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The role of government policies for Italian firms during the COVID-19 crisis

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\textbf{ABSTRACT}

This paper aims to respond to this research question: “How effective have government incentives been in preserving firm profitability and growth during the COVID-19 crisis?”. We used a large, representative sample of Italian companies, which has produced a deeper study than the macro analyses provided by national statistics. Results show that government policies alleviated the negative effects of the pandemic on troubled companies, but it was not enough to maintain the same financial health as firms that did not need this support. Small companies were the most adversely affected by the pandemic.

1. Introduction

The COVID-19 crisis has prompted emerging literature on the impact of the pandemic on varied firm aspects such as value (e.g., Shen et al., 2020; Hu and Zhang, 2021), growth (e.g., Bose et al., 2021; Chen et al., 2021) or even the impact from a gender perspective (Liu et al., 2021). Some studies have analyzed not just current growth, but innovation, which affects companies’ potential growth, and have found it has decreased caused by COVID-19 (Jin et al., 2022). Companies’ worrying perspectives in a context of uncertainty could be worsened by the increase in the cost of equity capital because of the pandemic (Ke, 2022). The severity of this crisis was evidenced by the dramatic fall in the prices of listed firms’ stocks during the first months of 2020 (Neukirchen et al., 2022), due to a sharp deterioration of the profitability-risk relationship. In this research environment, some works investigate the influence of monetary authority strategies (e.g., Chen and Yeh, 2021) or government policies during the downturn (e.g., Fendel et al., 2021). The work of Iyer and Simkins (2022) interestingly reviews the economic impact of the Covid-19 emergency, evidencing how governments played a key role in their response to the crisis. Focusing on the Italian context, which suffered from a tight lockdown because of the pandemic (Erdem, 2020), the government issued several decrees to help companies face this extraordinary situation and stay in business, as indicated in the text of the decrees. In light of such governmental strategies, the aim of the present work is to investigate the effectiveness of the policies adopted by the Italian government through these decrees. Specifically, we study the effect of the pandemic and subsequent State aid on firm profitability and growth. Our choice to study this topic stems from the fact that firms are the engine of the economic system, and their growth is essential for job creation and the overall welfare of a country. Considering this relevance, the extant literature has shown particular interest in the determinants of firm growth (Zhou and De Wit, 2009; Gupta et al., 2013), and our work aims to enrich this strand of research. Our findings reveal that, despite a decrease in sales, the support provided by the government has mitigated the negative effects of the COVID-19 crisis. However, we observe that firms that took advantage of the State aid were the most resilient during the pandemic.

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incentives did not perform as well as firms that did not. Therefore, despite the fact that State assistance supported firms, their survival and growth after the downturn could not depend only on government incentives. Our work contributes to the existing literature in several ways. First, we have studied a large sample of firms during the pandemic at the micro (firm-specific) level. Second, we have examined the effect of the COVID-19 crisis on the balance sheets of firms. Third, we have highlighted the effect of State aid during the emergency.

2. Literature review and research question

Many recent papers have investigated the firm-level effects of the COVID-19 pandemic (e.g., Shen et al., 2020; Arnold and Rhodes, 2021; Doruk et al., 2021; Krieger et al., 2021; Huang et al., 2021; Carter et al., 2022; Tchuigoua et al., 2022; Hsu and Yang, 2022; Kumar and Zbib, 2022). These effects could have been influenced by government incentives, which have played a key role in firms (Songling et al., 2018; Minh and Ngoc, 2021), especially during the recent COVID-19 crisis (Tarkom, 2021). Along these lines, Tarkom (2021) and Iyer and Simkins (2022) have recently focused on the impact of government incentives on firms during the coronavirus emergency. Our work joins the direction of such recent studies, and our research question is of relevance because firm growth, which is a core topic in the academic literature as above mentioned, might be influenced in the years ahead because of the recent economic shock. The most commonly used proxies of firm growth are based on the measurements of differences in firm size (Coad and Hölzl, 2021), in terms of employment, sales, and total assets. Jovanovic’s (1982) noteworthy contribution and that of other papers suggest that the growth of a company is related to age and size (e.g., Heshmati, 2001; Mateev and Anastasov, 2010). There are a number of important papers that have used the Jovanovic model (e.g., Dunne and Evans, 1987; Hughes, 1994; Heshmati, 2001; Honjo and Harada, 2006; Morone and Testa, 2008; Mateev and Anastasov, 2010; Halitwanger et al., 2013; Coad et al., 2013; Lawless, 2014; Navaretti et al., 2014; Anton, 2019; Sanchez-Vidal et al., 2020; Yang and Tsou, 2020; Navaretti et al., 2022). Moreover, firm growth is related to profitability (Santos and Brito, 2012). All this evidence prompted us to explore the effect of Italian government policies during the COVID-19 crisis in terms of firm profitability and growth.

3. Research design: data, methodology, and variables

The study employs a large, unbalanced panel sample of 8612659 firm-year observations (collected from the AIDA database of Bureau van Dijk) of non-financial Italian companies over the 2012–2020 period. Our work applies the Jovanovic model (1982), as it is a very commonly used model to measure firm growth and has been used in authoritative doctrine, as mentioned above. The Jovanovic model used is the following:

\[
\text{FirmGrowth} = \beta_0 + \beta_1 \text{Size} + \beta_2 \text{Age} + \beta_h X + \epsilon
\]

The logic of the model is that firm growth is associated with an increase in sales, so it is opportune to use this model since a decrease in sales was the first immediate firm-level effect of the pandemic. Table 1 displays the variables employed in our study and reports the calculation of each single variable.

