RESEARCH ARTICLE

Corporate Social Responsibility and
Environmental Management

WILEY

Facing the storm: Lessons from corporate social responsibility during the covid pandemic

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Abstract

This study analyzes the impact on the sustainability performance of firms during the outbreak of the COVID-19 pandemic, based on microdata made available by the World Bank through the Enterprise Surveys platform. By employing econometric estimation techniques like multinomial limited dependent variable model alongside data visualization tools, this analysis provides insights into the effects of the pandemic outbreak, as well as the moderating influence of enterprise innovation levels and CSR. The findings highlight that the duration of firm operations and company size play significant roles in mitigating turnover during the initial response to the pandemic. The analysis evaluates the actions taken by companies and governments to navigate the crisis, one and a half years after its appearance: containing the impact has a strong social impact, related to corporate social responsibility. The companies that successfully contained the shock and recovered more quickly are those that relied on innovation through their private investments or government measures. The analysis reveals how evenly distributed government subsidies have failed to produce significant effects.

KEYWORDS
corporate social responsibility, COVID-19, crisis companies, efficacy government measure, ordered probit model, visual analytics

1 | INTRODUCTION

The corporate crisis resulting from the COVID-19 pandemic has become a crucial issue in the professional and academic life of both researchers and institutions. For entrepreneurs and their management teams, the pandemic brought an end to a relatively predictable business reality for all firms, producing a management nightmare that required intensive and strategic resource reallocation decisions in an unexpectedly short period of time. Increasingly widespread reliance on global supply chains magnified the tactical complexity of managing this feat, as senior firm management struggled to maintain business continuity. From the beginning of 2020, entrepreneurs will be facing a heavily restructured and volatile global market.

For the last 2 years, the COVID-19 pandemic has dominated the world political and economic agenda, and has exerted enormous impacts on every nation's economy, health care system, and other aspects of social life. After the outbreak of COVID-19 in Chinese city of Wuhan, the pandemic spread across China and parts of Europe. In March 2020, the World Health Organization (WHO) declared COVID-19 to be a pandemic (Luong & Nguyen, 2020). As the number of COVID-19 cases kept increasing, the WHO recommended that countries implement "lockdowns" keeping people inside their homes

and allowing them to leave only for basic needs. The over-riding concern of health professionals at the time was to reduce the speed of contagion, promoting social restrictions such as maintaining social distancing, wearing masks outside the home, and canceling public events. However, while such measures assisted in mitigating the spread of the virus and decreased the rate of contagion, they also imposed considerable social and economic costs in other ways (Chiriboga et al., 2020; Mandel & Veetil, 2020). For example, restricting most of the workforce to stay at home reduces both the economic activity of both production and consumption. The impact on a nation's economy was observed both at the micro and macro level (Giammetti et al., 2020). These extraordinary measures were adopted by national governments, creating new economic conditions that forced many firms to significantly revise their business strategies to adopt a new normal at an exceptional speed. As a result, this environment has created a unique incident in the economic history of human kind (Fairlie, 2020a; Welfens, 2020).

Italy was the first European country hit hardest by the COVID-19 outbreak. As the economy was suffering from stagnant growth over the last decade, Italy was the first to face the attack of the pandemic (Modi et al., 2021, Viola et al. 2021 among others) by adopting stringent measures of social distancing and closure of economic activities. Understanding what happened to Italian firms during this dynamic time of economic change can raise our understanding of what happened in the economies of other modern and advanced countries to better plan for maintaining economic integration and improving post-pandemic recovery. Economic crises are often considered like a broom that sweeps out inefficient or unproductive companies, leaving the healthy companies in the market to further prosper. However, we have witnessed a type of freezing of the Italian industry, with the forcing of blocking of layoffs and the assumption of business continuity.[1] Bankruptcies dropped drastically in 2020.[2] This aspect, on the one hand, enhances the effectiveness of government intervention which in Italy has also seen the strong intervention of the European Commission. On the other hand, it highlights the anomaly that the most serious pandemic crisis of this century did not produce significant failures. Therefore, our analysis also has value in terms of predicting which companies will fail once government subsidies and legislative provisions unlock the possibility of failure.

To contribute to the literature on this theme, this study analyzes the factors that have affected the sales revenues of companies in Italy. The analysis uses microdata recently published by the World Bank, which has investigated the impact of the COVID-19 pandemic across the private sector of economies across several countries. Using ordered regression and visual analytics models, the empirical results point to heterogeneous effects across this sample of countries. Such variation arises from the effects of differing public policies, differences in the organization of firms, as well as variation in labor adjustments to exploit remote work opportunities to retain employees, among other factors.

The contribution of the paper is to assess if, also in the unprecedent time, the moderating effect of innovation and CSR management policy can reduce the impact of external shock. To estimate this, we employ the most important database released by World Bank on this topo, a unique survey on Italian firms (with three different follow up surveys) and we obtain very insightful implication for policymaker and managers. This is the first analysis that combined World Bank data and econometric approach evaluating the effect of CSR and innovation to reduce the impact of Covid-19 on enterprises.

The outline of this study follows in multiple section. The first section of the analysis describes the problem and its relevance to the academic debate. The second section summarizes the growing literature on the impact of the COVID pandemic on country economies and describes the research hypothesis. The third section explains the research design, describes the data sample. The fourth section reveals the empirical technique employed to analyze this empirical data set. The fifth section illustrates the empirical results, while the last section summarizes the research conclusions and makes suggestions for future research.

2 | LITERATURE REVIEW

The economic crisis that was produced by the COVID-19 pandemic is dissimilar to previous crises in the sheer scope of economic activities that were interrupted. The pandemic affected nearly all geographic areas of the global economy and produced unexpectedly severe and immediate consequences. Spare parts and intermediate production components quickly became unavailable, as sudden supply chain interruptions from government shutdowns and meager buffer stocks from just-in-time inventory practices conspired to seriously decrease global production. Further, government-imposed travel bans and frontier closures decreased both labor mobility consumer proximity among the service industries (Rapaccini et al., 2020).

This analysis contributes to the growing field of evaluating the economic impact of the COVID-19 pandemic. Most of the previous research is based on a direct comparison of previous crises with the current one, using macro level simulations in combination with measures of economic vulnerability to the pandemic. For example, Ludvigson et al. (2020) generalize from previous natural disasters to models the new Covid crisis as series of large, multi-period exogenous shocks. Bonadio et al. (2020) adopt a quantitative framework that simulates the global curfews as a decrease in labor supply across 64 countries. They assume that labor supply changes with the ratio of work that can be done from home in a particular sector, after controlling for variation in the severity of the country's lockdown measures.

