of Covid-19 pandemic on firms of different size and in different sectors; we combine the industry groups in Table 2 and three-size classes (1-9 employees; 10-49 employees; 50+ employees), estimating the "crisis-aid effect" within each of the 33 sector-size combinations. Due to the size distribution of Italian firms, where micro and small firms are largely predominant and large firms are very few, we combine the two classes of medium-sized and large firms into one single group.

As for the economic and structural characteristics, our specification, for each of the 33 sector-size combinations, is the following:

$$X = (LSize_i, MN_i,\ LVP_i, LDA_i, LVA_i,\ LFC_i\ , LCI_i, LEq_i) \qquad (1)$$

where prefix *L* stands for logarithm, $Size_i$ is the firm size (in terms of number of workers), MN_i is a dummy variable indicating whether the firm belongs to a domestic or a Multi-national group, VP_i is the value of production, DA_i is the debt-asset ratio, VA_i is the value added, FC_i the financial charges, CI_i is the capital intensity (in terms of fixed asset-to-employee ratio), Eq_i is the shareholders' equity.

We run our procedure separately to compare two pairs of periods: 2019-20 and 2011-12, 2019-20 and 2018-19. Furthermore, for each variable in *X* we additionally impose a caliper, *c*. Depending on the number of total observations at a sector-size level, the caliper ranges from 0.001 to 1.6.

We conduct a Mahalanobis matching approach (Rubin, 1980). This matching algorithm selects for each 2019-20 firm *i*, the *k* nearest neighbors from 2018-19 and 2011-12 periods which have the smallest distance from *i*. In our case, we set *k* = 3. In doing so, we opt for matching with replacement, allowing for pre-pandemic units to match to more than one pandemic observation.[6]

Distance is measured by the Mahalanobis distance metric, MD, which is computed on all predictor variables:

$$\mathrm{MD}_{ij} = \begin{cases} (X_i - X_j)\,\Sigma^{-1}(X_i - X_j)\ if\ |X_i - X_j| \le c \\ \infty \qquad\qquad\qquad\qquad if\ |X_i - X_j| \le c \end{cases} \qquad (2)$$

In case that there is no control observation fulfilling the caliper condition, there may even be no match. If this is the case, the crisis observation for which no match could be found is disregarded from further analysis.

The difference between the downgrades of 2019-20 and those of 2011-12 and 2018-19 – calculated among the matched units – is our "crisis-aid effect": if the difference is positive (downgrades of firms in 2019-20 are higher than those of firms in the pre-pandemic reference period), it means that the impact of the pandemic crisis (which, ceteris paribus, increased the share of downgrades) was greater than that of Government aids (which decreased the share of downgrades); conversely, if the difference is negative (downgrades in the pandemic period are lower than those in the pre-pandemic reference period), it implies that the impact of aids on downgrades was greater than that of the pandemic.

[6] In other words, a 2011-12 (or 2018-19) observation *j* only falls under the 3 nearest neighbors if its distance from the 2019-20 observation *i* – i.e. the difference between its financial/economic conditions and those of observation *i* – does not exceed the caliper on *X*.

5. Results

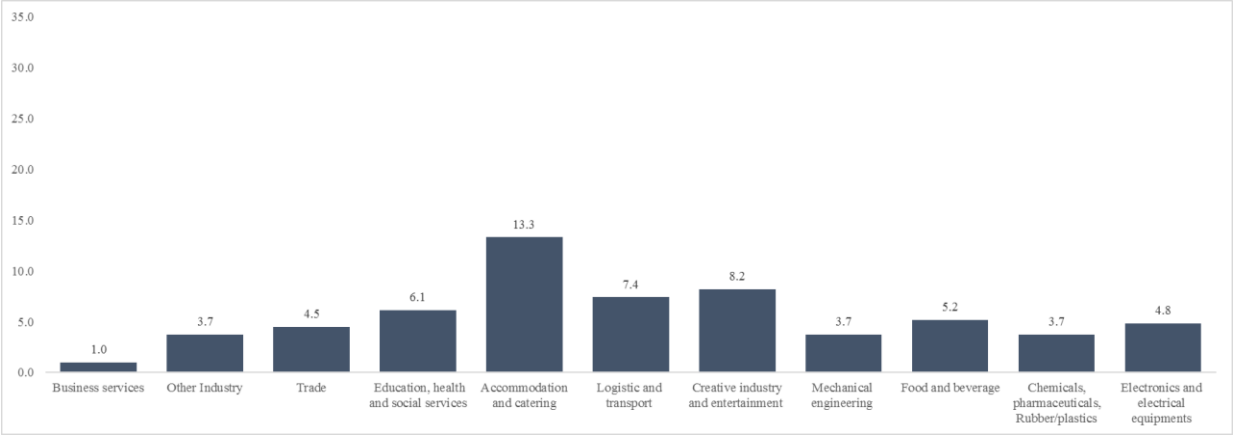
The tests show that the comparison of share of downgrades has been made on well balanced subsets (see Table B1 in Appendix B). Results are reported in Figures 3 and 4, by firm size class and sector, where only the differences in downgrades with statistical significance are considered.