Table 1

| Variables          | Calculation                                                                 |
|--------------------|-----------------------------------------------------------------------------|
| Employee Growth    | variation in the number of employees for each firm compared to the previous year |
| Sales Growth       | variation in sales for each firm compared to the previous year                |
| Grants             | balance sheet value of grants obtained by the firm scaled to sales           |
| Total Asset Growth | growth of total assets compared to the previous year                          |
| ROA                | net income to total assets                                                  |
| Interest           | financial expenses emerging from firm income statements to EBIT             |
| Fixed Assets       | fixed material assets/total assets                                          |
| Short-Term Assets  | short-term assets/total assets                                              |
| Stock              | total inventory/short-term assets                                           |
| Cash               | cash/short-term assets                                                      |
| Debt               | total debt/total assets                                                    |
| Fin_Debt           | financial debt/total assets                                                 |
| Size               | natural log of total assets over the previous year (t-1)                    |
| Age                | natural logarithm of 1 + firm age, where firm age is equal to study year minus year of incorporation |
| Financial Slack    | (debt minus cash)/total assets                                              |
| D_COVID_small      | if the year is 2020 and if the firm is small according to the European Commission definition |
| D_COVID_medium     | if the year is 2020 and if the firm is medium-sized according to the European Commission definition |
| D_COVID_large      | if the year is 2020 and if the firm is large according to the European Commission definition |

Note: we have eliminated firm-year observations with meaningless economic information, like companies that showed a value for the ratio of fixed assets/total assets higher than 1 or lower than zero.

Jovanovic’s model is a very commonly used model that was formulated after Gibrat’s (1931) law.
4. Empirical results

4.1. Descriptive statistics

Table 2 shows the descriptive statistics for the variables used. Table 3 reports the descriptive statistics for the variables measuring firm growth (Employees, Size, and Sales).

The mean value of Employees is 10.63, and small enterprises make up the vast majority of our sample. It is noticeable that when using both Total Assets and Sales, most companies are classified as small too. To summarize, the dummies according to size do not change much depending on the definition of size.

4.2. The effect of Italian government policies during the COVID-19 crisis

Table 4 shows that the number of employees did not drastically fall despite the pandemic, probably because firms had the opportunity to take advantage of a layoff period using a special integration fund provided by a decree-law the Italian government issued on April 8th, 2020 (the so-called “Decreto Liquidità”).

Table 5 shows trends in the variables Sales Growth, Grants, ROA, and Interest. Panel A shows an abrupt decrease for 2020, after many years of a positive trend for Sales Growth. Panel B shows the trend of the variable Grant, which reflects non-taxable revenues that

Table 2

| Variable            | Obs  | Mean  | Median | Std. Dev. | Min  | Max  |
|---------------------|------|-------|--------|-----------|------|------|
| Employee Growth     | 4,188,222 | 0.027 | 0.000  | 0.413     | −1.000 | 418,000 |
| Sales Growth        | 6,046,242 | 0.133 | 0.001  | 0.738     | −135.750 | 109,000 |
| Grants              | 7,151,907 | 0.062 | 0.000  | 4.744     | −409.000 | 6,354,000 |
| Total Asset Growth  | 7,039,849 | 0.113 | 0.009  | 0.748     | −1.000 | 1,159,965 |
| ROA                 | 8,582,142 | 0.017 | 0.007  | 0.413     | −289.000 | 963,057 |
| Interest            | 8,139,761 | 0.100 | 0.000  | 10.179    | −10,878.300 | 18,326,730 |
| Fixed Assets        | 8,564,116 | 0.215 | 0.069  | 0.289     | 0.000  | 1.000  |
| Short-Term Assets   | 8,564,116 | 0.667 | 0.785  | 0.322     | 0.000  | 1.000  |
| Stock               | 8,506,715 | 0.190 | 0.007  | 0.293     | 0.000  | 1.000  |
| Cash                | 8,506,109 | 0.246 | 0.122  | 0.287     | 0.000  | 1.000  |
| Debt                | 8,568,544 | 0.656 | 0.740  | 0.288     | 0.000  | 1.000  |
| Fin_Debt            | 730,501  | 0.197 | 0.118  | 0.227     | 0.000  | 1.000  |
| Size                | 7,146,219 | 6.073 | 6.089  | 1.888     | 0.000  | 18.361 |
| Age                 | 13,082,003 | 2.312 | 2.485  | 0.955     | 0.000  | 5.476  |
| Financial slack     | 628,194  | 0.071 | 0.047  | 0.347     | −1.000 | 1.000  |

As can be seen in Table 2, the panel is unbalanced, as there are not always observations for each company and every year. This is crucial when it comes to the number of observations of the variables created as differences (e.g., the growth variables). The other source of unbalance comes from the fact that there are observations which do not always have a value for all variables in one specific year. The most noteworthy example of this is the variable Fin_Debt, which is an item not always available in the AIDA database.