Other studies in the literature use high-frequency data to observe the Covid-19 crisis' effect in real time. Hassan et al. (2020) analyze the impact through data from earnings reports, while Chetty et al. (2020) uses unemployment claims and debit or credit cards

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[1]Concerning this point, we recommend that you investigate a series of legislative measures:
- *Organismo Italiano di contabilità: Decreto Legge n. 23 dell'8 aprile 2020–Disposizioni temporanee sui principi di redazione del bilancio*
- *Decreto-legge 8 aprile 2020, n. 23, "Decreto Liquidità"*

[2]https://www.bancaditalia.it/pubblicazioni/note-covid-19/2021/2021.0.1.27-ciclo.economico.fallimenti-nota.covid.pdf

transaction data. Evidence from these and other sources reveal a severe and sudden impact from the pandemic on the sales revenues and employment levels of the firm. Other findings argue that the effect of the pandemic was quite similar across country economies, after controlling for variation in governmental lockdown measures. Further, Aum et al. (2020) claims that the fear of disease exposure, rather than the direct impacts of the lockdown, was the main force behind the drop in local employment in South Korea, where no lockdown measure was adopted. They argue that the high-contract industries were hit hardest by the COVID-19 crisis. In this sense, strictly according to the literature review, we evaluate how much the several weeks of government-imposed closure have affected the decline in turnover.

As the pandemic slowed and restrictions loosened over time, researchers have been trying to implement direct evidence using surveys about the effect of COVID-19 pandemic on employment and overall business activities at different phases of pandemic. It is reported that there has been significant incidences of revenue losses, business closures, mass layoffs and illiquidity in the short run (see Dai, Hu, and Zhang (2020) for evidence in China and Bartik et al. (2020); Humphries et al. (2020a); Adams-Prassl et al. (2020); Fairlie (2020a); Fairlie (2020b) for evidence in the United Kingdom, United States and Germany). Those surveyed firms report that they suffered most from decreased demand, which is becoming more obvious over time, and they were hit from various channels (Balleer et al., 2020; Dai, Feng, et al., 2020). Acharya and Steffen (2020) report a significant boost in the cash holding of some US companies when the COVID-19 threat became obvious. It is argued that this increase in cash reflects the growing worries of managers about potential downgrade in the company's credit rating and difficulty and extra cost of raising cash after the downgrade. Bartik et al. (2020) and Zhang (2020) states that firms found themselves in a major financial distress as revenues fell due to pandemic.

Although the long-term effects of the COVID-crisis remain largely uncertain, the evidence obtained from past crises imply that considerable damaging impacts will manifest in the long run. According to Barrero et al. (2020), the reallocation effects of the pandemic will prevail many years after the crisis has ended. While most firms struggle when they face continuously low demand, a major crisis like the COVID-19 pandemic has the potential to eliminate the strong and weak firms alike (Foster et al., 2016; Hallward-Driemeier & Rijkers, 2013). Recent predictions, like that of Bosio et al. (2020), imply that there are multiple scenarios of economic shock where healthy firms are hurt by liquidity shortages, regardless of the productivity level, age, or size of the firm. Further, most economic activities are hindered by uncertainty, where the reason for delays in business reopening is not health concerns, but it is relatively small demands in the United States (Balla-Elliott et al., 2020). Also, radical firm innovations were less likely to occur during past crises, with cash being transferred to intangible investment (Duval et al., 2020; Granja & Moreira, 2023). Baker et al. (2020) found that there was an extraordinary level of uncertainty reported during the COVID-19 crisis, where firms considerably reduced their spending on innovation and general management improvements, at the expense of future productivity growth.

The fastest growing section of literature on this topic has employed cross-country data to assess the effect of the pandemic on firm performance. However, there are a few empirical studies that rely on small samples, such as Beck et al. (2020), who makes use of survey results taken in April of 2020 from about 500 firms in 10 emerging economies to argue that many firms have responded to the pandemic by decreasing investment rather than lowering employee salaries. Another survey (Facebook et al., 2020) about small medium enterprises (SMEs), on e-commerce websites shows that the COVID-19 crisis has caused a significant decline in both firm sales revenues and level of employment. Currently, there is appears to be no analysis that covers the entire pandemic period with reference to the nation most affected in economic and human terms: Italy.

This article not only fills this gap in the literature about the economic effect of the COVID pandemic, but it also documents systematic evidence on the efficacy of government policies to mitigate this negative economic impact. Government economic policies combating the COVID-19 pandemic have been tracked at the macro level across many countries by both the IMF Policy Tracker and the Oxford COVID-19 Government Response Tracker. Studies about the past crises show that supporting industries can be beneficial for the involved firms, even though such support is often temporary. For example, Bruhn, 2020 argues that, after the financial crisis of 2008, and especially for the small businesses, wage subsidies in Mexico helped to hasten the process of employment recovery. Following the 2004 Tsunami in Sri Lanka, government gave cash grants to small firms, helping them survive the crisis (De Mel et al., 2012).

The persistence and severity of the COVID-19 crisis make it imperative to better understand how the level of effectiveness across various government programs is impacted by their different attributes. For example, the Paycheck Protection Program is considered to have raised both the level of employment and the probability of firm survival in the United States (Bartlett et al., 2020; Humphries et al., 2020b). However, it seems that the first-come-first-serve nature of this program favored large firms and reduced the effectiveness and equity of the overall program (Humphries et al., 2020b). Chen et al. (2022) argues that payment deferral and exemption support seems to make SME's cash flows better, while loans do not seem to be effective in reducing SME's cash limitations or giving small firms sufficient incentive to re-open. This is mainly attributed to the misallocation of credit and unforeseen difficulties that emerge in attaining the loan supports. Whereas most countries have started to run fiscal deficits due to stimulus packages created to address the Covid-19 pandemic, it becomes important to provide a more systematic and current stream of evidence from which to inform the debates about optimal public policies to support private economic activity. Our analysis compares the access and effectiveness of the public policy tools to which companies in Italy have had access.

The exploration of the relationship between corporate social responsibility (CSR) and corporate survival is relatively limited in the existing literature. Several studies have reported a positive relationship between them (Collier & Esteban, 2007; Grigore, 2009; Luo & Bhattacharya, 2006). The concept of contemporary CSR

incorporates sustainability, as socially responsible firms efficiently and effectively utilize resources to attain sustainable development. Although corporate sustainability and corporate social responsibility are used interchangeably in the literature, they have distinct differences (Porter & Kramer, 2013). Carroll's (1983) four-part definition of CSR can be considered as the blueprint for sustainable development. According to this definition, firms have economic, legal, ethical, and philanthropic responsibilities. Sahut et al. (2012) support this concept by stating that adherence to CSR policies enhances firm productivity, effectiveness, and efficiency, ultimately leading to survival.