The first element to highlight is that, with respect to the percentages of downgrades observed in 2018-19 (Figure 3), for all sectors and size classes the 2019-20 values are always higher, so that the differentials are positive. On the one hand, this is consistent with the very different business cycle phases included in the two period: growth in 2018-19, severe crisis in 2019-20. On the other hand, aggregate results (see Figure 1) are confirmed also at sector level, indicating that, for each sector-size combination, the Government aids have at best mitigated, but not eliminated, the negative effects of the pandemic recession, in this paper represented by the absence of a substantial increase in the entries into the class of Highly at-risk firms.

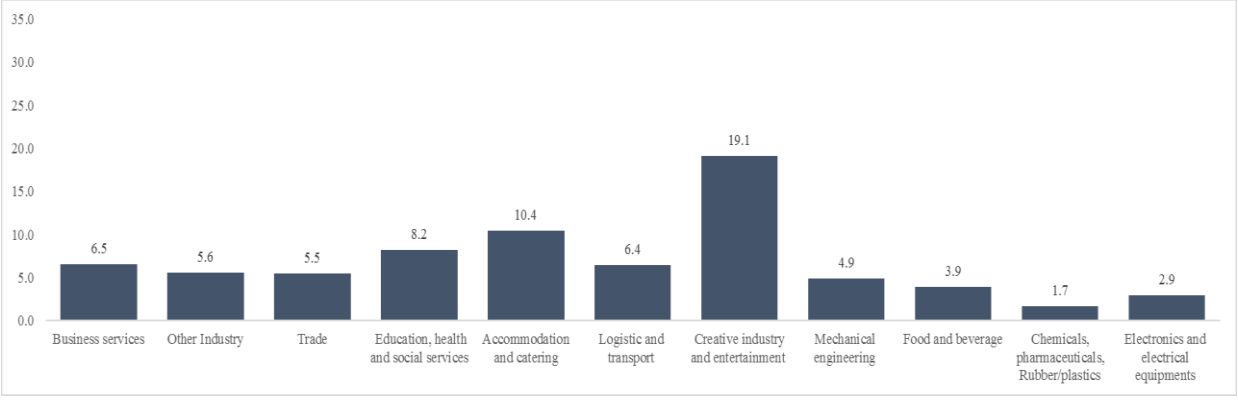
However, results are highly heterogeneous: the amount of differentials changes across sectors and size classes, being in most sectors lower for micro and small enterprises with respect to larger firms. To the extent that, as mentioned in Section 1, the smaller size classes have been more severely hit by the crisis, this result is a clue of effectiveness of the firm support measures in limiting the economic impact of pandemic. At the same time, notwithstanding the considerable amount of aids, for each size class the differentials are higher in correspondence of the sectors which suffered the most from the crisis: Accommodation and catering and Creative industry and entertainment, and Education, health and social services. In the first two sectors, finally, the differentials are much lower for micro and small enterprises, indicating that the Government measures may be more effective in supporting the economic and financial conditions of smaller firms.

Figure 3 – The crisis-aid effect on downgrades, by sector and size class; 2019-20 *vs*. 2018-19 (percentage points)

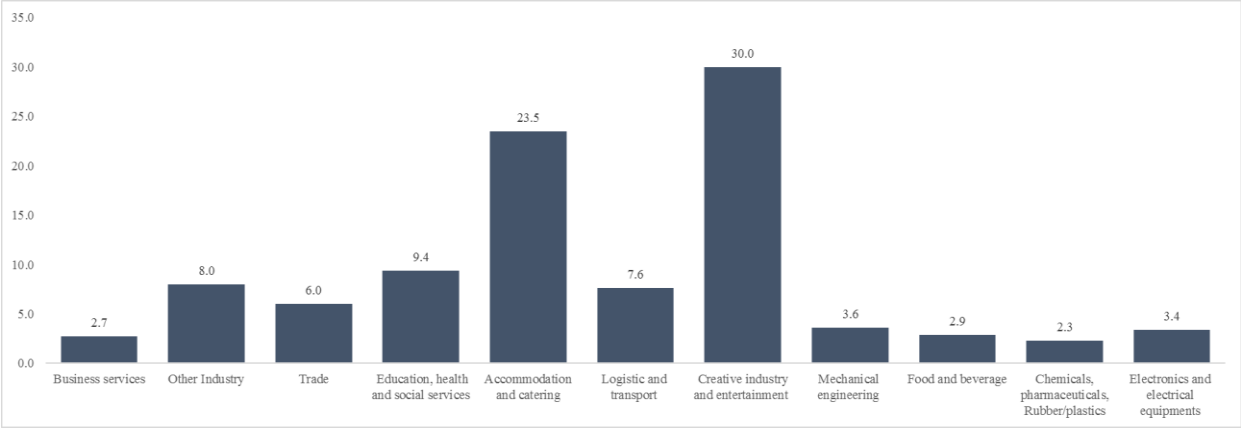
a) Micro-enterprises (<10 workers)



b) Small enterprises (10-49 workers)



c) Medium and large enterprises (>= 50 workers)