Table 3

| Variable         | Obs  | Mean  | Std. Dev. | Min  | Max  |
|------------------|------|-------|-----------|------|------|
| Employees        | 8,408,509 | 10.63 | 207.39    | 0    | 142,694 |
| Dummy Small      | 8,408,509 | 97.19% | 0.17     | 0    | 1    |
| Dummy Medium     | 8,408,509 | 2.38%  | 0.15     | 0    | 1    |
| Dummy Large      | 8,408,509 | 0.43%  | 0.07     | 0    | 1    |
| Tot.             | 100.00% | 0      | 0        | 0    | 1    |
| Total assets     | 8,612,659 | 9,076.01 | 1,177,204 | 0    | 1,541,720,000 |
| Dummy Small      | 8,612,659 | 95.16%  | 0.21     | 0    | 1    |
| Dummy Medium     | 8,612,659 | 3.64%  | 0.19     | 0    | 1    |
| Dummy Large      | 8,612,659 | 1.19%  | 0.11     | 0    | 1    |
| Tot.             | 100.00% | 0      | 0        | 0    | 1    |
| Sales            | 8,611,636 | 3,050.14 | 99,195.07 | 0    | 68,326,090 |
| Dummy Small      | 8,611,636 | 96.75%  | 0.18     | 0    | 1    |
| Dummy Medium     | 8,611,636 | 2.58%  | 0.16     | 0    | 1    |
| Dummy Large      | 8,611,636 | 0.66%  | 0.08     | 0    | 1    |
| Tot.             | 100.00% | 0      | 0        | 0    | 1    |

1 Two examples of the different firms that participate in each analysis are mentioned to give the reader a brief idea: the number of companies for the 8,582,142 firm-year observations of the ROA variable of Table 5 is 1,564,991 different enterprises, and the observations (5,477,196) of the regression of Model I in Table 9 correspond to 1,073,978 different companies.
firms record on their balance sheets when they receive non-refundable cash aid. The mean makes an extraordinary jump upwards in 2020 due to support from government funds, as stipulated in the decree issued by the Italian government on May 19th, 2020 (the so-called "Decreto Rilancio"), which allowed each firm to obtain a sum of money proportionate to their decrease in sales caused by the coronavirus emergency. However, the subsidy was only available for firms that reported a 30% or greater drop in sales in March 2020 compared to March 2019. A comparison between the mean and median indicates that the average company did not receive any subsidy at the end of 2020 because many firms did not suffer the above-mentioned drop in sales.

Panel C shows that the value of ROA was maintained in 2020. It seems that the State grants and the decrease of interest payments were able to compensate for the drop in sales. Additionally, article 60 of the decree issued by the Italian government on August 14th, 2020 (the so-called "Decreto Agosto") gave companies the option to not report depreciation among their costs in their 2020 financial statements, which produced a positive impact on net income.

The trend for the variable Interest may have decreased for two reasons. First, according to Article 56 of the decree issued by the

2 We winsorized at the 5% level in line with the work by González-Fernández and González-Velasco (2020). We have also trimmed, instead of winsorizing, as a robustness check for the three growth variables, and the obtained results are similar.
Italian government on March 17th, 2020 (the so-called "Decreto Cura Italia"), firms could suspend the payment of their financing installments. Consequently, the corresponding financial interest included in the installments was not reported as a cost in their financial statements. Second, firms reduced their banking operations because of the pandemic, which meant there was a significant decrease in the bank charges in proportion to the number of banking operations carried out.

Table 6 shows an increase in the values of total assets in 2020, which could be explained by the considerable amount of non-refundable cash that was reported on the asset side of firms’ balance sheets. Fixed Assets reflects the “Decreto Agosto” effects of lower depreciation. Moreover, firms increased their cash levels and financial debt from 2019 to 2020. This large boost in cash is the main reason for the increase in total assets. The decree called “Decreto Liquidità” gave firms the opportunity to address the immediate need for liquidity by obtaining a six-year loan from banks, with a grace period of two years, guaranteed by the State Guarantee Fund.

Figures A.1-A.12 in the Appendix A graphically illustrate the trends observed in Tables 4-6.

4.3. Firm growth before and after the COVID-19 crisis: Jovanovic’s (1982) model

After an overview to the companies’ financial status at the end of each year, including 2020, we investigated the effect of the pandemic and the effectiveness of government incentives first on firm profitability (Tables 7 and 8) using the difference-in-differences (DD) technique, as in Zheng (2022), and then on firm growth (Table 9) using the Jovanovic (1982) model. The pandemic caused a decrease in sales growth from 2019 to 2020, with potential negative effects on net income. Government incentives tried to safeguard firm profitability in two ways: by providing other revenues (grants) or reducing costs in the profit and losses statement (firms had the opportunity to not report depreciations, postpone interest payments, or obtain a State reimbursement of social costs for employees). Therefore, to appreciate the effectiveness of these government policies, we tested whether firms that used government incentives kept the same profitability levels (in terms of ROA) as firms that did not use them.