Insolvency risk for both corporations and entrepreneurs increase during any economic crisis. Such vulnerability is greater for firms in developing economies, where the financial system is underdeveloped or shallow, often resulting in illiquidity and insolvency (WBG, 2020). Further, the significant reduction in economic activity due to lockdown measures arising during the Covid-19 pandemic has led to even greater challenges for firms trying to meet their financial obligations. As cash flows and sales revenues contracted, firms could not meet their fixed operating costs, rents, or interest payments (OECD, 2020). Healthy companies, that could survive are now facing liquidity constraints that may lead to solvency problems. The WB data set used in our analysis allows us to evaluate the decline in sales revenue and estimate the extent to which the pandemic has worsened firm liquidity and increased other risks that are pushing companies into bankruptcy. As part of the efforts of the World Bank Group to understand the impact of COVID-19 on the private sector, the Enterprise Analysis unit is conducting follow-up surveys on recently completed Enterprise Surveys (ES) in several countries. These short surveys follow the baseline ES and are designed to provide quick information on the impact and adjustments that COVID-19 has brought about in the private sector. The universe of inference is all registered establishments with five or more employees that are engaged in one of the following activities defined using ISIC Rev. 3.1: manufacturing (groupd D), construction (group F), services sector (groups G and H), transport, storage, and communcations sector (group I) and information technology (division 72 of group K). The name of three datasets is Enterprise Survey Follow-up on COVID-19.

Our analysis develops two research questions:

1. Which companies have managed to contain the sharp decline in sales revenues during the initial shock arising from first wave of the Covid-19 pandemic?
2. As companies and governments took countermeasures after this initial shock to govern the economy, and implemented these actions during a great deal of uncertainty surrounding the pandemic crisis, what were those factors that favored firm adaptation and economic resilience and that produced a faster recovery?

We address these research questions with a combined approach that employs both quantitative and visual analytics to examine a recent and largely unexplored dataset.

3 | RESEARCH DESIGN

The World Bank Group (WBG) conducted a three-wave survey to record information across the different phases of the evolving COVID-19 pandemic. The questionnaire collected data on the impact of disease on some companies dimensions: sales revenues, production, labor, salaries, liquidity and insolvency, and preferred measures of public support. This approach allows the researcher to construct a complete and dynamic picture of firm impacts arising from the pandemic crisis at an international level. While not all companies responded to all the different stages of the survey, many European nations had completed the three phases of data collection analysis by December of 2021. Italy was among those nations that completed all three phases of the investigation. We focus our attention on Italy, as it was the first European country to have suffered significantly from the pandemic. As a modern state with an advanced economy, this impact occurred while Italy was among the slowest growing economies in Europe. This scenario represents a perfect case study for this important issue.

We have chosen all the companies that had participated in all three phases of the survey to better understand the evolution of the economic crisis throughout the survey period. The data includes responses from micro, small, medium, and large businesses, across all main sectors of the economy (i.e., manufacturing, retail, and other services, including construction). Specifically, our analysis combines the ordered regression models with visual analytics to explore those factors that influence the decline in labor turnover. This variable was recorded in two fundamental periods: immediately at the start of the crisis through the first phase of the questionnaire, and again in the summer of 2021 through the third wave of the questionnaire.

To answer the first research question, we will investigate all the characteristics of the companies that contributed to containing the pandemic shock using the decrease in turnover compared to the same period of the previous year as a dependent variable. While the decline in turnover is certainly not the only factor that determines a business crisis, we will use it as a proxy for reflecting the severity of the corporate crisis, to evaluate those factors that have either mitigated or accentuated this difficulty. For example, there was a freezing of procedures and bankruptcies in Italy during the pandemic period. What impact did this event have on firm performance across the many sectors of the Italian economy?

To answer the second research question, we seek to identify the types of companies that closed the gaps first and ascertain how they closed them. Specifically, our analysis focuses on the firms' responses in the drop in turnover that occurred in the third phase of administration of the questionnaire. What are the differences in the factors of firms, as collected across the first and third phase of administration of the questionnaire?

4 | MATERIALS AND METHODS

There are 161 companies represented in this data sample that have been monitored in all three phases of the survey analysis. The firms

TABLE 1 Description of variables, correspondence with questions of the world bank enterprise survey, name, and type of indicator

Wave	Code	Question	Reply/description	Name	Type
		For how many weeks has this establishment been closed (or was closed) due to the COVID-19 outbreak since wave1?		Weeks	Continuous
ROUND2	COV2c3a	Since the outbreak of Covid-19, did this establishment experience any of the following changes in response to the COVID-19 outbreak?	Introduced new or improved products or services?	Change_a	Dummy
ROUND2	COV2e1a	Since wave1, has/have this establishment's liquidity or cash flow increased, remained the same, or decreased?		Liquidity_2	Ordered discrete
ROUND2	COV2f2a	Did any of these measures involve any of the following	Cash transfers for businesses	Cash_transfer_2	Dummy
ROUND2	COV2f2b	Did any of these measures involve any of the following	Deferral of credit payments, utility bills, rent or mortgage, suspension of interest payments, or rollover of debt	Financial measure_2	Dummy
ROUND2	COV2f2c	Did any of these measures involve any of the following	Access to new credit	New credit_2	Dummy
ROUND2	COV2f2d	Did any of these measures involve any of the following	Tax reductions or tax deferrals	Fiscal measure_2	Dummy
ROUND2	COV2f2e	Did any of these measures involve any of the following	Wage subsidies	Wage subsidies_2	Dummy
ROUND2	COV2f2f	Did any of these measures involve any of the following	Other	Other measure_2	Dummy
ROUND2	COV2f2g	Did any of these measures involve any of the following	Support (technical assistance or subsidies) for adoption of digital technologies	Digital technologies_2	Dummy
ROUND3	COV3b5	Since the outbreak of COVID-19, did the top manager of this establishment change?		Top_manager	Dummy
ROUND3	COV3b6	Currently, is the top manager female?		Female_manager	Dummy
ROUND3	COV3c3a	Since (insert previous round month), did this establishment experience any of the following changes in response to the COVID-19 outbreak?	Introduced new or improved products or services?	inno_prod	Dummy
ROUND3	COV3f2a	Did any of these measures involve any of the following	Cash transfers for businesses	Cash_transfer_3	Dummy
ROUND3	COV3f2b	Did any of these measures involve any of the following	Deferral of credit payments, utility bills, rent or mortgage, suspension of interest payments, or rollover of deb	Financial measure_3	Dummy
ROUND3	COV3f2c	Did any of these measures involve any of the following	Access to new credit	New credit_3	Dummy
ROUND3	COV3f2d	Did any of these measures involve any of the following	Tax reductions or tax deferrals	Fiscal measure_3	Dummy
ROUND3	COV3f2e	Did any of these measures involve any of the following	Wage subsidies	Wage subsidies_3	Dummy
ROUND3	COV3f2f	Did any of these measures involve any of the following	Other	Other measure_3	Dummy