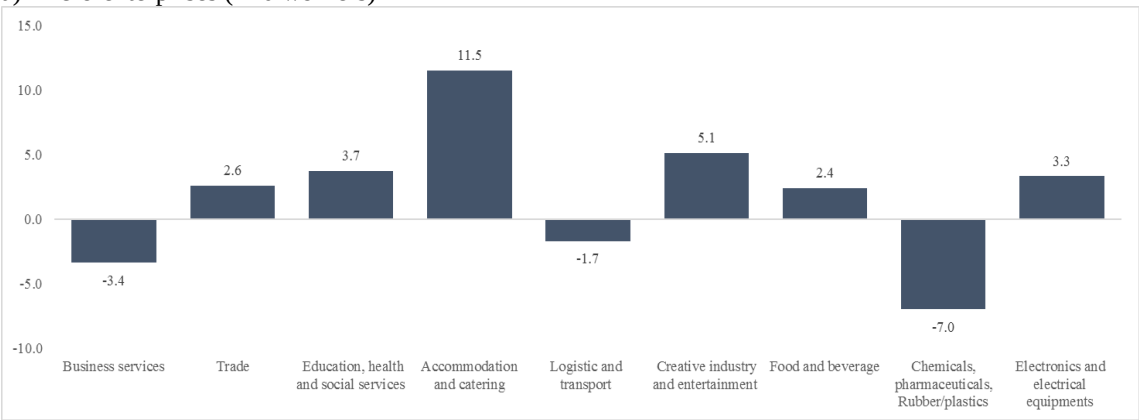
Source: Authors' calculations on Istat data

A comparison between 2019-20 and 2011-12 crises (Figure 4) provides further evidence about the role played by Government aids. As mentioned before, the 2019-20 crisis, although concentrated in a few months of the year, had a more severe impact on GDP than the 2011-12 crisis; if the economic-financial conditions had been equal, therefore, a stronger negative effect on downgrades could have been expected. In this context, possible negative differentials would be evidence of the role played by aid measures.

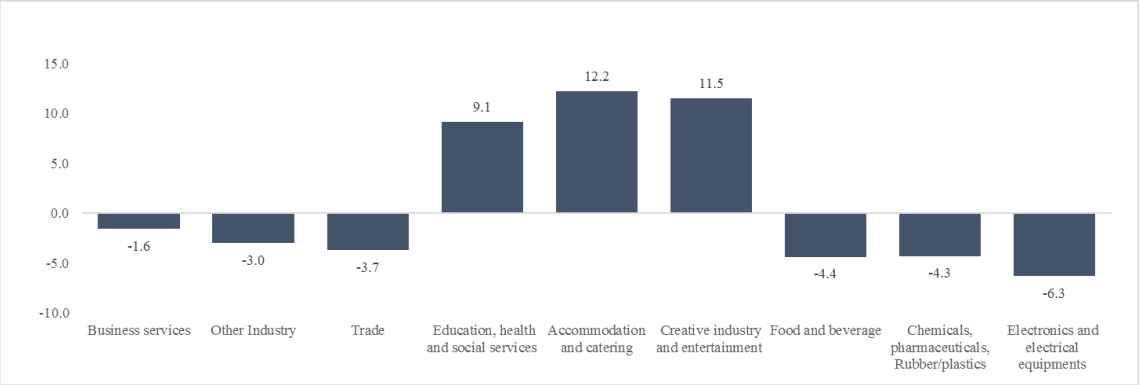
In all size classes there are cases in which this occurs. Among micro enterprises, for example, the differentials are negative for firms operating in Business services, Logistics and transport, Chemical, pharmaceutical, rubber and plastics. In other terms, the firm structure being equal, the impact of the 2019-20 crisis on economic and financial conditions of enterprises – also due to the state aid scheme – has been milder than in 2011-12. In other seven sector this did not occur, particularly, again, for micro firms operating in Accommodation and catering, Creative and entertainment and Education and health sectors. As for the small firms, these three latter activities are the only ones where the shares of downgrades in 2019-20 are higher than in 2011-12 (Figure 4b). In other six sectors (Other industry, Trade, Food and beverage, Electronics and electrical equipment), on the other hand, the differentials are negative, suggesting more effectiveness in Government measures.