DD estimation quantifies how a group of individuals, businesses in this case, would be affected by a rapid change in the economic climate, a policy, or a general treatment, in terms of a specific outcome: profitability, in our study. In our case, companies who take

| Decreti Liq. | Pre-decree | Post-decree | Diff. |
|-------------|------------|-------------|------|
| Companies not treated | 0.029 | 0.032 | |
| N | 3,028,815 | 452,868 | |
| Companies treated | 0.029 | 0.019 | |
| N | 1,545,253 | 236,244 | |
| Differences | 0.000 | 0.012 | 0.013*** |
| N | 4,574,068 | 689,112 | |
| Decreto Rilancio | Pre-decree | Post-decree | Diff. |
| Companies not treated | 0.032 | 0.042 | |
| N | 2,049,880 | 333,123 | |
| Companies treated | 0.035 | 0.037 | |
| N | 2,095,597 | 326,924 | |
| Differences | 0.003 | 0.005 | 0.008*** |
| N | 4,145,477 | 660,047 | |
| Decreto Agosto | Pre-decree | Post-decree | Diff. |
| Companies not treated | 0.029 | 0.032 | |
| N | 3,974,058 | 664,508 | |
| Companies treated | 0.027 | 0.011 | |
| N | 659,478 | 91,408 | |
| Differences | 0.002 | 0.021 | 0.019*** |
| N | 4,633,536 | 755,916 | |
| Decreto Cura Italia | Pre-decree | Post-decree | Diff. |
| Companies not treated | 0.033 | 0.028 | |
| N | 299,535 | 39,302 | |
| Companies treated | 0.025 | 0.014 | |
| N | 83,358 | 9,887 | |
| Differences | −0.008 | −0.014 | −0.006 |
| N | 382,893 | 49,189 | |

Note: The dependent variable is ROA, defined by Net income/Total Assets. The treatment variables are Decreto Liquidità, which takes the value of 1 when the company was able to borrow significantly in 2020 (its long-term debt was at least 10% higher than the previous year) and zero otherwise; Decreto Rilancio, which takes the value of 1 if the company received grants in 2020 and zero otherwise; Decreto Agosto takes the value of 1 if the company decreased depreciation in 2020 when its fixed assets did not decrease and zero otherwise; Decreto Cura Italia, which takes the value of 1 when the company decreased financial expenses in 2020 when its debt did not decrease and zero otherwise. N stands for number of observations. The asterisks ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

As Liu (2009) points out, “policy reactions to the ‘credit rationing’ problem... are needed to redress the perceived flaws in the credit market”
proposed model when analyzing firm main explanatory variables: size and age, many authors, as Heshmati (2001), add other variables to the model that could affect growth learning, because firms in a small, perfectly competitive industry vary in size as a result of how they gain efficiency over time. To the reported in Table 8, confirm the findings in Table 7.

Interestingly confirm the results of Table 8, corroborating our findings. The pre-pandemic period is 2012–2019. Results for the difference in differences estimation comparing 2018 to 2020. In this table, we have controlled for the fact that the pre (years 2012–2019) and post-treatment period (2020) are quite unbalanced, and thus, we compare 2018 to 2020.

| Decreto Liquidità | Pre-decree | Post-decree | Diff. |
|-------------------|------------|-------------|-------|
| Companies not treated | 0.037 | 0.032 | 0.005 |
| N | 407,869 | 452,868 | 54,999 |
| Companies treated | 0.040 | 0.019 | 0.021 |
| N | 214,918 | 236,244 | 21,326 |
| Differences | 0.003 | –0.012 | –0.015 *** |
| N | 622,787 | 689,112 | 66,325 |
| Decreto Rilancio | Pre-decree | Post-decree | Diff. |
| Companies not treated | 0.041 | 0.042 | 0.001 |
| N | 281,077 | 333,123 | 52,046 |
| Companies treated | 0.045 | 0.037 | 0.008 |
| N | 284,586 | 326,924 | 42,338 |
| Differences | 0.004 | –0.005 | –0.009 *** |
| N | 565,663 | 660,047 | 94,384 |
| Decreto Agosto | Pre-decree | Post-decree | Diff. |
| Companies not treated | 0.038 | 0.032 | 0.006 |
| N | 544,964 | 664,508 | 119,544 |
| Companies treated | 0.033 | 0.011 | 0.022 |
| N | 86,708 | 91,408 | 4,700 |
| Differences | –0.005 | –0.021 | –0.017 *** |
| N | 631,672 | 755,916 | 124,244 |
| Decreto Cura Italia | Pre-decree | Post-decree | Diff. |
| Companies not treated | 0.038 | 0.028 | 0.010 |
| N | 36,012 | 39,302 | 3,290 |
| Companies treated | 0.035 | 0.014 | 0.021 |
| N | 9,744 | 9,887 | 143 |
| Differences | –0.003 | –0.014 | –0.010 *** |
| N | 45,756 | 49,189 | 3,433 |

Note: DD estimation attempts to measure the effects of a sudden change in economic environment, policy, or general treatment on a group of individuals/companies. Firms treated are those who took advantage of the government incentives. DD employs the control group’s outcome as a proxy for what would have happened in the treatment group if there had been no treatment. The difference between the post-treatment, treated, and control groups’ average is then used to calculate the treatment effects. This post-treatment average difference and its statistical significance is given in the column “Diff.”. The dependent variable is ROA, defined by Net income/Total Assets. The treatment variables are Decreto Liquidità, which takes the value of 1 when the company was able to borrow significantly in 2020 (its long-term debt was at least 10% higher than the previous year) and zero otherwise; Decreto Rilancio, which takes the value of 1 if the company received grants in 2020 and zero otherwise; Decreto Agosto takes the value of 1 if the company decreased depreciation in 2020 when its fixed assets did not decrease and zero otherwise; Decreto Cura Italia, which takes the value of 1 when the company decreased financial expenses in 2020 when its debt did not decrease and zero otherwise. The asterisks ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

advantage of government incentives are those that are being treated. The outcome of the control group is used by DD as a proxy for what would have occurred in the treatment group if no treatment had been administered. The treatment effects are then determined by comparing the averages of the post-treatment, treated, and control groups. The column “Diff.” contains the post-treatment average difference as well as its statistical significance.