(Continues)

TABLE 1 (Continued)

Wave	Code	Question	Reply/description	Name	Type
ROUND3	COV3f2g	Did any of these measures involve any of the following	Support (technical assistance or subsidies) for adoption of digital technologies	Digital technologies_3	Dummy
ROUND1	COVb2a/ COVb2b/ COVb2c	Comparing this establishment's sales for (insert last completed month) with the same month in 2020, did sales increase, remain the same, or decrease? By what percentage did the sales increase or decrease?		Change_sales1	Ordered discrete
ROUND3	COVb2a/ COVb2b/ COVb2c	Comparing this establishment's sales for (insert last completed month) with the same month in 2020, did sales increase, remain the same, or decrease? By what percentage did the sales increase or decrease?		Change_sales3	Ordered discrete
ROUND1	COVb3a	In the last completed month, that is in (insert last completed month), what percentage of this establishment's sales were:National sales	National sales	National sales	Dummy
ROUND1	COVb3b	In the last completed month, that is in (insert last completed month), what percentage of this establishment's sales were	Indirect exports (sold domestically to third party that exports products)	Indexport	Dummy
ROUND1	COVb3c	In the last completed month, that is in (insert last completed month), what percentage of this establishment's sales were	Direct exports	Export	Dummy
ROUND1	COVc3	Has this establishment adjusted or converted, partially or fully, its production or the services it offers in response to the COVID-19 outbreak?		Change_production	Dummy
ROUND1	COVc6	Currently what is the share of this establishment's workforce working remotely?		Smart_working	Continuous
ROUND1	COVd1	Permanent, full-time employees end of last completed month		Full_time	Continuous
ROUND1	COVd2	Female permanent full-time workers end of last completed month		Female_fulltime	Continuous
ROUND1	COVe1b	Since the outbreak of COVID-19, has/have this establishment's [insert option] increased, remained the same, or decreased?	Sales on credit	Sales_on_credit	Ordered discrete
ROUND1	COVe1c	Since the outbreak of COVID-19, has/have this establishment's [insert option] increased, remained the same, or decreased?	Purchases on credit	Purchases	Ordered discrete
ROUND1	COVf2a	Did any of these measures involve any of the following	Cash transfers for businesses	Cash_transfer1	Continuous
ROUND1	COVf2b	Did any of these measures involve any of the following	Deferral of credit payments, rent or mortgage, suspension of interest payments, or rollover of debt.	Financial measure_1	Continuous
ROUND1	COVf2c	Did any of these measures involve any of the following	Access to new credit	New credit_1	Continuous
ROUND1	COVf2d	Did any of these measures involve any of the following	Fiscal exemptions or reductions	Fiscal measure_1	Continuous

TABLE 1 (Continued)

Wave	Code	Question	Reply/description	Name	Type
ROUND1	COVf2e	Did any of these measures involve any of the following	Wage subsidies	Wage subsidies_1	Continuous
ROUND1	COVf2f	Did any of these measures involve any of the following	Other	Other measure1	Continuous
ROUND1		Female permanent full-time workers end of last completed month on permanent full-time employees end of last completed month		Femal intensity	Continuous

can be categorized by what they produce and by their employment levels immediately before the COVID-19 shock. Micro-businesses (less than 15 employees) account for 49% of these observations, while about 21% of observations are firms with more than 100 employees. Most firms in the data set are in manufacturing (70%), with the remainder in service (21%) and retail (9%) sectors.

Table 1 describes the variables used, the data collection period (in terms of wave of questionnaires), and the questions appearing on the questionnaire. Table 2 summarizes the descriptive statistics of the variables used in the analysis.

There is a set of variables that approximate the CSR concepts: female participation in the governance, female participation and gender equality in labor force, welfare policy at firm level (smart working), and among others, the investment in sustainable innovation. This is the first attempt to measure the impact of this variables in the probability to face the external shock; indeed, we hypnotize that the CSR and innovation policy can increase the resilience of firms.

To answer the research questions, a combined approach is used: ordered model regression and visual analytics. The decision to make the variable of turnover, which is issued continuously by WB, orderly and discreet is preferred for cleanliness of the data and the need for clustering to avoid errors due to the precise estimates self-declared by the respondent. Table 3 denotes how the variable reflecting a decrease in turnover (declared in a timely manner by the companies) is divided into classes of turnover loss. This step is important for neutralizing any uncertainties and indecisions that the precise data brings with it, especially since the data are self-declared by the companies. This serves to reduce the uncertainty of the model output and make the analysis more robust.

4.1 | Methodology

Survey questions seeking people's opinions often generate data in the form of ordinal, or ordered, responses. One example is to what extent an individual agrees or disagree with a given statement or view. Another example would be measuring life satisfaction in a scale from 1 to 10. In such ordered responses the categories in the resulting variable represent rankings rather than cardinal values that can be objectively compared across respondents. In such cases an ordered probit

model is a commonly used as an estimating strategy in these types of ordered response models (McKelvey & Zavoina, 1975). Our dependent variable is a change in sales, which we categorize in an ordinal way following the descriptions found in Table 3.

Our analysis uses a latent variable model for determining categorical choice, with a functional form for latent variables and a decision rule for the observed outcome. The functional form for latent variable is as follows:

$$Y_{it}^* = X'_{it}\beta + U_{it},$$

where the dependent variable Y_{it} is an unobserved latent variable. X'_{it} is a vector containing a set of covariates describing the individual's personal attributes by financial, social, demographic factors such as income, age, gender, year of education, origin, employment, number of doctor consultation, and health status. β is the corresponding column vector of coefficients and U_{it} is the error term that is conditional on the explanatory variable, and it follows the standard normal distribution $u \mid x \sim N(0,1)$.

Assuming five categories exist, our dependent variable takes the values of 1, 2, 3, 4, and 5. There are then 4 defined cut-off points, α_i, such that $\alpha_1 < \alpha_2 < \alpha_3 < \alpha_4$. The quarterly sales change category will be determined based on the following formulae:

$$Y_{it} = 1 \text{ if } Y_{it}^* \leq \alpha_1.$$

$$Y_{it} = 2 \text{ if } \alpha_1 \leq Y_{it}^* \leq \alpha_2.$$

$$Y_{it} = 3 \text{ if } \alpha_2 \leq Y_{it}^* \leq \alpha_3.$$

$$Y_{it} = 4 \text{ if } \alpha_3 \leq Y_{it}^* \leq \alpha_4.$$

$$Y_{it} = 5 \text{ if } \alpha_4 \leq Y_{it}^*.$$

Thus, for a model with five observed outcomes the formula for the ordered probit specification is:

$$\Pr(y = 1 | x) = F(\alpha_1 - x'\beta),$$

$$\Pr(y = 2 | x) = F(\alpha_2 - x'\beta) - F(\alpha_1 - x'\beta),$$

TABLE 2 Summary statistics of variables used in the analysis

	Mean	Median	Std.dev	Min	Max
Weeks	6.01	6.00	2.93	1.00	14.00
Change_Sales1	2.78	3.00	1.42	1.00	5.00
Change_Sales3	3.01	3.00	0.94	1.00	4.00
Exporter	0.11	0.00	0.32	0.00	1.00
indexp	0.03	0.00	0.17	0.00	1.00
National sales	0.84	1.00	0.37	0.00	1.00
Cash_transfer_2	0.49	0.00	0.50	0.00	1.00
Financial measure_2	0.15	0.00	0.36	0.00	1.00
New credit_2	0.02	0.00	0.13	0.00	1.00
Fiscal measure_2	0.06	0.00	0.25	0.00	1.00
Wage subsidies_2	0.55	1.00	0.50	0.00	1.00
Other measure_2	0.00	0.00	0.00	0.00	0.00
Digital technologies_2	0.02	0.00	0.13	0.00	1.00
Cash_transfer_3	0.59	1.00	0.50	0.00	1.00
Financial measure_3	0.24	0.00	0.43	0.00	1.00
New credit_3	0.18	0.00	0.39	0.00	1.00
Fiscal measure_3	0.11	0.00	0.31	0.00	1.00
Wage subsidies_3	0.64	1.00	0.48	0.00	1.00
Other measure_3	0.02	0.00	0.12	0.00	1.00
Digital technologies_3	0.13	0.00	0.34	0.00	1.00
Cash_transfer1	0.50	0.50	0.50	0.00	1.00
Financial measure_1	0.50	0.50	0.50	0.00	1.00
New credit_1	0.38	0.00	0.49	0.00	1.00
Fiscal measure_1	0.30	0.00	0.46	0.00	1.00
Wage subsidies_1	0.55	1.00	0.50	0.00	1.00
Other measure1	0.02	0.00	0.14	0.00	1.00
d_liquidity_2	−0.57	−1.00	0.59	−1.00	1.00
d_purchases_1	−0.25	0.00	0.64	−1.00	1.00
d_sales_on_credit	−0.33	0.00	0.61	−1.00	1.00
Female_intensity	0.29	0.22	0.25	0.00	1.00
d_top_manager	0.04	0.00	0.20	0.00	1.00
d_female_manager	0.19	0.00	0.39	0.00	1.00
d_change_production	0.14	0.00	0.34	0.00	1.00
d_change_a	0.12	0.00	0.33	0.00	1.00
d_inno_prod	0.14	0.00	0.35	0.00	1.00
Smart_working_1	7.37	0.00	14.99	0.00	100.00
Full_time_1	72.22	16.00	129.10	1.00	780.00
Female_fulltime_1	15.88	4.00	37.53	0.00	300.00

$$\Pr(y = 3|x) = F(\alpha_3 - x'\beta) - F(\alpha_2 - x'\beta),$$

$$\Pr(y = 4|x) = F(\alpha_4 - x'\beta) - F(\alpha_3 - x'\beta),$$

$$\Pr(y = 5|x) = 1 - F(\alpha_4 - x'\beta),$$

where F is represented as cumulative standard normal distribution.

These five equations allow us to calculate the probability of any observed outcome (sales change). The unknown coefficients, β,

are assumed to be the same for all outcome levels (parallel-lines assumption). Parallel line assumption of standard ordered model neglects possible heterogeneous effects of some explaining factors (Pfarr et al., 2010). In this context, parallel line assumption implies that the effect of independent variables, such as those that affect quarterly sales changes, will be the same on sales changes across every category of sales changes. The parallel line assumption can be tested by using Brant's test within an ordered probit approach. The coefficients from the ordered probit regression are not normally

TABLE 3 Correspondence between change in sales (continuous variable) and the transformation in ordered discrete variables, used as dependent variables. On the top panel the data of first wave; on the bottom panel, the data of last wave

Wave 1	
Value of old "change in sales" variable	Value of new "change in sales" variable
0 > = change sales > = −15	5
−15 > change sales > = −30	4
−30 > change sales > = −50	3
−50 > change sales > = −75	2
−75 > change sales > = −100	1
Wave 3	
Value of old "change in sales" variable	Value of new "change in sales" variable
Change sales >0	4
Change sales = 0	3
0 > change sales > = −40	2
−40 > change sales > = −100	1

interpreted directly. Instead, an odds ratio, reflecting the marginal effect or predicted probabilities, are used to better interpret such regression results.

Additionally, our approach will be combined with visual analytics tools. This serves to broaden the audience of readers with respect to a central theme, making the resulting information on the dynamics of shooting and resilience both graphically intuitive and richer in content, as portrayed through radar and Sankey diagrams.

5 | RESULTS

The presentation of the empirical results is divided into two parts. First, we present those factors that contributed most to the shock due to the onset of the pandemic, and which therefore caused the greatest damage in terms of loss of sales. In this analysis we will use only variables extracted from the first wave of the questionnaires. This part of the analysis seeks to directly answer the first research question.

Second, we will evaluate the technical, organizational, and public policy factors that allowed companies to recover labor turnover. In this case we will use the turnover level of the third wave by crossing the data with all the previous surveys. This part of the analysis seeks to directly answer the second research question. In addition, we will also evaluate government policy measures, identifying both the timing and the effectiveness of those policies that worked the most. Our regression results show that it is not enough *for firms* to have asked for help, it is also necessary to have asked for the "right" help, because not all public policy measures have been effective in the same way.

5.1 | Econometric results

5.1.1 | The first shock

Table 4 collects the results of the models proposed to evaluate the impact of some regressors on the decline in turnover due to the sudden lockdown and consequent blocking of economic activities. The models proposed in this case concern intrinsic characteristics of companies in terms of size and internal organization. Five such models are presented in this table.

The first model relates the characteristics of the company to the outlet market (if the company is characterized by being a direct or indirect exporter) and the weeks of closure of the company, captured by the variable weeks. In this model, only the latter is statistically significant with a clear result: the lower the number of closure weeks, the lower the loss of turnover.

In the second model, the weeks of company closure is related to various characteristics of a company's human resources: the number of full-time workers and the number of full-time female jobs. The significant variables once again are the number of closure weeks (the effect of which remains the same as the previous model) and the number of full-time workers that captures company size. The larger the company, the smaller the decline in company turnover.