Figure 4 – The crisis-aid effect on downgrades, by sector and size class; 2019-20 *vs*. 2011-12 (percentage points) (a)

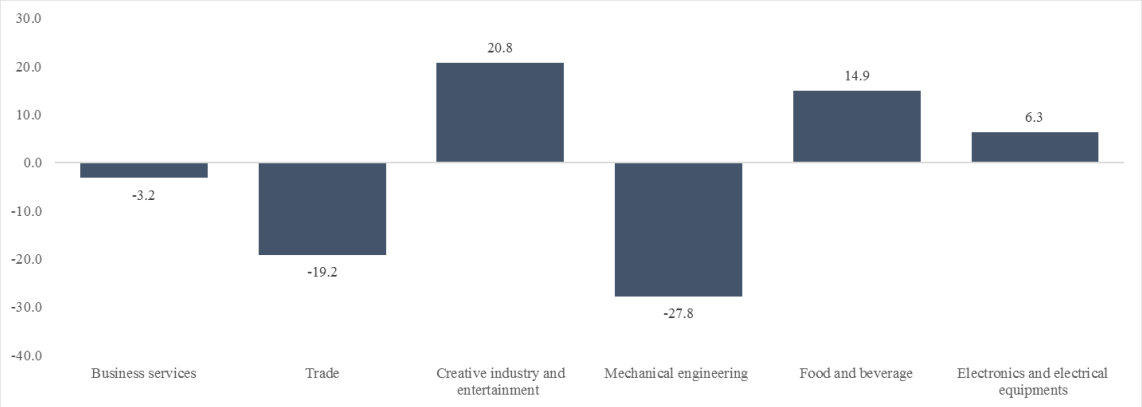
a) Micro-enterprises (<10 workers)



b) Small enterprises (10-49 workers)



c) Medium and large enterprises (>= 50 workers)



(a) Only statistically significant differences are reported in the figure.
Source: Authors' calculations on Istat data

6. Conclusions

In this paper we propose a new synthetic indicator of the economic-financial solidity (EFSI) of Italian firms; it is built by taking into consideration three areas of economic-financial performance: profitability, solidity and firm liquidity, evaluated in terms of sustainability over time. It allows to classify firms in terms of four classes, characterized by a different degree of sustainability of its three components and thus by a different exposure to income and financial risks: Healthy, Fragile, At-risk, Highly at-risk. Looking at its long-term dynamic, EFSI reveals the process of strengthening of economic-financial conditions of Italian business system occurred during the last decade; looking at the most recent years, it shows the share of Healthy firms reaching a peak during the pandemic crisis. The surprising 2020 result seems to be consistent with the evidence of resilience showed by Italian business system during the pandemic recession; this latter, in turn, is due to both the improvement of firms' solidity over the last decade and the massive package of aids approved by the Government to provide support to firms, which could have limited the worst economic effects of pandemic. In order to investigate this aspect, we make use of EFSI to assess whether, and to what extent, the public support to firms contributed to limit the worsening of enterprises balances, expressed by the "downgrades" i.e. the entries into Highly at-risk class of the indicator.

To do so, we run two counterfactual exercises estimating what the downgrade rates would have been during the crisis of 2019-20 had the business system has the same economic-financial structure prevailing in 2011 (i.e. at the eve of 2011-12 crisis) or in 2019 (i.e. the last year of economic growth). Results show high heterogeneity among sectors and size classes. With respect to 2019, public aids did not outweight the negative consequences of the pandemic, but limited its impact especially on the smaller firms, those more severely hit by the crisis; downgrade rate differentials are higher especially in Accommodation and catering, Creative industry/entertainment and Education, health and social services activities. When we compare the pandemic crisis with the 2011-12 one, the role of firm aids emerges more clearly: despite the fact that the pandemic crisis had a stronger economic impact on GDP than the previous crisis episode, downgrades were generally lower in the most recent crisis, as aids more than fully compensate for the negative effects of the pandemic. This result

holds for several sectors considered and for each size class, with the notable exceptions, again, of micro and small firms in Accommodation and catering, Creative and entertainment and Education and health sectors.

In sum, this exercise allows us to evaluate the soundness of economic-financial conditions of Italian firms during the pandemic year. Using the EFSI indicator, our results show that the entry into Highly at-risk class, has been limited, in many cases also reducing it with respect to the 2011-12 recession. This evidence reveals the effectiveness of the firm aids put in place during the pandemic: in general, they seem to have been successful in limiting, especially for smaller size firms, a deterioration in the economic-financial conditions of companies, reducing the likelihood of insolvency proceedings and thus preserving the integrity of the business system.

References

Adelino, M., Ma, S. & Robinson, D., (2014). Firm age, investment opportunities, and job creation. NBER Working Papers, No. 19845, National Bureau of Economic Research, Cambridge, MA, http://dx.doi.org/10.3386/w19845.