Although we observed that ROA remained stable in 2020 for the whole sample in Table 5, the results interestingly show that the differences between treated and not treated firms are statistically significant and negative, indicating that the profitability of firms that used government incentives decreased despite the State aid. Consequently, it is possible that firms that used government incentives experienced such a difficult economic situation that government policies could not fully compensate the negative effects of the crisis. In both cases, the overall profitability is still positive, which seems to indicate that the government’s measures have been successful, given the severity of the crisis. The treatment or government measures where the effects of the crisis are more evident is in companies that have not reported depreciation (Decreto Agosto). We can conclude that these companies really needed to show healthier profit and loss accounts. On the other hand, the cases where the companies treated show less difference in profitability is due to the Rilancio decree, for which we can deduce that these grants were really needed, and their impact has been remarkable, although insufficient to completely overcome the effect of this crisis.

As a robustness test, we selected a year randomly, and we compared this year with the pandemic period. The results, which are reported in Table 8, confirm the findings in Table 7.

Additionally, we performed the same analysis in Table 8 by comparing each year of our database with the year 2020. This approach is important to balance the samples that compare pre and post COVID-19 periods, as the post-pandemic period is only 2020, while the pre-pandemic period is 2012–2019. Results for the difference in differences comparison in pairs (which are reported in the appendix A) interestingly confirm the results of Table 8, corroborating our findings.

After examining firm profitability, we analyze firm growth in Table 9, by using Jovanovic’s (1982) model, which is usually the proposed model when analyzing firm’s growth, making it dependent on age and size. This model is based on the notion of life cycle learning, because firms in a small, perfectly competitive industry vary in size as a result of how they gain efficiency over time. To the main explanatory variables: size and age, many authors, as Heshmati (2001), add other variables to the model that could affect growth.
Table 9
Results for the different specifications of the Jovanovic model. Before performing our statistical analysis, we tested whether our 2020 sample was representative and able to explain the effect of the pandemic compared to the previous year. We compared the frequencies of companies by industry NACE (at the 2-digit level) between 2019 and 2020 by running the chi-squared goodness-of-fit test, which showed a non-significant value, meaning that the frequencies are not significantly different, for which there is no bias by sector.

| Model: OLS | I    | II   | III  | IV   | V    | VI   | VII  |
|-----------|------|------|------|------|------|------|------|
|           | Firm | Growth | Firm | Growth | Firm | Growth | Firm | Growth | Firm | Growth | Firm | Growth | Firm | Growth | Firm | Growth | Firm | Growth |
| Size      | -0.015*** | -0.016*** | -0.008*** | -0.008*** | -0.008*** | -0.008*** | -0.016*** | -0.016*** | -(64.190) | -(65.980) | -(14.030) | -(14.020) | -(14.100) | -(14.100) | -(64.150) | -(64.150) |
| Age       | -0.157*** | -0.156*** | -0.106*** | -0.106*** | -0.105*** | -0.105*** | -0.157**** | -0.156*** | -0.172*** | -0.178*** | -0.172*** | -0.172*** | -0.178*** | -0.178*** | -0.157**** | -0.156*** |
| D COVID   | -0.090*** | -0.095*** | -0.172*** | -0.172*** | -0.172*** | -0.172*** | -0.095*** | -0.095*** | -(64.260) | -(64.260) | -(342.610) | -(342.610) | -(73.210) | -(73.210) | -(72.870) | -(72.870) |
| D COVID_medium | 0.085 *** | 0.021 *** | 0.021 *** | 0.021 *** | 0.021 *** | 0.021 *** | 0.089 *** | 0.089 *** | (25.100) | (25.100) | (3.330) | (3.330) | (3.000) | (3.000) | (26.590) | (26.590) |
| D COVID_large | 0.146 *** | 0.047 *** | 0.047 *** | 0.047 *** | 0.047 *** | 0.047 *** | 0.153 *** | 0.153 *** | (25.230) | (25.230) | (5.980) | (5.980) | (5.130) | (5.130) | (26.070) | (26.070) |
| Financial slack | 0.000 *** | -0.008 *** | -0.008 *** | -0.008 *** | -0.008 *** | -0.008 *** | -0.012 *** | -0.012 *** | -(0.090) | -(0.090) | -(1.770) | -(1.770) | -(2.570) | -(2.570) |
| Fin. slack *medium | 0.019 ** | 0.014 ** | 0.019 ** | 0.014 ** | 0.019 ** | 0.014 ** | 0.002 ** | 0.002 ** | (3.300) | (3.300) | (2.420) | (2.420) | (2.180) | (2.180) |
| Fin. slack *large | 0.064 *** | 0.059 *** | 0.064 *** | 0.059 *** | 0.064 *** | 0.059 *** | 0.099 *** | 0.099 *** | (7.000) | (7.000) | (6.190) | (6.190) | (4.310) | (4.310) |
| Financial slack *small*cov | 0.097 *** | 0.097 *** | 0.097 *** | 0.097 *** | 0.097 *** | 0.097 *** | 0.071 *** | 0.071 *** | (4.310) | (4.310) | (5.050) | (5.050) | (5.050) | (5.050) |
| Financial slack*medium*cov | 0.038 *** | 0.038 *** | 0.038 *** | 0.038 *** | 0.038 *** | 0.038 *** | 0.038 *** | 0.038 *** | (1.330) | (1.330) | (1.330) | (1.330) | (1.330) | (1.330) |
| Grants    | -0.002 *** | -0.002 *** | -0.043 *** | -0.043 *** | -0.043 *** | -0.043 *** | -0.002 *** | -0.002 *** | -(2.540) | -(2.540) | -(2.000) | -(2.000) | -(2.590) | -(2.590) | -(2.540) | -(2.540) |
| Grants*medium | -0.537 *** | -0.537 *** | -0.537 *** | -0.537 *** | -0.537 *** | -0.537 *** | -0.537 *** | -0.537 *** | -(5.440) | -(5.440) | -(5.440) | -(5.440) | -(5.440) | -(5.440) | -(5.440) | -(5.440) |
| Grants*large | -0.244 *** | -0.244 *** | -0.244 *** | -0.244 *** | -0.244 *** | -0.244 *** | -0.244 *** | -0.244 *** | -(4.600) | -(4.600) | -(4.600) | -(4.600) | -(4.600) | -(4.600) | -(4.600) | -(4.600) |
| Grants*small*cov | -0.107 *** | -0.107 *** | -0.107 *** | -0.107 *** | -0.107 *** | -0.107 *** | -0.107 *** | -0.107 *** | -(0.310) | -(0.310) | -(0.310) | -(0.310) | -(0.310) | -(0.310) | -(0.310) | -(0.310) |
| Industry dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |

(continued on next page)
Table 9 (continued)

| Model: OLS | I | II | III | IV | V | VI | VII |
|------------|---|----|-----|----|---|----|-----|
|            | Firm Growth | Firm Growth | Firm Growth | Firm Growth | Firm Growth | Firm Growth | Firm Growth |
| Adj R2     | 0.05         | 0.05         | 0.03         | 0.03         | 0.03         | 0.05         | 0.05         |
| Number of observations | 5477196 | 5477196 | 526626 | 526626 | 526626 | 526626 | 5403030 |
|            |              |              |              |              |              |              |              |

Note: This table reports the results of the Jovanovic model to which several variables have been added. The dependent variable measuring firm growth is Sales Growth (which is expressed in terms of logarithms). This is the usual transformation carried out by authors using the Jovanovic (1982) model, such as, for example, Heshmati (2001). We used this proxy of growth in sales since it is appropriate to capture the effect of the pandemic considering the significant drop in sales resulting from the advent of the crisis. D_COVID is the dummy for 2020. To test the combined effect of the size factor and the COVID-19 crisis, we created three categories: small, medium, and large firms and generated two multiplicative dummies for the year 2020: D_COVID_medium, and D_COVID_large (both binary variables). Industry dummies are important, as the crisis that COVID-19 created had a very different impact depending on the sector (Li et al., 2021). The inclusion of year dummies aims to collect the macroeconomic environment that affected companies’ growth. These year dummies included or did not include the year 2020 in the different regressions depending on whether we used D_COVID. Model I adds the COVID dummy, which is 1 for year 2020 and zero otherwise. Model II adds the multiplicative dummies of COVID and medium and large company dummies, leaving the multiplicative variable for small firms as the dummy base. Model III adds the variable Financial Slack at the beginning of the period, which could be important because it allows companies to have a stockpile of financial resources that may play a role during an economic crisis, impacting positively on their growth (Sánchez-Vidal et al., 2020). The lower number of observations from Model III is due to the unavailability of the variable Financial Debt for most of the companies, as shown in the descriptive statistics. Model IV provides greater detail, as it adds a multiplicative variable for financial slack for medium and large companies (in this case, continuous variables, as one of the components: financial slack, is), leaving the impact for the smaller firms reflected in the base variable (Financial slack in this model). Model V reports the results for all the aforementioned variables in the previous models with the addition of interactions between the variable Financial Slack, the COVID dummy, and dummies regarding firm size (small, medium, and large companies). As financial slack is continuous, so are these multiplicative variables. Model VI adds a multiplicative variable for Grants for medium and large companies (in this case, continuous variables), leaving the impact for the smaller firms reflected in the base variable (Grants in this model). Finally, Model VII reports the results for all the aforementioned variables in the previous models with the addition of interactions between the variable Grants, the COVID dummy, and dummies regarding firm size (small, medium, and large companies). We also ran the Jovanovic model considering the variable Fixed Assets, which is a proxy for tangibility and a potential driver of availability of finance and growth (Gong et al., 2021) (results are available upon request), observing that having fixed assets was positive for growth in the whole period. Industry and year dummies are included in the model and have a significant impact on the F of the overall model, as shown by the nested-model F test (not reported). The asterisks ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors in parentheses. As a robustness test, we have removed outliers (all observations at the 2.5% level in each tail) of all the variables (except for dummies) from Table 9. Results confirm the findings of the different models.
too. Our results show that Size and Age display a negative and significant coefficient, as predicted by Jovanovic (1982) and others (e.g., Honjo and Harada, 2006). The COVID dummy unsurprisingly shows a negative and significant sign, confirming the findings indicated in Paragraph 4.2. Model II yields interesting results, as there is a negative impact of COVID for small firms (as demonstrated by the variable D_COVID, as it measures the effect on small companies in this model), slightly negative for medium companies, and positive for large companies (in this last case, the result of summing up the coefficients of the base dummy: D_COVID and that of D_COVID_Large). Thus, as small enterprises make up more than 95% of our sample, their influence alone drives the coefficient for the COVID dummy in Model I. This result supports the evidence of the national statistics, which showed a decrease in the Italian GDP of −8.9% for 2020 and also followed the same direction as the evidence in Table 5 (median of sales growth for 2020 of −7.13%). This is also in line with the evidence by Sun et al. (2022), who use Chinese data to show that small and medium-sized businesses experienced greater financial hardship than larger businesses during the pandemic, and this has an impact on growth, as we shall see in Models II to V.