The third model adds a dummy variable to the second model reflecting the presence of female managers. This variable is found to be statistically insignificant. The fourth and fifth models are hybrid models. Specifically, the fourth model considers the type of company exporter, indirect exporter, or domestic seller (depending the 50 + % percentage of sales devoted to each kind of market) and the number of full-time female workers. Only the latter variable is significant: the more women are present, the greater the loss of turnover in the period immediately following the pandemic. This is not surprising, as it has been widely reported that female workers have been disproportionately losing their jobs during covid relative to male workers, as the service industry (which hires disproportionately more women) has been harder hit than the manufacturing industry (which hires disproportionately men). The fifth model, all three significant variables are statistically significant, revealing that indirect exporting companies have had a small decline in turnover (implying that they already had a diversified clientele), as well as large companies. The impact of the presence of female workers is again negative.

5.1.2 | The reaction

Turning attention to the second research question, these five models are implemented to take into account factors external to the company, such as the interventions and public subsidies implemented by the government (and detected in the I, II, and III wave). Table 5 provides an exhaustive summary of the models implemented in this analysis regarding the impacts on the dependent variable, reflecting the decrease in turnover during the stabilization period of the pandemic (the new normality).

TABLE 4 Results of ordered probit model. Dependent variable: change in sales_1

	Model 1	Model 2	Model 3	Model 4	Model 5
indexporter	−0.02				0.49*
exporter	−0.09			−0.20	
domestic seller				−0.24	
female manager			−0.03		
weeks	−0.14***	−0.12***	−0.12***		
n. full time_1		0.0016**	0.0019**		0.0018***
n. female full time_1		−0.25	0.00	−0.68**	−0.57**
% of predicted case	29.40%	34.20%		28.80%	29.20%
cut1	−1.497***	−1.328***	−1.2911***	−1.054***	−0.652***
cut2	−1.0285***	−0.854***	−0.8175***	−0.6167**	−0.205
cut3	−0.3117*	−0.128	−0.0926	0.0571	0.482***
cut4	0.228	0.4232**	0.4579**	0.57908**	1.015***

*$p < 0.10$; **$p < 0.5$; ***$p < 0.01$.

TABLE 5 Resutls of ordered probit model. Dependent variable: change in sales_3

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
indexporter	−0.24						
exporter	−0.63						
domestic seller	−0.57						
d_purchase_1		0.21					
d_sales on credit_1		−0.18					
d_liquidity_2		0.54***					
inno_prod						0.33	
d_change prod						0.03	
smart working_1						0.01*	
n. female full time_1			−0.60**	−0.58**			
n. full time_1			0.0015**	0.0015**	0.0015**		
d top manager			−0.55		−0.49		
female manager				−0.28	−0.23		
female intensity					−0.64*		−0.85**
d_change_a							0.49**
% of predicted case	37.50%	37.30%	39.10%	42.20%	36.60%	36.00%	35.40%
cut1	−2.08***	−1.87***	−1.65***	−1.68***	−1.70***	−1.39***	−1.73***
cut2	−1.11*	−0.85***	−0.64***	−0.66***	−0.68***	−0.40***	−0.72***
cut3	−0.26	0.04	0.25*	0.23	0.21	0.46	0.15

*$p < 0.10$; **$p < 0.5$; ***$p < 0.01$.

In this case, we can allocate the variables into different types of interventions that were put in place by the firm in terms of reorganization in production and/or financial terms, as well as any interventions implemented by institutions outside the company, such as government policy measures. In both cases, we will characterize the variables based on their time period, based on the World Bank's findings. A variable that is characterized by a subscript value of 1 indicates a value detected during the first row of the questionnaire. The subscript value 2 or 3 indicates a value detected during the second or third row of the questionnaire, respectively. This delineation is useful for understanding the correct timing of the implementation of the measures, as well as the time required for an adopted measure to produce the desired effects.

These policy analysis models reveal that the most significant factors, as compared to the seven models proposed in this case, are

TABLE 6 Results of ordered probit model. Dependent variable: change in sales_3

	Model 1	Model 2	Model 3
cash_transfer1	−0.54**		
financial measure_1	0.39		
new credit_1	−0.32		
fiscal measure_1	0.14		
wage subsidies_1	−0.14		
other measure1	0.59		
cash_transfer_2		−0.83***	
financial measure_2		−0.43	
new credit_2		0.27	
fiscal measure_2		1.33**	
wage subsidies_2		−0.41*	
digital technologies_2		−0.28	
cash_transfer_3			0.23
financial measure_3			0.54*
new credit_3			0.13
fiscal measure_3			−0.70**
wage subsidies_3			−0.21
other measure_3			5.64**
digital technologies_3			1.01**
% of predicted case	42.90%	47.30%	48.50%
cut1	−1.63	−2.19***	−1.23***
cut2	−0.88	−1.19***	−0.29
cut3	0.05	−0.23	0.41

*$p < 0.10$; **$p < 0.5$; ***$p < 0.01$.

mainly related to the internal reorganization of the company. (A specific focus on the most effective measures taken by the government will be proposed in a later section.) We present in order the results of this phase of analysis.

In the first model, the characteristics of the company are assessed (whether exporter, national seller, or indirect exporter): none of these variables have a statistically significant effect on our dependent variable, which is the recovery of labor turnover.

In the second model, some interventions that were put in place by the company are analyzed. In particular, the impact of liquidity growth, the "sales on credit" or "purchase on credit" trend is assessed. Only the first variable has a statistically significant (and positive) impact on the dependent variable. The greater liquidity growth, the greater the labor turnover.

The third model analyzes innovative interventions at the company level. In particular, the percentage of personnel in smart working, innovation of product and change of production. In this model, only smart working is found to be statistically significant and positive. The greater the number of people who can work in smart working, the lower the reduction in turnover.

In the fourth model, factors relating to productive and organizational innovation are considered: "cash transfer for business" measure

and female intensity. Both are statistically significant, with the first. If you are in the presence of "cash transfer for business" measure, the recovery of turnover is greater. If the company is highly intensive in female workers, the pace of recovery is smaller.

The last three models characterize and describe the management of human resources. The impact of the variables involved in the three models can be summarized in this way: the greater presence of full-time women workers slows the reduction in turnover, with a good level of statistical significance. The data is also confirmed by the female intensity variable, which goes in the same direction. Further, the bigger the company, the sooner they recover (the size factor is captured by the full time variable 1). Whether the top manager is a woman or has changed during the pandemic does not seem to be a statistically significant aspect in the sample we are considering. (A further study of the interactions of these regressors appears in Table 5).

5.1.3 | Government measure efficacy

The analysis culminates in the ordered probit model results reported in Table 6, where the measures implemented by the government are examined. These measures were treated separately from other business recovery factors to allow the effect of the policy measures to be isolated and measured. This allows these measures to be distinguished temporally, to reveal the optimal timing and effectiveness between them. Thus, Table 6 presents three models. In the first model, all the measures taken in the first period. In the second model, only those measures adopted in the second wave were included. In the third model, only those measures adopted in the third wave were included.

In the first period model, the variables do not appear to be very effective in recovering the loss of turnover due to the pandemic shock. Only the variable Cash Transfer measure appears to have a statistically significant (negative) impact.