Adian, I., Doumbia, D., Gregory, N., Ragoussis, A., Reddy, A. & Timmis, J. (2020). Small and medium enterprises in the pandemic: Impact, responses and the role of development finance. Policy Research Working Paper; No. 9414.Washington, DC: World Bank.

Aramonte, S. & Avalos, F. (2020). Corporate credit markets after the initial pandemic shock. In: BIS Bulletin (26), Bank for International Settlements, Basel, https://www.bis.org/publ/bisbull26.pdf

Bajgar, M., Berlingieri, G., Calligaris, S., Criscuolo, E.L. & Timmis, J. (2019). Industry concentration in Europe and North America. OECD Productivity Working Papers 18, OECD Publishing, Paris, http://dx.doi.org/10.1787/2ff98246-en

Bartik, A., Bertr, M., Cullen, Z., Glaeser, E.L., Luca, M. & Stanton, C. (2020). The impact of Covid-19 on small business outcomes and expectations. *Proceedings of the National Academy of Sciences*, Vol. 117/30. pp. 17656–17666. http://dx.doi.org/10.1073/pnas.2006991117.

Baker, S.R., Bloom, N., Davis, S.J., & Terry, S.J. (2020). Covid-induced economic uncertainty. NBER Working Paper n. 26983. Cambridge, MA: National Bureau of Economic Research.

Beck, T., (2020). Finance in times of Covid-19: What next? In: Baldwin, R. & di Mauro, B.W. (Eds.), *Mitigating the Covid Economic Crisis: Act fast and do whatever it takes*. CEPR Press, Paris & London. https://cepr.org/publications/books-and-reports/mitigating-covid-economic-crisis-act-fast-and-do-whatever-it-takes

Bénassy-Quéré, A., Boot, A., Fatás, A., Fratzscher, M., Fuest, C., Giavazzi, F., Marimon, R., Martin, P., Pisani-Ferry, J., Reichlin, L., Schoenmaker, D., Teles, P. & di Mauro, B.W. (2020). A proposal for a Covid credit line, VoxEu.org, https://hdl.handle.net/1814/66681.

Bugamelli, M., Lotti, F., Amici, M., Ciapanna, E., Colonna, F., D'Amuri, F., Giacomelli, S., Linarello, A., Manaresi, F., Palumbo, G., Scoccianti, F. & Sette, E. (2018), Productivity growth in Italy: a tale of a slow-motion change, Bank of Italy Questioni di Economia e Finanza, n. 422, January, https://www.bancaditalia.it/pubblicazioni/qef/2018-0422/QEF_422_18.pdf.

Calvino, F., Criscuolo, C. & Verlhac, R., (2020). Declining business dynamism: Structural and policy determinants. OECD Science, Technology and Industry Policy Papers, No. 94, OECD Publishing, Paris, https://doi.org/10.1787/77b92072-en.

Calvino, F., Criscuolo, C. & Menon, C., (2015). Cross-country evidence on start-up dynamics. OECD Science. Technology and Industry Working Papers, No. 2015/6, OECD Publishing, Paris, http://dx.doi.org/10.1787/5jrxtkb9mxtb-en.

Campello, M., Giambona, E., Graham, J.R. & Harvey, C.R. (2011). Liquidity management and corporate investment during a financial crisis. *The Review of Financial Studies*, 24(6), 1944–1979.

Çelik, S., Demirtaş, G. & Isaksson, M., (2019). Corporate bond markets in a time of unconventional monetary policy. OECD Capital Market Series, Paris, https://www.oecd.org/corporate/Corporate-Bond-Markets-_in-a-Time-of-Unconventional-Monetary-Policy.htm

Chowdhury, S.R. (2011). Impact of global crisis on small and medium enterprises. *Global Business Review*, 12(3), 377–399.

Costa, S., Sallusti, F., Vicarelli, C. & Zurlo, D. (2022). Firms' solidity before an exogenous shock: Covid-19 pandemic in Italy. *Economic Analysis and Policy*, 76, 946-961.

Cros, M., Epaulard, A. & Martin, P. (2021), Will Schumpeter catch Covid-19? CEPR Discussion Paper DP15834.

Damodaran, A., (2010). *Applied corporate finance*. Hoboken, NJ, U.S.: John Wiley & Sons.

De Mitri, S., De Socio, A., Nigro, V. & Pastorelli, S., (2021), Financial support measures and credit to firms during the pandemic. Bank of Italy, Occasional Papers, No. 666, December.

Demmou, L., Calligaris, S., Franco, G., Dlugosch, D., Adalet McGowan, M. & Sakha, S., (2021). Insolvency and debt overhang following the Covid19 outbreak: Assessment of risks and policy responses. OECD Economics Department Working Paper, No. 1651, OECD Publishing, Paris, http://dx.doi.org/10.1787/747a8226-en.