In Model III, we added the variable Financial Slack, highlighting that financial issues do not necessarily produce an additional problem if companies want to grow, taking the period as a whole. The results of Model IV showed a positive sign for medium and large companies, which indicates that, for them, enjoying a financial buffer had a positive impact on growth. This evidence is in line with that of Zheng (2022), who finds that firms with cash reserves outperform businesses without sufficient cash reserves, confirming the relevance of cash holdings for firms (Fasano and Deloof, 2021). The negative result of small companies may be due to the fact that they are so financially constrained that they need to sacrifice some growth to keep minimum precautionary financial slack. The results of Model V are very interesting, and, for example, the full impact of having financial slack for medium companies in the first year of COVID-19 is the sum of −0.012 and 0.071, and thus positive. The same is true for medium and large companies (though not significant in this last case). Models III, IV, and V suffer from the imbalanced panel, and the number of observations is clearly smaller than the other regressions. In Models VI and VII, the variable Grants shows a negative sign, indicating that companies receiving grants grow less, which was the requirement to receive a grant. In particular, it seems that medium companies that received grants were those most affected by this crisis.

5. Conclusions and implications

This paper analyzes how Italian firms responded to both the COVID-19 crisis and the consequent State aid provided by the Italian government. We observe that firms experienced a sharp decrease in sales, and this was not accompanied by a corresponding fall in the number of employees, probably due to a special integration fund provided to safeguard employment. We also observed that Italian firms took advantage of the opportunity provided by the government to avoid paying installments on outstanding loans, which meant their financial expenses decreased compared to the years prior to 2020. Moreover, Italian firms used the cash incentives provided by government to a significant extent. In Paragraph 4.2, Model II yields interesting results, as there is a negative impact of COVID for small firms (as demonstrated by the variable D_COVID, as it measures the effect on small companies in this model), slightly negative for medium companies, and positive for large companies (in this last case, the result of summing up the coefficients of the base dummy: D_COVID and that of D_COVID_Large). Thus, as small enterprises make up more than 95% of our sample, their influence alone drives the coefficient for the COVID dummy in Model I. This result supports the evidence of the national statistics, which showed a decrease in the Italian GDP of −8.9% for 2020 and also followed the same direction as the evidence in Table 5 (median of sales growth for 2020 of −7.13%). This is also in line with the evidence by Sun et al. (2022), who use Chinese data to show that small and medium-sized businesses experienced greater financial hardship than larger businesses during the pandemic, and this has an impact on growth, as we shall see in Models II to V.

In Model III, we added the variable Financial Slack, highlighting that financial issues do not necessarily produce an additional problem if companies want to grow, taking the period as a whole. The results of Model IV showed a positive sign for medium and large companies, which indicates that, for them, enjoying a financial buffer had a positive impact on growth. This evidence is in line with that of Zheng (2022), who finds that firms with cash reserves outperform businesses without sufficient cash reserves, confirming the relevance of cash holdings for firms (Fasano and Deloof, 2021). The negative result of small companies may be due to the fact that they are so financially constrained that they need to sacrifice some growth to keep minimum precautionary financial slack. The results of Model V are very interesting, and, for example, the full impact of having financial slack for medium companies in the first year of COVID-19 is the sum of −0.012 and 0.071, and thus positive. The same is true for medium and large companies (though not significant in this last case). Models III, IV, and V suffer from the imbalanced panel, and the number of observations is clearly smaller than the other regressions. In Models VI and VII, the variable Grants shows a negative sign, indicating that companies receiving grants grow less, which was the requirement to receive a grant. In particular, it seems that medium companies that received grants were those most affected by this crisis.

CRediT authorship contribution statement

Francesco Fasano: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. F. Javier Sánchez-Vidal: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. Maurizio La Rocca: Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration.

Declaration of Competing Interest

The authors have no relevant financial or non-financial interests to disclose.

Data availability

Data will be made available on request.

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Table A.1
Results for the difference in differences estimation comparing 2020 to each single previous year (except for 2018 which is reported in Table 8).

| Comparison | Decreto Liquidità | Decreto Rilancio | Decreto Agosto | Decreto Cura Italia |
|------------|-------------------|------------------|----------------|---------------------|
|            | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   |
| Companies not treated | 0.019     | 0.032     | 0.010   | 0.002     | 0.005     | 0.003   | 0.001     | 0.004     | 0.003   |
| Companies treated | 0.017     | 0.019     | 0.003   | 0.012     | 0.015     | 0.003   | 0.013     | 0.016     | 0.003   |
| Differences | -0.003   | -0.012   | -0.010 *** | -0.002   | -0.005   | -0.003 *** | -0.001 | -0.001   | -0.002 *** |