In the second period model, "Cash Transfer" remains statistically significant, but with a negative sign (which is likely due to a problem of endogeneity,[3] as many measures spanned both periods 1 and 2.) The same is true for Wage subsidies measure. The impact of wage subsidies and Tax reduction or deferrals measures also becomes important.

In the third period model, more measures become statistically significant, in particular "Other measure" and Deferral of Credit Payment. Tax reduction or deferral also has a significant impact, but exerts a negative effect, probably due to endogeneity problems that are not addressed here.

5.2 | Visual analytics results

The analysis of the measures continues with the graphic approach. Figure 1 summarizes, as the percentage of the total sample of

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[3]Please note that is impossible to address endogeneity with this anonymous dataset.
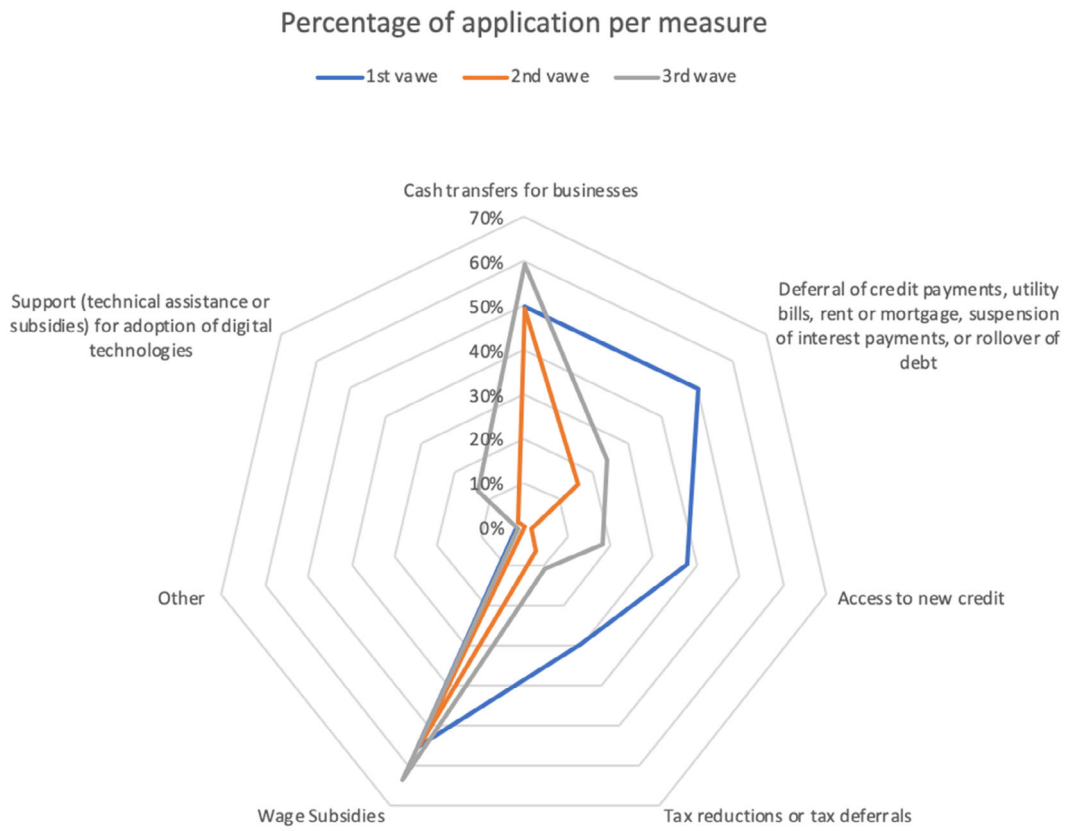
FIGURE 1 Radar diagram of government measure adopted by companies, for each wave.
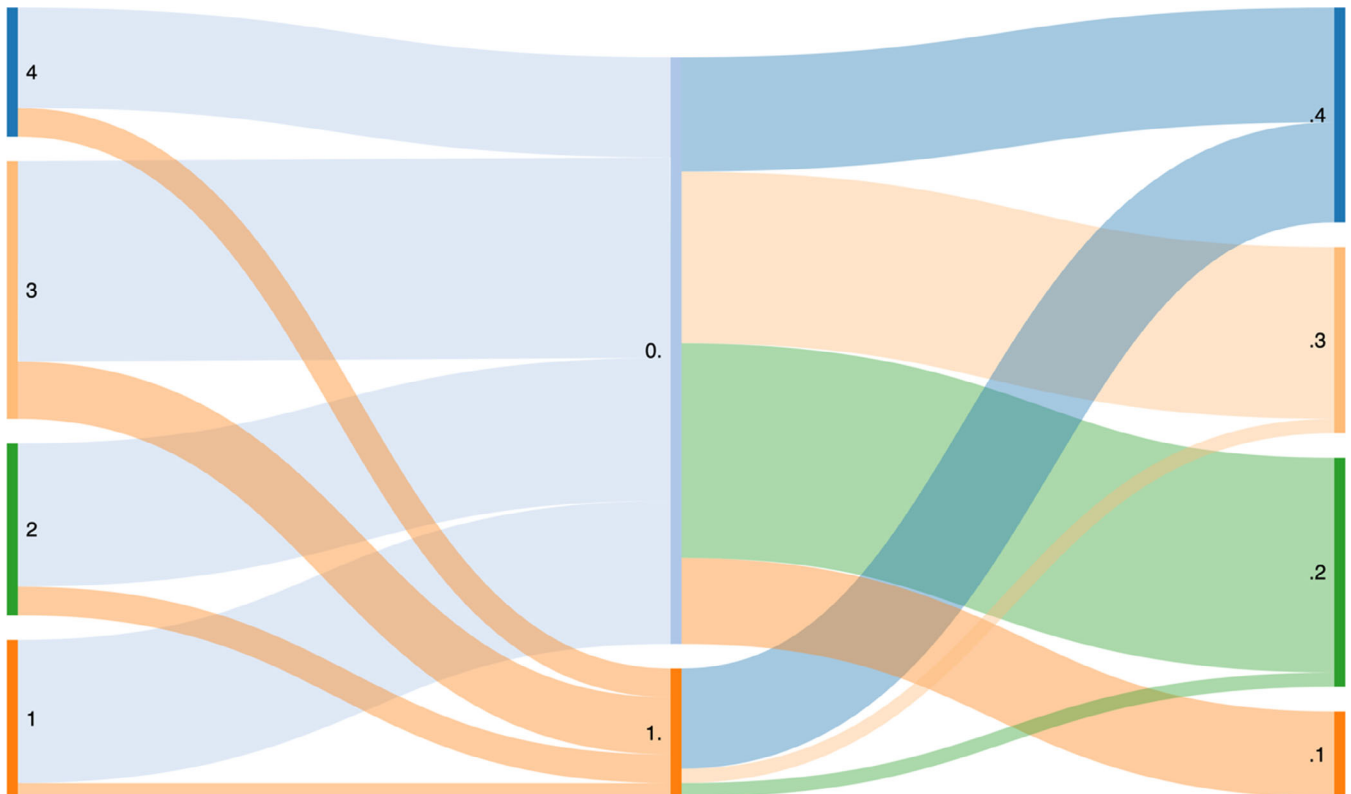

FIGURE 2 The sankey diagram of change in sales_1, companies that applied for "support for adoption of digital technologies" government measure and change in sales_3.

companies that answered the question, those firms that chose a specific measure for each period. This highly informative graph allows us to understand if and how preferences for businesses have changed across the three waves during the pandemic year.