Didier, T., Huneeus, F., Larrain, M. & Schmukler, S.L. (2021). Financing firms in hibernation during the Covid-19 pandemic. *Journal of Financial Stability*, 53.

Dorr, J.O., Licht, G. & Murmann, S. (2021). Small firms and the Covid-19 insolvency gap. *Small Business Economics*. 58, 887–917.

Dottori, D. & Micucci, G. (2018). Corporate liquidity in Italy and its increase in the long recession. Bank of Italy Quaderni di Economia e Finanza n. 420, January.

European Union (2006), Regulation (EC) of the European parliament and of the council, establishing the statistical classification of economic activities NACE Revision 2 and amending Council Regulation (EEC) No 3037/90 as well as certain EC Regulations on specific statistical domains; Regulation no 1893/2006, 30/12/2006, https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32006R1893.

Gal, P., Nicoletti, G., Renault, T., Sorbe, S. & Timiliotis, C. (2019). Digitalisation and productivity: In search of the Holy Grail – Firm-level empirical evidence from EU countries. OECD Economics Department Working Papers, No. 1533, OECD Publishing, Paris, http://dx.doi.org/10.1787/5080f4b6-en.

Goodell, J.W. (2020). Covid-19 and finance: Agendas for future research. *Finance Research Letters*, 35. https://doi.org/10.1016/j.frl.2020.101512.

Istat, Istituto Italiano di Statistica (2017). Rapporto sulla competitività dei settori produttivi. (in Italian) https://www.istat.it/it/archivio/197346.

Istat, Istituto Italiano di Statistica (2023a). Rapporto sulla competitività dei settori produttivi. (in Italian) https://www.istat.it/it/archivio/282020

Istat, Istituto Italiano di Statistica (2023b). Registrazioni e fallimenti di imprese. (in Italian) https://www.istat.it/it/archivio/284437.

Kahn, C. & Wagner, W. (2021). Liquidity provision during a pandemic. *Journal of Banking & Finance*, 133. https://doi.org/10.1016/j.jbankfin.2021.106152.

Kaminsky, G.L. & Reinhart, C.M. (1999). The twin crises: the causes of banking and balance-of-payments problems, *American Economic Review*, 89(3), 473-500.

Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Morales Reyes, C.A., Prochotta, A., Steinbrink, K.M. & Berger, E.S.C. (2020). Startups in times of crisis – A rapid response to the Covid-19 pandemic. *Journal of Business Venturing Insights*, 13.

Lang, M. & Maffett, M. (2011). Transparency and liquidity uncertainty in crisis periods. *Journal of Accounting and Economics*, 52(2–3), 101-125.

Luzi, O. & Monducci, R. (2016). The new statistical register 'Frame SBS': Overview and perspectives. *Rivista di Statistica Ufficiale*, 1, 5–14.

OECD (2020). Coronavirus (Covid-19): SME policy responses. OECD Policy Responses to Coronavirus (Covid-19). OECD Publishing, Paris, http://dx.doi.org/10.1787/04440101-en

OECD (2021). Strengthening economic resilience following the Covid-19 crisis: A firm and industry perspective. OECD Publishing, Paris, http: //dx.doi.org/10.1787/2a7081d8-en.

Orlando, T. & Rodano, G., (2020). Firm undercapitalization in Italy: business crisis and survival before and after Covid-19. Bank of Italy, Questioni di Economia e Finanza n. 590, December. https://www.bancaditalia.it/pubblicazioni/qef/2020-0590/QEF_590_20.pdf?language_id=1.

Orlando T. & Rodano G. (2022), The impact of Covid-19 on bankruptcies and market exits of Italian firms, Bank of Italy Covid Papers, 24 January. https://www.bancaditalia.it/pubblicazioni/note-covid-19/2022/nota_covid_fallimenti_eng_24_gen_2022.pdf?language_id=1.

Miklian, J. & Hoelsher, K., (2022). SMEs and exogenous shocks: A conceptual literature review and forward research agenda. *International Small Business Journal: Researching Entrepreneurship*, 40(2), 178–204.

Pelosi, M., Rodano, G. & Sette, E. (2021). Zombie firms and the take-up of support measures during the Covid-19. Bank of Italy Questioni di Economia e Finanza n. 650, November. https://www.bancaditalia.it/pubblicazioni/qef/2021-0650/QEF_650_21.pdf?language_id=1.

Piva E. & Guerini, M. (2023). The impact of the COVID-19 pandemic and pandemic-related policies on new firm creation: an analysis of the Italian case. Small Business Economics, 60, 1009–1031. https://doi.org/10.1007/s11187-022-00621-w.

Reinhart, C. & Rogoff K. (2009). *This time is different: eight centuries of financial folly*. Princeton University Press.