Comparison 2013 – 2020

| Comparison | Decreto Liquidità | Decreto Rilancio | Decreto Agosto | Decreto Cura Italia |
|------------|-------------------|------------------|----------------|---------------------|
|            | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   |
| Companies not treated | 0.018     | 0.032     | 0.014   | 0.020     | 0.042     | 0.022   | 0.017     | 0.032     | 0.015   |
| Companies treated | 0.016     | 0.019     | 0.007   | 0.020     | 0.037     | 0.018   | 0.021     | 0.032     | 0.004   |
| Differences | -0.002   | -0.012   | -0.011 *** | -0.002   | -0.005   | -0.007 *** | -0.001 | -0.001   | -0.003 *** |

Comparison 2014 – 2020

| Comparison | Decreto Liquidità | Decreto Rilancio | Decreto Agosto | Decreto Cura Italia |
|------------|-------------------|------------------|----------------|---------------------|
|            | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   |
| Companies not treated | 0.022     | 0.032     | 0.010   | 0.024     | 0.042     | 0.022   | 0.021     | 0.032     | 0.001   |
| Companies treated | 0.021     | 0.019     | 0.002   | 0.026     | 0.037     | 0.022   | 0.026     | 0.032     | 0.000   |
| Differences | -0.001   | -0.012   | -0.013 *** | -0.004   | -0.005   | -0.008 *** | -0.001 | -0.001   | -0.005 *** |

Comparison 2016 – 2020

| Comparison | Decreto Liquidità | Decreto Rilancio | Decreto Agosto | Decreto Cura Italia |
|------------|-------------------|------------------|----------------|---------------------|
|            | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   |
| Companies not treated | 0.030     | 0.032     | 0.002   | 0.036     | 0.042     | 0.028   | 0.029     | 0.032     | 0.003   |
| Companies treated | 0.031     | 0.019     | 0.012   | 0.037     | 0.037     | 0.032   | 0.031     | 0.032     | 0.000   |
| Differences | -0.001   | -0.012   | -0.013 *** | -0.004   | -0.005   | -0.009 *** | -0.001 | -0.001   | -0.005 *** |

Comparison 2019 – 2020

| Comparison | Decreto Liquidità | Decreto Rilancio | Decreto Agosto | Decreto Cura Italia |
|------------|-------------------|------------------|----------------|---------------------|
|            | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   | Pre-decree | Post-decree | Diff.   |
| Companies not treated | 0.038     | 0.032     | 0.004   | 0.043     | 0.042     | 0.039   | 0.039     | 0.032     | 0.006   |
| Companies treated | 0.038     | 0.019     | 0.019   | 0.046     | 0.037     | 0.031   | 0.031     | 0.032     | 0.014   |
| Differences | -0.000   | -0.012   | -0.013 *** | -0.003   | -0.005   | -0.008 *** | -0.008 | -0.001   | -0.003 *** |

Note: DD estimation attempts to measure the effects of a sudden change in economic environment, policy, or general treatment on a group of individuals/companies. Firms treated are those who took advantage of the government incentives. DD employs the control group’s outcome as a proxy for what would have happened in the treatment group if there had been no treatment. The difference between the post-treatment, treated, and control groups’ average is then used to calculate the treatment effects. This post-treatment average difference and its statistical significance is given in the column “Diff.”. The dependent variable is ROA, defined by Net income/Total Assets. The treatment variables are Decreto Liquidità, which takes the value of 1 when the company was able to borrow significantly in 2020 (its long-term debt was at least 10% higher than the previous year) and zero otherwise; Decreto Rilancio, which takes the value of 1 if the company received grants in 2020 and zero otherwise; Decreto Agosto takes the value of 1 if the company decreased financial expenses in 2020 when its debt did not decrease and zero otherwise; Decreto Cura Italia, which takes the value of 1 when the company decreased financial expenses in 2020 when its debt did not decrease and zero otherwise. The asterisks ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Graph A.1. Mean and median values of the variable Employees Growth from 2012 to 2020.
A.2 – Mean and median values of the variable Sales Growth from 2012 to 2020.

Graph A.2. Mean and median values of the variable Sales Growth from 2012 to 2020.
Graph A.3. Mean and median values of the variable Grants from 2012 to 2020.
A.4 – Mean and median values of the variable ROA from 2012 to 2020.

Graph A.4. Mean and median values of the variable ROA from 2012 to 2020.
A.5 – Mean and median values of the variable Interests from 2012 to 2020.

Graph A.5. Mean and median values of the variable Interests from 2012 to 2020.
A.6 – Mean and median values of the variable Total Asset Growth from 2012 to 2020.

Graph A.6. Mean and median values of the variable Total Asset Growth from 2012 to 2020.
**Graph A.7.** Mean and median values of the variable Total Fixed Asset from 2012 to 2020.
A.8 – Mean and median values of the variable Short Term from 2012 to 2020.

Graph A.8. Mean and median values of the variable Short Term from 2012 to 2020.
A.9 – Mean and median values of the variable Inventories from 2012 to 2020.

Graph A.9. Mean and median values of the variable Inventories from 2012 to 2020.
Graph A.10. Mean and median values of the variable Cash from 2012 to 2020.
Graph A.11. Mean and median values of the variable Debt from 2012 to 2020.
A.12 – Mean and median values of the variable Fin_Debt from 2012 to 2020.

Graph A.12. Mean and median values of the variable Fin_Debt from 2012 to 2020.
Appendix A

Table A.1, Graph A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.10, A.11, A.12

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