Each point of the graph reflects a specific measure implemented by the Italian government. There are three lines, with blue representing the answers from the first wave, orange representing the answers from the second wave, and gray representing answers from the third wave. This radar chart is divided into different levels represented by concentric stars, each corresponding to the percentage of companies that have joined that specific measure.

This figure illustrates in a single image the mapping of the trend and repositioning of companies while accessing the measures provided for the containment of the crisis. Combined with the previous quantitative analysis, this diagram represents the most requested and most effective measures.

It is evident that wage subsidies were the most used measure in each period, being chosen by 55% to 60% of all companies in each period of the pandemic. Access to credit and other financial measures (for example the deferral of credit payment) were also widely used in the first phase but were then substantially reduced or abandoned during the remaining two waves of the crisis. Cash tansfer for business, on the other hand, remains a popular measure used throughout all phases of the pandemic, even growing to about 60% adoption in the last phase of the questionnaire. Interestingly, about 10% of companies requested support for adoption of digital technologies in the last phase of the pandemic. While this is a clear sign of a newfound proactivity of businesses, it also reveals a strong reversal from which many businesses had started. For this reason, it is important that companies continue to invest in digital trans business training, as written by the Italian government in the Recovery and Resilience Plan.

Our graphical analysis continues using the Sankey diagram depicted in Figure 2. This graph, widely used in the literature to explain the change in electoral flows, is used here to understand and measure the recovery in business turnover. The dependent variable variation of the turnover for the first wave (divided into classes, as explained above) is measured on the left side of the graph. The right side measures the dependent variable variation of the turnover for the third wave (again, divided into classes). Observing the transition of companies between the two sides helps us understand which companies have "changed class" by improving their turnover or reducing their decline.

The center of the graph exhibits an intermediate axis that shows the values of the "support for digital investment and transformation" measure variable. It represents the companies that have had access (if the value is equal to 1) to interventions for the implementation of new technologies and digital transformation action. We chose this measure for two reasons: first, because it is considered fundamental for the scientific literature relating to innovation and business productivity, and second, because it is the one that presents the most conforming results derived from the prior econometric analysis.

Table 6 confirms that this measure has had a particularly positive effect for those companies that have decided to adopt it. In fact, all

the companies that have chosen it have seen their turnover increase, or in any case reduce their losses. Among other things, it was the companies that had suffered the most from the shock of the first wave (and therefore above all belonging to classes 1, 2, 3) that requested it.

Without wishing to generalize beyond the objectives of this work, it is worth emphasizing how the only non-welfare measure not provided in the form of an economic subsidy (but rather as a service for innovation) is the most useful for reducing losses in the medium period. The Sankey diagrams have been constructed for all sizes of firms, but for reasons of space they are not provided in this version of the paper. However, the authors will provide these graphs upon request.

6 | DISCUSSION AND CONCLUSION

Business pulse survey results show a persistent effect on labor turnover arising from the Covid-19 crisis. Businesses have been adversely affected by the crisis due to experiencing more than one shock at the same time. Most business have incurred great uncertainty about their future and have faced considerable declines in both sales revenues and access to much needed financial resources. A great deal of companies report that they are very close to insolvency and have experienced layoffs. Given this relatively pessimistic business environment, government policies can play a significant role in reducing the adverse impacts and help businesses survive the continuous waves of economic crises and initiate a long run recovery process.

Italy has adopted support programs for businesses and employees in response to the shock of the Covid-19 pandemic. These support programs include payments for worker salaries, providing subsidized loans, or postponing tax payments. These policies were implemented in the initial phase of the crisis to support business cash flows and avoid firm closures. Cirera et al. (2020) argues that it was difficult and for firms to access these support programs, and that their assistance was limited. Treating the decline in labor turnover as a proxy for the possible crisis allows us to understand what will happen when the economy starts up again without the parachute of legislative aid.

The results of our empirical analysis make it clear to us that not all the measures that were most commonly adopted by businesses have proved to be effective for assisting the economic recovery.

Those companies that were able to recover sooner are those that invested in innovation, despite the great difficulties of the moment. While firm size helped insulate some companies, the Italian economy is dominated by micro enterprises. Our research reveals that the ability to stabilize flexible forms of work, a growth in liquidity and product or service innovation are the decisive factors needed for the rapid economic recovery and the salvation of businesses across the Italian economy. These are not trivial policy and managerial implications.

The COVID-19 economic crisis is on-going, as active cases and deaths due to pandemic persist. As a result, the negative impacts on individual health and the economy viability of firms will both continue to be affected in the near future. The ability of business of all sizes

and across all sectors to adapt to the "new normal" is crucial in determining the nation's economic performance. Therefore, consistent, and high-frequency data collection is important in understanding the long-term economic impact of the COVID-19 pandemic.

Similarly, the positive relationship between corporate social responsibility (CSR) and sustainable survival aligns with previous findings in the literature, including Sahut et al. (2012), Grigore (2009), Collier and Esteban (2007), and Luo and Bhattacharya (2006). This connection between CSR and sustainable survival is rooted in stakeholder theory, suggesting that active engagement in social activities enhances the ability of family firms to maintain their survival.

This study does have certain limitations that open up opportunities for future research. First, the analysis tracks three waves of World Bank data, but it is not possible to assess the long-term effects. Second, due to the European Union's homogeneous and coordinated response to the pandemic shock, there is insufficient data to conduct a counterfactual analysis, such as excluding subsidies altogether. We believe there is room for improvement in this article, particularly by strongly differentiating the industry sectors and addressing the potential boost effects in specific fields, such as healthcare.

Finally, it is key to understand to what extent the COVID-19 crisis has diminished the economic growth path of both developed and developing countries. Expanding a similar analysis to a broader collection of international data will allow both public policy decision makers and firm managers to make better decisions to preserve productivity growth. This analysis reveals some key areas of focus for determining how the negative impacts of the pandemic can be mitigated by increasing the incentives for applying resources toward innovation, with particular attention to the allocation of wealth between different industries (Di Mauro & Syverson, 2020).

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