Rubin, D.B. (1980). Bias reduction using Mahalanobis-Metric matching. *Biometrics*, 36(2), 293–298. https://doi.org/10.2307/2529981.

Saez, E. & Zucman, G. (2020 March 30). *Jobs aren't being destroyed this fast elsewhere. Why is that?* The New York Times, from https://www.nytimes.com/2020/03/30/opinion/coronavirus-economy-saez-zucman.html.

Tirole, J. (2006). *The theory of corporate finance*. Princeton, NJ, U.S.: Princeton University Press.

WTO (2021). Economic resilience and trade. World Trade Report, https://www.wto.org/english/res_e/booksp_e/wtr21_e/00_wtr21_e.pdf.

Appendix A. The EFSI (Economic-Financial Solidity Indicator)

EFSI is a synthetic indicator, set up in accordance with literature regarding three dimensions of firm economic and financial soundness: profitability, financial solidity and liquidity. In particular, for each dimension, an assessment (positive or negative) of the degree of sustainability is made on the basis of the following criteria:

1) as for profitability, the comparison between the value of profitability (Return on investment - ROI) and the average cost of debt capital (i), with a threshold value of sustainability of 1:

$$Profitability = ROI/i \qquad [1]$$

2) As for solidity, a combination between the level of indebtedness (or Leverage) – whose soundness threshold value is around 2 – and the degree of correlation between sources and uses, whose sustainability threshold is 1.3. Combining the two elements, the following indicator of sustainable financial solidity is calculated:

$$Solidity = 0.5\frac{1}{Leverage} + 0.5\frac{EQ}{FA} \qquad [2]$$

Where $Leverage = debt\ capital/equity$, $EQ = equity + long\ term\ debt\ capital$ and $FA = fixed\ assets$

The indicator is then calculated as an average between *1/ Leverage* and the degree of correlation between the financial use and sources, with a sustainability threshold of 0.9. In this way, allowing for forms of "compensation" between the two terms of the relation [2] it is possible to take into account sectoral specificities.

3) As for liquidity, the following index is used:

$$Liquidity = 0.5\frac{DA+LA}{STF} + 0.5\frac{DA+LA+INV}{STF} \qquad [3]$$

where $DA = differed\ asset$, $LA = liquid\ asset$, $INV = inventories$ and $STF = short\ term\ debt\ capital$

The first ratio has a sustainability threshold as close as possible to 1; the second one a sustainability threshold of 1.5. A threshold of 1.5 has been set for the Liquidity index.

The combination of these three indexes provides the basis to obtain a firm-level synthetic indicator of economic-financial solidity (EFSI), combining the judgments of sustainability/unsustainability of each of these three elements (the condition of above/below threshold). In particular, we assign

On these premises, a synthetic indicator of economic-financial solidity (EFSI) is obtained, combining the judgments of sustainability of each of these three elements; we assign values between -1 and 1 to these combinations (see Table 1), considering an implicit set of weights that gives more relevance to profitability with respect to solidity and more relevance to solidity with respect to liquidity. Then we classify firms in four classes, characterized by a different degree of sustainability of its three components and thus by a different exposure to income and financial risks (Table 1): Healthy, Fragile, At-risk, Highly at-risk.

EFSI synthetic indicator is rooted in the firm's ability to generate profitability in a sustainable way, and essentially follows the well-known accounting Modigliani-Miller formula;

$$ROE = [ROI + (ROI - i)Leverage]\frac{NI}{EBT} \qquad [4]$$

where $NI = net\ income$ and $EBT = earning\ before\ taxation$

This relation, in determining the level of net profitability (Return on equity - ROE), focuses first on the differential between *ROI* and *i* and then defines the role of debt. If $ROI > i$, even a high debt will be sustainable, but in the event of unexpected market turbulence there would be a risk to generate heavy losses; it follows that the analysis of the differential between ROI and i must be considered together with the analysis of solidity.

Appendix B – Matching balance tests

Table B1 - Balance in matching (a)

Sectors	Size	Variance ratio													
		2011-12 vs. 2019-20							2018-19 vs. 2019-20						
		LVA	LVP	LDA	Lsize	Leq	LCI	LFC	LVA	LVP	LDA	Lsize	Leq	LCI	LFC
Business-related services	micro	1.00	0.99	1.00	1.00	1.00	0.99	0.99	1.01	1.01	0.99	1.01	1.00	1.01	0.99
	small	1.10	1.09	1.08	1.06	1.10	1.10	1.12	0.99	0.99	0.98	0.99	0.99	1.00	0.99
	medium and large	1.19	1.20	1.10	1.14	1.11	1.15	1.20	1.00	1.00	0.95	1.00	0.99	1.00	0.97
Other Industry	micro	1.00	1.00	1.03	1.00	1.01	1.02	1.00	1.01	1.01	1.00	1.00	1.00	1.01	0.99
	small	1.01	1.02	1.02	1.03	0.99	1.00	1.02	1.00	1.00	0.99	0.99	0.99	1.00	0.99
	medium and large	0.95	0.95	1.02	0.98	0.99	0.96	1.02	1.00	1.00	0.99	1.00	1.00	1.00	1.01
Wholesale and retail trade	micro	1.01	1.00	1.01	1.00	0.99	1.00	0.99	1.01	1.00	0.99	1.00	1.01	1.01	0.99
	small	1.02	0.99	1.02	1.00	0.96	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00
	medium and large	1.01	0.85	1.35	1.03	0.91	0.80	1.13	1.00	1.00	0.99	1.00	1.00	1.01	1.01
Education, Health and social services	micro	1.04	1.03	1.08	1.01	1.03	1.06	1.02	1.00	1.00	0.98	0.99	1.00	1.00	0.99
	small	0.90	0.91	1.01	0.93	0.93	0.98	1.00	0.99	0.98	0.98	0.99	0.99	0.99	0.96
	medium and large	1.06	1.11	0.95	1.03	1.17	1.12	1.22	1.00	0.99	0.97	1.00	1.00	1.01	0.99
Accomodation and catering	micro	1.10	1.10	1.00	1.06	1.08	1.04	1.06	1.00	1.00	0.99	0.99	0.99	1.00	0.98
	small	1.04	1.06	0.99	1.07	1.02	1.00	1.03	0.99	0.99	0.97	0.99	0.98	0.99	0.98
	medium and large	1.35	1.21	1.09	0.99	1.11	1.04	1.20	0.98	0.98	0.94	0.99	0.99	0.99	0.97
Logistic and transports	micro	1.06	1.10	1.14	1.04	1.12*	1.13*	1.14*	1.00	1.00	0.98	0.99	0.99	1.01	0.99
	small	1.04	1.02	1.04	1.07	0.99	0.98	0.96	0.99	0.99	0.97	0.99	1.00	1.00	0.99
	medium and large	1.06	0.99	0.97	1.07	0.92	0.94	0.87	1.00	1.01	1.00	1.00	1.01	1.02	1.01
Creative industry and entertainment	micro	1.01	1.02	1.11	1.00	1.01	1.06	1.06	0.99	0.99	0.97	0.99	0.99	1.00	0.98
	small	0.90	0.88	1.00	0.96	0.96	0.86	0.93	0.96	0.96	0.93	0.97	0.94	0.97	0.97
	medium and large	1.14	1.13.	2.55	0.89	0.86	1.00	0.76	0.93	0.93	0.99	0.89	0.91	0.90	1.00
Mechanical engineering	micro	1.08	1.07	0.95	1.07	0.93	0.97	0.98	0.99	0.99	0.97	1.00	0.99	1.01	0.99
	small	1.03	1.03	0.96	1.02	1.05	0.99	0.99	0.99	0.99	0.97	0.99	1.00	0.99	0.99
	medium and large	0.80	0.77	1.32	0.85	0.88	0.68	0.95	0.99	1.00	1.00	0.99	0.99	0.99	0.99
Food production	micro	1.14	1.12	1.01	1.10	1.11	1.06	1.06	1.00	1.00	0.97	0.98	0.99	1.00	0.99
	small	1.16*	1.14	1.08	1.12	1.11	1.11	1.10	1.00	1.00	0.97	1.01	1.00	1.00	1.00
	medium and large	1.07	1.09	0.73	1.20	1.18	2.50	1.45	1.00	1.00	1.00	1.01	1.00	1.00	1.02
Chemical and pharmaceuticals	micro	1.17	1.08	1.06	1.12	1.03	1.03	1.15	0.99	1.00	0.96	0.98	1.00	1.02	0.99
	small	1.04	1.06	1.00	1.01	1.05	0.96	1.01	1.00	1.00	0.96	1.00	1.01	1.02	1.01
	medium and large	0.82	0.76	0.59	0.85	0.76	0.72	0.59	0.99	0.99	0.75*	1.00	1.00	1.00	0.99
Electronic and electrical equipments	micro	1.17	1.16	1.15	1.12	1.15	1.13	1.13	0.99	0.99	0.98	0.99	0.99	1.02	0.98
	small	0.94	0.98	1.04	0.98	1.10	1.04	1.07	1.05	1.03	1.04	1.05	1.05	1.04	1.09
	medium and large	0.70	0.75	1.00	0.77	0.74	0.77	0.77	1.05	1.05	1.15	1.04	1.02	1.07	1.09

(a) The table shows balance assessment statistics for all matching variables. Variance ratio statistics refer to the ratio of the variance among the matched control observations and the variance among the treated (i.e. 2019-20) observations for the respective variable. The values without stars lie within the range which indicates a good balance.